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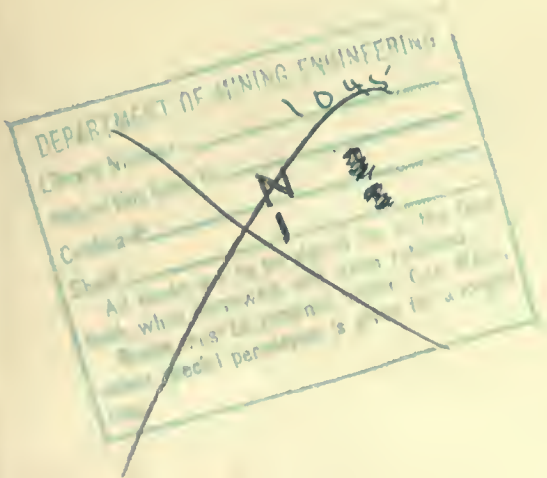
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H. FOSTER BAIN - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

Greeting

Editors, as well as other people, enjoy writing their friends at Christmas and New Year. Unfortunately, speaking for ourselves at least, preparation of an annual review number interferes sadly with holiday pleasures. No great good comes except through elimination, and it is probably safe to assume that the wealth of material appearing in this issue of the *Mining and Scientific Press* will be received as sufficient substitute for the individual letters the Editors would have liked to send to their many friends around the world. After all, it is the primary function of the editor of a technical journal to gather and spread before his readers the best there is of current knowledge regarding practice. The pleasant friendships that are formed are by-products, though to the editor himself they may represent the difference between success and failure; just as by-products do in many another instance. No editor may succeed save through the help of friends, and therefore, gentlemen, for myself and my associates, I wish first of all to thank you for your generous friendship. The men who have helped in preparation of this issue; those who in the course of the past year have contributed articles, new items, or friendly suggestions; those who when requested have patiently dug up facts from records, or collected

notes on processes: the engineers who have sent their cards for publication in our professional directory; the advertisers who, through a year none too good from a selling viewpoint, have given generously of their business; and, last but most numerous of all, you, the widely scattered and usually "gentle" readers;—to all of you our thanks are due, and are gladly given. Your continued support demonstrates that there is a field for high-class technical journalism, for something better and more informing than thinly disguised manufacturer's catalogs or stock-broker's letters, for something more timely and more human than severely technical proceedings of learned societies. It is this field that the *Mining and Scientific Press* claims for its very own. If we print less of market news than others, if there be counties in the United States or districts abroad that occasionally fail of mention, if we leave ancient details of practice mainly to text-books, it is because we believe that mining engineers care most for fresh technological data and next for discussion of the larger currents of human affairs that vitally influence their work. I repeat that success comes only through elimination of the less important, and, while editors are not infallible of judgment, the fact that the *Press* has grown while pursuing the policy outlined, indicates that it has won approval. Life's success is measured not alone in dollars, even among miners who devote their energies to increasing the world's stock of gold and silver, and the *Mining and Scientific Press* wants more than the largest circulation and the greatest advertising clientele. It wants the greatest measure of confidence of the men of the mining world, and with the continued help of our friends we shall strive always to merit and to hold that confidence. Having this, we have faith to believe that all these other things will be added unto us.

During the year just closed, fortune has been kind in that there have been but few changes in our staff. Death took from among our special correspondents T. Lane Carter, one especially gifted, having the eye to see and the pen to describe the interesting places of the world. Mr. M. W. von Bernewitz, whose experience in Australasia has given him a fund of practical knowledge, has come to strengthen our force.

It would be invidious to single out the names of those to whom especial thanks are now due. The table of contents and the advertising pages show those who have mainly contributed. The lists include the leaders in the profession and among the manufacturers. We are proud of their support, and we believe that it indicates that the *Mining and Scientific Press*, with a record of over half a century of useful work, is today the 'organ of the profession'—rather than a private money-making venture. This is at least the ideal of the editors, the publisher, and the stockholders. The degree to which we shall continue to realize our ideals rests with you, gentlemen of the ancient and honorable profession of mining. And so, on behalf of myself and associates, I again thank you for your past and present support and, wishing you all good things in the New Year, confidently ask its continuance.

H. Foster Bain.

ESTIMATES of the production of the Butte district for the year just closed place it at 320,000,000 pounds of copper, 50,000,000 pounds of zinc, and $8,000,000 in silver and gold, having a total value of between $65,000,000 and $70,000,000.

CLOSE of the year in Australia found labor troubles prevalent or impending in many districts. Kalgoorlie advices are to the effect that a general strike may come at any time. Drought, injuring the crops, has raised the cost of living, and the men are restive. Decreasing yield and steadily mounting expense multiply the troubles of the operator, and just where the balance shall rest is not easily determined.

FIFTY YEARS AGO, as we learn from the *Mining and Scientific Press* of January 4, 1862, then in its third volume and still "the only mining, mechanical, and scientific paper on this continent," floods were interfering with the gold yield of California, J. D. Whitney was about to present his report to the legislature, and "Augustin's Method of Extracting Silver with Salt Water' was sufficiently new to warrant careful description.

COMMODITY prices during the year, according to Bradstreet's index numbers, have shown a marked upward tendency, the number for November being 9.478 as compared with an average of 8.713 for 1911. The composite pig iron price December 1 was 17.400, compared with 17.226 for November and 14.005 for 1911, according to *The Standard Metal Digest*. The index for general metal prices shows an increase greater than for general commodities.

FEW contributions of more general and immediate importance to miners have been made by geologists than the discovery of the phenomenon of secondary enrichment, its analysis, and the formulation of criteria for its recognition. We are especially glad to present this week the first part of a general discussion of the subject written by Mr. C. F. Tolman, Jr., whose wide experience in Mexico and the Southwest gives him especial familiarity with those types of copper deposits in which secondary enrichment is especially well displayed.

MINING companies in British Columbia have had an unusually prosperous year, having declared in dividends during 1912 a total of $1,312,876. The Hedley Gold Mining Company leads with a declaration of $360,000, or at the rate of 30 per cent, while the Standard Silver-Lead Mining Company, with $425,000, exceeds in amount, but not in rate, having paid 21¼ per cent. The British Columbia Copper Company has paid $177,512 and declared an additional dividend of $88,756, payable early this month, while the Le Roi No. 2, Ltd., has paid $29,400, or at the rate of one shilling per share. The gratifying total of dividends would have been considerably larger, under normal circumstances, for the Granby Consolidated Mining, Smelting & Power Company, Ltd., made large operating profits during the year that were retained to finance the construction of the new plant at Hidden Creek.

PHILIPPINE statistics for 1912 are not yet available. In 1911 the total value of the mineral output was $1,381,402. The output has been growing at the rate of a quarter to a half million dollars each year. The increase in gold production alone in 1912 amounted to more than $200,000. A full report will be presented later.

METALLURGICAL advances are treated with unusual fullness in this number of the *Mining and Scientific Press*, in accordance with our established policy of giving first place to technology rather than market news. Even this does not exhaust our ammunition. Mr. J. W. Hutchinson has prepared an account of his methods of treating concentrate that fittingly supplements his series of articles on the 'Operation of the Goldfield Consolidated Mill,' which we published in 1912. Originally planned for this number, the article has been held over in order to allow adequate room for illustrations.

LEAD SMELTING in 1912 did not attract the attention that was lavished upon copper smelting. Nevertheless, the year was not without significant events, among which first place must be given to the opening of the Pine Canyon smelter of the International Smelting & Refining Company. The entry of this company into the field long dominated by the American Smelting & Refining Company has already resulted not only in competition in buying but in stimulating development. Mr. L. S. Austin has prepared for us a most interesting description of the new plant. We had hoped to include it in this, our review number, but have been compelled regretfully to set it aside for later publication.

AMONG features of this issue that we present with especial pleasure are letters to Western mining men from the efficient and hard-working directors of two of the great bureaus at Washington, Mr. J. A. Holmes of the Bureau of Mines, and Mr. George Otis Smith of the United States Geological Survey. Both speak for institutions of much usefulness that are justly esteemed, not only in the Western states, but wherever mining is looked upon as a dignified calling and a serious business. In turn, the good opinion of the men in the field is highly regarded at Washington. The recent suggestion of the Prospectors Alliance that all Government bureaus be boycotted shows a lamentable lack of ability to discriminate between good and evil.

ONE of the features of 1912 on the Pacific Coast was the revival of the California Miner's Association, which held a particularly successful session in December. Workingmen's compensation, tailing disposal, the Panama-Pacific Exposition, and other topics were discussed, but the keenest interest was evinced when speakers touched upon the relations of the miner to the Government. With admirable poise, Mr. W. C. Ralston, president and chairman of the committee in charge, had arranged for speakers on both sides of each question. In editorial comment at the time, we pointed out that, to one listening, the debate appeared one-sided, since it happened that more of those criticizing than defending the Government were able to attend. We take especial pleasure, therefore, in presenting this week the first part of the excellent general statement in behalf of the Government prepared by Mr. W. C. Mendenhall, himself a citizen of California, at the request of the Secretary of the Interior. In debate each necessarily argues but one side of a case, and in a sense it is fair to say each speaks from a selfish viewpoint—from the one nearest his own heart. We are sure, however, that readers of Mr. Mendenhall's paper, however much they may have been stung by a sense of injustice suffered, will recognize the earnest purpose to be fair that is the underlying motive. The Government has been occasionally unfortunate in its choice of agents, as have the miners in choice of advocates. We believe that there is no necessary conflict and that nothing will so promote agreement as further frank interchange of ideas.

IDENTITY of names leads often to confusion, and when to it is added similarity in position, it is not surprising that credits and debits get sadly mixed. Mr. Robert Bell, late acting director of the Geological Survey of Canada, has been given undesirable publicity in connection with the Hawthorne trial and some of it has fallen undeservedly on Mr. J. Mackintosh Bell, formerly director of the Geological Survey of New Zealand. Mr. Robert Bell is a geologist of the old school mainly known for his work as an explorer. He has excellent things to his credit, but no especial qualifications for passing upon mining properties. Mr. J. M. Bell is a younger man, who after service in Canada and graduation at Queen's and Harvard, served with distinction in New Zealand. Later he joined an excellent firm of engineers and has recently been in Canada on professional work. We can not imagine that he or his firm would have made the mistake of endorsing the Hawthorne schemes.

DIAMOND mining is in bad repute in New York, where Brazilian ventures have turned out badly. Nevertheless, men associated with the Canadian Mining & Exploration Company have taken an option upon the Arkansas diamond field that has been worked in a small way for the last few years. The geological features, as pointed out some years since by Mr. John C. Branner, at that time state geologist, are entirely favorable. Diamonds of good quality have been found, and since the United States purchases 60 per cent of the world's annual output and there is a heavy tariff on importations, there is every inducement to develop the field if possible. As an excellent illustration of the scale of modern mining, it may be noted that Mr. W. W. Mein, the engineer in charge, proposes to mine and crush 100,000 tons by way of sampling the property. Nothing less, it is felt, will safely determine the average yield of the ground. Mr. Ralph Stokes, at one time by the way our correspondent in South Africa, is in immediate charge of the work. He has recently written most informingly of the Premier diamond mine, in *The Mining Magazine*, and is especially competent to undertake the task.

The Future of Gold Production

Because of its intrinsic worth and the enhancement of interest due to its employment as a standard of value, gold will always remain the metal of premier concern. The basis of the currency of all the chief nations of the world, it functions in a vital, though esoteric, way to influence every phase of life. During recent years world-wide concern has been expressed regarding the steady increase of commodity prices or, to use the stock phrase, 'the high cost of living.' In some quarters the theory is vigorously asserted that this is due to the great increase of gold production in the past decade, and in other quarters it is no less vigorously denied. With these collateral phases of the gold-mining industry, we have no present concern, purposing here to consider present sources of production and what may reasonably be expected to be the course of development in the near future. But we may add in passing that, in our view, the cost of high living is frequently confused with the high cost of living, and the structure of the modern social fabric is so complex that it is highly improbable that there can exist so simple relationship between commodity prices and gold production as some students have been led to believe.

Almost anything can be proved by the judicious use of statistics, and serious blunders may result from indiscriminating tabulations. But when employed with caution, statistics are useful to exhibit relationships and tendencies not otherwise discernible. The table below, showing the annual gold production of the world at three-year intervals since 1906, will be found significant. The figures for 1906 and 1909 are from the report of the Director of the Mint, while those for 1912 are estimates from various sources.

Gold Production of the World, Fine Ounces

	1906.	1909.	1912.
Africa	6,553,484	8,271,575	9,117,600
United States	4,565,333	4,821,701	4,436,400
Australasia	3,985,684	3,435,007	2,671,800
Russia	943,056	1,566,443	1,070,000
Mexico	896,615	1,153,400	1,212,600
India	584,744	501,097	532,000
Canada	581,657	473,591	.....
The Guianas	201,113	191,446	.....
Colombia	105,982	153,826	.....
Total, world	19,366,550	21,982,713	.....

The table makes evident that the rate of increase of production is steadily declining. Production in all the principal regions, with the exception of South Africa and Mexico, is decreasing at a faster rate than can long be compensated by the growing yield of those two countries, the decline in Russia alone more than offsetting the increase in Mexico. Mr. H. C. Hoover, in a recent interview given to the New York *Sun*, discussed at some length the probable future production of gold, reaching the conclusion that the 'first crop' of easily won gold in placers and outcrops has been mainly harvested. Elsewhere in this issue Mr. T. A. Rickard treats in detail of the output during the past year. It would be unprofitable to thresh over old straw, but certain features of the matter may well be emphasized. The table below shows the production of the leading states of the United States for 1905, 1908, and 1911, and may serve to make clear the present situation. The total production of the United States for 1912,

Gold Production of the United States

	1905.	1908.	1911.
California	$19,197,100	$19,329,700	$19,928,500
Colorado	25,701,100	22,871,000	19,138,800
Nevada	5,359,100	11,689,400	18,096,900
Alaska	14,925,600	19,858,800	16,665,200
South Dakota	6,913,900	7,742,200	7,429,500
Utah	5,140,900	3,946,700	4,486,200
Montana	4,889,300	3,160,000	3,649,700
Arizona	2,691,300	2,500,000	3,521,400
Total, U. S.	$88,180,700	$94,560,000	$96,890,000

as estimated by the Director of the Mint, is $91,700,000; a decline of over $5,000,000 as compared with 1911. It will be noticed that the increase in 1908 over 1905 was roughly measured by that shown by Nevada, while 1911 as compared with 1908 shows a total increase of only one-third of that of the same state. The Goldfield Consolidated, which has been such a tremendous producer, is nearing its end, and the detailed figures for 1912 by states, presented on another page, seem to show that the declining output of the Goldfield Consolidated is the chief factor in the lessened yield of the country for the past year. This illustrates an essential feature of gold-mining: the more productive a gold mine is, the faster it is worked out and the sooner it ceases to produce. It is good business policy to 'gouge' a rich mine. The rapid rate of increase in production which the Rand has shown since the close of the Boer war is, however, to be deprecated rather than acclaimed, since it signifies the earlier approach of a period of declining yield. In many of our states, as well as in many of the chief producing countries abroad, the larger part of the output is derived from but a few large mines, the closing down of one of which would serve to more than offset any probable increase in production elsewhere in the area. When mosquitoes die no one misses them; when a Goldfield Consolidated, a Robinson, or a Homestake ceases to produce, a whole new district will scarcely serve to counterbalance the loss.

Over against the certain exhaustion, in course of time, of the mines now productive, may be set the possibility of the discovery of important new mines, the increased yield from present ore reserves through improvements in metallurgical processes, and the possible yield from old tailing. The former has been so thoroughly covered by Mr. Hoover that it is not worth while to do more here than repeat that, now that both the north and south poles have been reached, geographical exploration has fairly thoroughly covered every important part of the earth's surface. This does not mean that everything has been discovered: Cripple Creek lay for years unnoticed, though but a few miles from the capitol of Colorado; but the chances for important discoveries are greatly decreased. It is doubtful if a new Rand or a new Cripple Creek will ever be discovered, though it might be unsafe to assert that no new

source of supply as important as these will ever be developed. The possibilities of Europe, Asia, Africa, and Australasia now appear to have been pretty thoroughly appraised; North and South America are more uncertain. Canada has shown tremendous development in recent years, and the skirmish line of prospectors is steadily forging toward the north from her southern border. Exploration is difficult in a boreal region, prospecting even more so, and it does not seem unreasonable to assume that in her unexplored areas Canada contains potential producing districts of considerable importance. Mining in South America has been hampered by unfavorable climatic conditions in many cases; consequent upon that disadvantage follow a whole train of governing conditions which conspire to increase working cost and decrease profits. It may be urged that the work done on the Panama Canal Zone is prophetic of what will shortly be the order of the day in all tropical countries, but it is easy to obtain a perverted view of the significance of such an achievement. The outlay of $13,000,000 on sanitation in the course of the expenditure of $250,000,000, to June 30, 1911, in the carrying out of a definitely planned enterprise, is one thing; procuring of healthful conditions in mining districts not yet proved to offer great profits, is another matter. Working conditions will assuredly be better as a result of our experience at Panama, but tropic lowlands will not be widely converted into pleasure resorts, for the present at least. It must not be forgotten that the cost of labor is steadily rising the world over, so that future changes will not be all net gain.

The possibilities of metallurgical improvement are similarly difficult to gauge, but do not appear to be great. Improvements will eventuate so long as earnest men continue to put their hearts and brains into their work, but it can scarcely be questioned that the margin is now small and the general manager already has to consider the saving of pennies where dollars were once a possibility. The stage of mechanical and chemical perfection to which the cyanide process has been brought is such that but little more can be gained: the cream has been skimmed, the skim-milk turned into cheese, and not much can be made of the whey. Generalization concerning mining costs is impossible; as cheap work has been done by primitive as by the most refined of modern methods. Nor is there much hope of salvation through the steadily increasing production of base metals, which it may be safely assumed will increase in proportion to man's needs. In the preceding table Utah, the sixth in the list, is the only state where an important part of the total gold production is obtained from base metal ores. In Colorado a little over one per cent of the total gold is obtained from lead ores, and a little less from copper ores; in Nevada two per cent of the total gold is from copper ores and only three-tenths of one per cent from lead ores; while in Montana copper ores contribute one-fifth and in Arizona one-third of the entire output of the yellow metal. Great increases in base metal output would not, therefore, serve to overcome even a slight decline in the yield of the Rand. The past decade has been characterized by a rapidly increasing output of gold, and the conclusion seems unavoidable that the coming decade will be characterized by a slowly declining output; a decline which, so far as can now be foreseen, there is little hope of ever again permanently converting into an increase. Be that as it may, we are firmly of the belief that industry and civilization will continue to progress, and that man will more and more completely subdue the material things of earth to serve his comfort and convenience.

Mexico in Unrest

The chief lesson of the epidemic of revolutions that has undone the pacification of Mexico which Porfirio Diaz had effected, is the need of proper legislation, and rigid enforcement of the laws when made, to prevent participation by our own citizens in such uprisings. The matter may be stated even more pointedly. Penalties of such severity should follow conviction for offenses of this nature as to render it so unsafe for financial interests in the United States to foment and encourage revolutions in foreign countries that capitalists and corporation managers would no more risk playing at the dangerous game of wholesale murder by proxy than they would risk the committing of murder personally to achieve some financial advantage. It is impossible to draw a line between the hiring of an assassin to kill a competitor on Wall Street and the furnishing of money and supplies to a disgruntled political agitator abroad to redden his country with the blood of civil war for the sake of some expected monetary benefits. It is rumored with such circumstantial detail as to produce moral conviction, that within the last twenty years three of the greatest corporations in America have deliberately unchained the dogs of war in countries with which we had concluded solemn treaties of amity and commerce. Venezuela, Nicaragua, and Mexico all have the United States to thank for revolutions which have torn them as only civil wars can do, and that have set them back in their course of development. If our consciences are so seared in respect to international ethics that we remain unmoved and take no effective measures to terminate nefarious proceedings of this kind, we might as well legalize the scheme, jestingly proposed by a shrewd and humorous Yankee in the Argentine, who saw an opportunity for a lucrative business in organizing a war company, ready to hire its soldiers and fleet to the highest bidder, whether revolutionist or representative of a government *de facto*. In all seriousness, the open and ruthless violation of our treaty engagements with Colombia, committed by the Roosevelt administration, was less discreditable than the shallow pretense of observing the neutrality laws which has brought our country into disrepute among all the Latin-American nations during the past two years.

The consequence of the pernicious activities of American citizens, and the connivance of our authorities at revolutionary efforts south of the Rio Grande, has been to let loose the basest passions of brutal men in a long series of rebellions, great and small.

marked by hideous savagery and by frightful destruction of life and property. The Mexican people fully understand the delicate and difficult position in which the Government at Washington has placed itself, and this is part of the cause for the contempt in which they hold Americans in that Republic. The threats from the White House sound even more hollow to the Mexican than they do to our own people. It is embarrassing to admonish a boy not to shoot firecrackers where he may among us, after we have put the firecrackers in his hand.

In addition, the Department of State has stultified itself with a series of absurd communications, both to the Mexican Government and to Americans resident in Mexico. The warnings sent to Americans through consuls made us seem so ridiculous that even the newsboys in the streets hurled insulting epithets at the *gringo* after it became evident that there was neither any intention to protect the lives of those who lingered nor to stop the revolution by intervention. The paltriest of all things is a threat. The stupid communication, indirectly recognizing the belligerency of Orozco, when followed by the announcement that the Madero administration would be held responsible for loss of life and property in any part of Mexico, brought forth a curt retort, so correctly framed in accord with the accepted tenets of international law as to admit of no reply. This added to the contempt of the Mexicans for our country and our people. The preposterous folly of the Administration at Washington in avowing that no intervention would occur gave the Mexicans practically a loose rein. We are not aware of any other country in the world that would commit so childish an indiscretion as to publish its purposes to the winds. The habit of diplomats is to say nothing until the time comes for some decisive action. It is part of the international game to leave the other country in doubt as to what you mean to do. So far as we can see, the present Administration has missed few opportunities to humiliate and endanger those of its citizens who are compelled to reside in Mexico. The last step, taken in the face of a formidable presentation of authenticated acts of violence against Americans, has been to announce that the *status quo* will be suffered to continue until the inauguration of a new president.

The moral effect of this pusillanimous policy has been to encourage revolutionary activity in all parts of Mexico, and to weaken the hands of President Madero. We believe that his sentiment toward our people is generous, and that his intent is to protect the alien to the best of his ability. As the head of the actual Government, he deserves support, but the so-called conciliatory attitude of the American Government makes his course more difficult than it would be if sterner measures were taken. These would arouse the dormant sense of responsibility in the Mexicans, and would tend to consolidate them and make them more careful of American interests, even though they should indulge in a little more rant and bluster. The situation in Mexico is not critical, but it is extremely serious. Three of the most formidable uprisings against the Madero government have been successfully quelled, but the revolutionary disease continues to be sporadic. The army and the corps of *rurales* is wholly inadequate to police the country. The creation of an army of sufficient size to preserve the peace is impossible on account of the lack of funds. Moreover, the army has been recruited in the past mainly from the renegade element, and this stands in the way of enlisting a volunteer force of the better class of citizens, even if money were available for the maintenance and the mobilization of a largely increased force.

The chief weapon needed for the pacification of Mexico, no matter how firm and wise the executive in the chair, is gold. The disturbance of business has been so profound that the industrial life of the country is palsied. The inevitable result has been a tremendous reduction in the revenues. The interest upon the bonded indebtedness of Mexico has been scrupulously paid, showing a proper sense of responsibility as well as a realization of the importance of maintaining the national credit. To do this, and to provide for the interest just falling due, in conjunction with general administration and war expenses, has caused an enormous drain upon the exchequer. One small loan of twenty million pesos was negotiated, through the house of Speyer, upon terms that are reputed to have been onerous; and agents are now abroad for the purpose of borrowing an additional forty million pesos. Meanwhile, the taxes upon tobacco and liquors have been raised, which was the least disturbing means of increasing the revenues. Also a horizontal raise of five per cent upon the customs duties has begun to weigh upon the people, and further elevations of the tariff are proposed. The municipalities, feeling the decrease of income as severely as the Federal Government, have likewise resorted to ingenious means to provide adequate funds. The promises of Madero, made in the flush of a prospering revolution, to reduce the burdens of taxation are impossible of fulfilment. This will augment the popular discontent, and will prove a further menace to political stability. The dilemma of the Administration resembles a snowball which grows as it rolls forward. From mixed motives, deplorable even though the peculiar situation in Mexico may seem on some accounts to warrant the action, President Madero has practised nepotism to a degree that has steadily lessened his popularity.

It is conceivable that several gentlemen, prominent in Mexican affairs, could assume the reins of authority with the approval and confidence of so large a majority of the population as to insure a speedier restoration of normal conditions. The President insists, however, that he will not resign, and that he must have a chance to 'make good.' He certainly has not had a chance to do so, and just as certainly he ought to have the opportunity; but if the present agitation in the country, and the persistent opposition in political circles in the Capital and in the larger cities, continues, he would prove himself a greater patriot by stepping aside, despite the worthiness of his motives and the dreams of reform which he has cherished. If he were given the hearty support of his own countrymen, the agrarian reforms which he proposes would unquestionably

produce a great alleviation of the conditions of the Mexican people, and in the end would benefit all classes. No other aspirant to the presidency is likely to insist upon such measures.

Nevertheless, if the situation does not soon change for the better, he cannot hope to make his projects effective. The situation will not change unless he can adequately finance the Government, including the police arm which is imperative for the re-establishment of order. He cannot finance the Government without the coöperation of foreign financiers. Therefore it is evident that the political stability of Mexico depends, on one side, upon a wise and statesmanlike attitude of the Government of the United States, both on the part of the legislative body and of the executive, and on the other side, it depends upon the willingness of foreign bankers to provide funds under suitable guarantees of national policy as well as of interest and amortization, so as to conserve the vast investments of outside capital which have already been made in that Republic.

Mill Practice in 1912

Busy millmen find it increasingly difficult to follow the latest practice throughout the world, and the annual review of cyanidation during the past year by Mr. Alfred James, which appears on another page of this issue, is correspondingly welcome. To paint the rose is useless, but some of the interesting points touched upon invite further discussion. The successful treatment of rich silver ores calls for the most attention. At Tonopah splendid results are obtained at moderate cost from ores containing 30 ounces of silver and a little gold. The mills at this centre are simple, and no complicated classification is necessary. The MacNamara and Belmont mills were started during the year, and the latter may be cited as an example of unusually good mechanical arrangement. It is making a high extraction at low cost, and in November produced 369,422 ounces, or about 12 tons, of silver bullion from 12,426 tons of ore. The Mexican mill at Virginia City was also started in 1912 and is making a 92 per cent extraction from an ore containing nearly 40 ounces of silver per ton. The application of hot cyanide solutions (about 60°F. at the mortar-boxes and 120°F. in the agitators) has been a great aid in securing higher extractions from these ores. At the Knight's Deep plant, on the Rand, solutions have been heated to 90 or 120°, but apparently this is to secure quicker settlement of slime, as no mention is made of increased extraction.

The 'new' metallurgy of Cobalt, in the mill of the Nipissing company, is of great interest. During November this plant treated 134 tons of a complex silver ore, yielding about 280,000 ounces of silver, or 2090 ounces per ton, with an extraction of 97 per cent. This is done in a tube-mill containing 3¼ tons of ore previously crushed to 20 mesh, 4¼ tons of mercury, 2 tons of 5 per cent cyanide solution, and 6 tons of pebbles. The pulp is filtered on vacuum-filters. This company has also built a stamp-mill for treatment of lower grade ores. Zinc shaving is generally preferred for precipitation of silver from cyanide solutions, but at the new Belmont mill zinc dust gives excellent results. Little has been heard from Mexico during the year, the revolution having interfered with the operation of many mills, but in his recent interesting little book, Mr. Ferdinand McCann gives details of the latest Mexican practice on silver ores.

It would seem that the so-called improved types of roasting furnace to which Mr. James refers are not well adapted to produce a sweet roast, such as is necessary in a dry treatment of sulpho-telluride ores. Perhaps the most interesting roasting plant erected during the year is that at the Goldfield Consolidated mill, which will be described in an early issue of this paper by Mr. J. W. Hutchinson. This plant treats concentrate containing copper, and the method employed should be interesting to our friends at Kalgoorlie, where the roasting and treatment of dry ore and concentrate has reached a high point of efficiency, more especially at the Associated, Kalgurli, Perseverance, and the Horse-Shoe. Rhodesian ores contain antimony, and roasting is being adopted, but if the volatilized antimony oxide condenses and accumulates at the feed end of the furnaces, a modification of the construction will be required.

The gyratory crusher holds the field for coarse crushing in the majority of cases. Where a large capacity is required, this type is the best, but for small plants the jaw crusher is useful and suitable. The use of heavy stamps has its adherents, but greater attention is now paid to such primary crushers as Chilean, Lane, Krupp, and other mills and rolls. The new Buckhorn mill in Nevada will employ rolls, Hardinge mills, and tube-mills. Stage reduction is admitted to give best results, and rolls are now so made that grooving is largely prevented. In tube-milling a number of millmen believe in using ore or rock for crushing, though the efficiency of this is questioned by others, as rough surfaces do not facilitate good impact.

The methods employed in elevating pulp afford an interesting subject for discussion, but practice varies greatly. Bucket elevators work well in many mills, including the Goldfield Consolidated and all the Broken Hill silver-lead mills; centrifugal pumps are considered the best at Tonopah; tailing-wheels at Waihi and two Kalgoorlie plants; plunger pumps at Bendigo and Kalgoorlie; and pumps and wheels on the Rand. Agitation practice is equally varied. Vacuum-filters are being used in many new mills, but at Kalgoorlie the filter-press is doing its usual good work. Labor costs are, however, an objection to it, and probably the practice will have to go under in time. Results from the treatment of low-grade ores at Stratton's Independence, the Treadwell group, Homestake, Wasp No. 2, and the splendid work on ore worth less than $6 per ton at the Perseverance, South Kalgurli, and Associated Northern mills, in Western Australia, are all of the greatest interest. The use of oil-fired assay and clean-up furnaces is increasing, as they afford a particularly convenient means of applying heat. On the whole, the past year was one of great interest to all metallurgists, and further improvement may be confidently expected during the coming year.

Metal Production and Prices in the United States in 1912

UNITED STATES PRODUCTION, 1911 AND 1912

Below are given figures of production for 1911 and estimates for 1912 for coal and the principal metals.

Coal:	1911.	1912.
Bituminous, tons short	396,296,000[1]	480,000,000[4]
Anthracite, tons long.	86,896,000[1]	76,900,000[4]
Pig iron, tons long.... ..	23,649,344[2]	29,700,000[5]
Copper, pounds.....	1,097,232,749[1]	1,249,000,000[4]
Gold, fine ounces.....	4,687,053[3]	4,435,270[3]
Silver, fine ounces.....	60,399,400[3]	62,369,974[3]
Lead, tons short.....	486,976[1]	480,965[4]
Spelter, tons short.....	286,526[1]	338,630[4]
Quicksilver, flasks.....	21,256[1]	23,256[6]

[1]U. S. Geological Survey figures.
[2]American Iron & Steel Association report.
[3]Joint estimates Bureau of Mint and Geological Survey.
[4]U. S. Geological Survey estimates.
[5]*Iron Age* estimate.
[6]Estimated.

Gold and Silver

The Bureau of the Mint and the United States Geological Survey have issued the following joint statement as the preliminary estimate of the production of gold and silver in the United States during the calendar year 1912. Beside these figures have been placed those for 1911 as given in the final report for the year, issued by the Geological Survey.

Copper

Estimates of production, made by B. S. Butler, of the United States Geological Survey, indicate an output for 1912 in excess of that for any previous year. The total for Lake and blister copper is figured at 1,249,000,000 lb., as against 1,097,232,749 for 1911. Valued at 16c., the output for 1912 was worth nearly $200,000,000, as against $137,154,092 the previous year. Figures published by the Copper Producers' Association show an output of refined copper in the first eleven months equal to 1,429,147,150 lb. The total for the year may be estimated at 1,560,000,000 lb., as against 1,433,875,026 in 1911.

Spelter

The production of primary spelter from domestic ore in 1912 is estimated by C. E. Siebenthal, of the U. S. Geological Survey, at 323,961 short tons and from foreign ore at 14,669 tons, a total of 338,630 tons, worth, at the average St. Louis price, $46,731,000, compared to a total of 286,526 tons in 1911, worth $32,663,964 and made up of 271,621 tons of domestic origin and 14,905 tons of foreign origin.

Lead

According to estimates made by C. E. Siebenthal, of the U. S. Geological Survey, total production of

GOLD AND SILVER PRODUCTION IN THE UNITED STATES

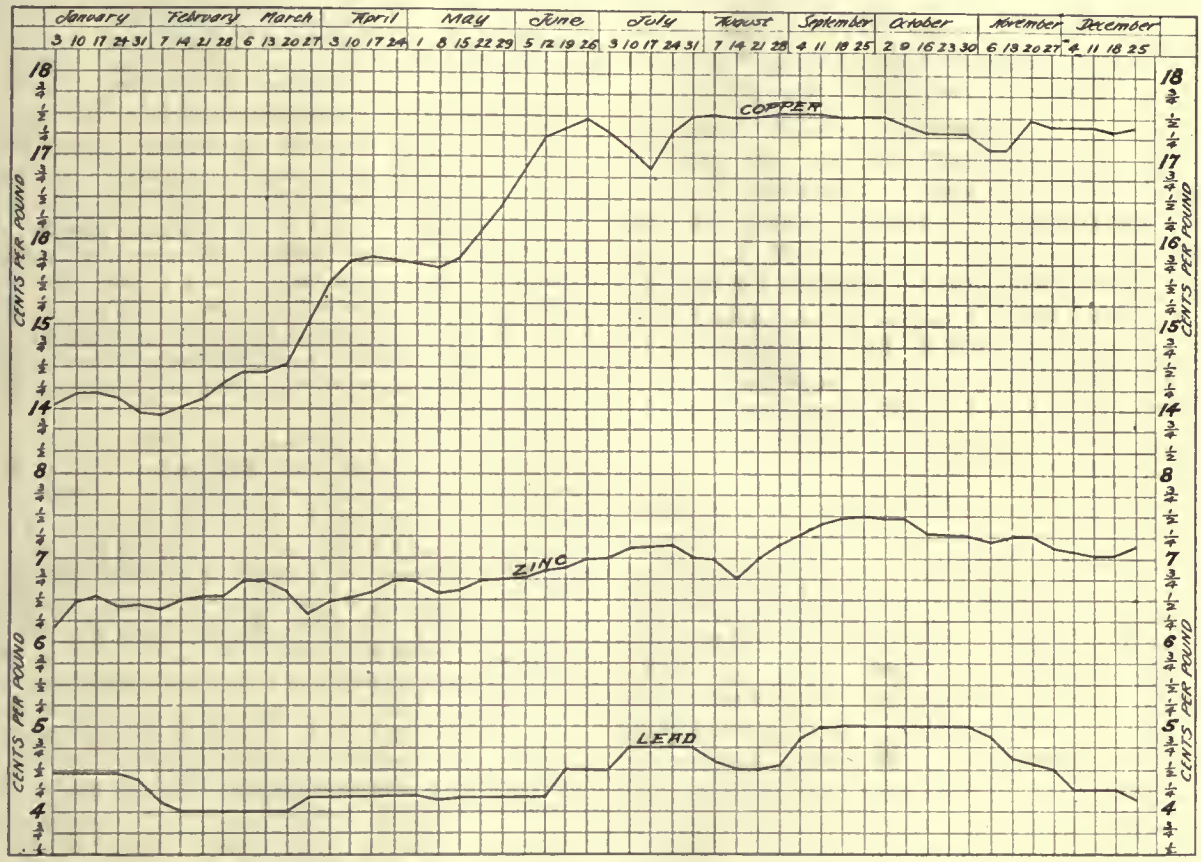
	Gold				Silver	
	1911.		1912.		1911.	1912.
State or Territory.	Fine oz.	Value.	Fine oz.	Value.	Fine oz.	Fine oz.
Alabama	890	$ 18,400	855	$ 17,674	200	237
Alaska	806,179	16,665,200	841,674	17,398,946	468,300	516,224
Arizona	170,348	3,521,400	159,807	3,303,504	3,228,900	3,456,989
California	964,041	19,928,500	966,943	19,988,486	1,270,900	1,255,192
Colorado	925,839	19,138,800	909,049	18,791,710	7,331,200	8,350,316
Georgia	1,548	32,000	478	9,881	600	65
Idaho	65,688	1,357,900	63,077	1,303,917	8,184,900	7,703,721
Illinois	.....	.....	.....	.....	4,000	3,740
Maryland	5*	100*	.....	.....	100*	201
Michigan	.....	.....	.....	.....	507,700	543,360
Missouri	.....	.....	15	310	49,100	25,311
Montana	176,554	3,649,700	156,507	3,325,287	12,163,900	12,338,589
Nevada	875,438	18,096,900	644,920	13,331,680	13,185,900	13,042,118
New Mexico	36,847	761,700	29,265	604,961	1,341,400	1,251,412
North Carolina	3,478	71,900	6,906	142,760	1,000	3,783
Oregon	30,679	634,200	30,515	630,801	44,800	79,896
Philippines	9,448	195,300	19,362	400,248	3,100	5,650
Porto Rico	97	2,000	.....	.....	100	.....
South Carolina	972	20,100	754	15,587	.....	40
South Dakota	359,402	7,429,500	377,116	7,795,680	200,300	200,796
Tennessee	576	11,900	478	9,881	107,000	109,773
Texas	189	3,900	492	10,170	444,200	420,994
Utah	217,020	4,486,200	211,736	4,376,971	11,630,600	12,795,072
Virginia	150	3,100	424	8,765	200	7,974
Washington	40,635	840,000	13,789	285,044	230,300	258,152
Wyoming	1,030	21,300	1,107	22,884	700	298
Totals	4,687,053	$96,890,000	4,435,270	$91,685,168	60,399,400	62,369,974

*Maryland and Pennsylvania.

refined lead, desilverized and soft, from domestic and foreign ores in 1912 was approximately 480,965 short tons, worth at the average New York price $43,286,850, compared to 486,976 tons in 1911 and 470,380 tons in 1910. These figures do not include an estimated output of 13,384 tons of antimonial lead.

NEW YORK METAL PRICES

Below is presented in tabular and graphical form a summary of metal prices in New York as quoted weekly in this paper. Following is a discussion of prices by our own correspondent and illuminating comment by E. G. Hothorn.



SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1911.	1912.		1911.	1912.
Jan.	53.81	56.25	July	52.57	60.67
Feb.	52.23	59.06	Aug.	52.17	61.32
Mch.	52.76	58.37	Sept.	52.43	62.95
Apr.	52.32	59.20	Oct.	53.37	63.16
May	53.31	60.88	Nov.	55.77	62.73
June	53.04	61.29	Dec.	54.85	63.38

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	12.29	14.09	July	12.47	17.19
Feb.	12.26	14.08	Aug.	12.41	17.49
Mch.	12.14	14.68	Sept.	12.20	17.56
Apr.	12.02	15.74	Oct.	12.19	17.32
May	11.99	16.03	Nov.	12.61	17.31
June	12.39	17.23	Dec.	13.55	17.37

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1911.	1912.		1911.	1912.
Jan.	5.45	6.42	July	5.70	7.12
Feb.	5.52	6.50	Aug.	5.95	6.96
Mch.	5.56	6.57	Sept.	5.86	7.45
Apr.	5.40	6.63	Oct.	6.10	7.36
May	5.35	6.68	Nov.	6.38	7.23
June	5.50	6.88	Dec.	6.30	7.09

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. Below are the average New York quotations by months:

	1911.	1912.		1911.	1912.
Jan.	4.48	4.43	July	4.50	4.71
Feb.	4.44	4.03	Aug.	4.50	4.54
Mch.	4.39	4.07	Sept.	4.48	5.00
Apr.	4.41	4.20	Oct.	4.27	5.08
May	4.37	4.20	Nov.	4.30	4.91
June	4.34	4.40	Dec.	4.45	4.20

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1911.	1912.		1911.	1912.
Jan.	44.60	43.75	July	48.00	43.00
Feb.	48.40	46.00	Aug.	50.00	42.50
Mch.	52.50	46.00	Sept.	47.50	42.12
Apr.	50.90	42.25	Oct.	46.12	41.50
May	46.50	41.75	Nov.	45.50	41.50
June	46.50	41.30	Dec.	44.50	39.75

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations in cents per pound:

	1911.	1912.		1911.	1912.
Jan.	41.25	42.53	July	42.40	44.25
Feb.	41.61	42.96	Aug.	43.32	45.80
Mch.	40.16	42.58	Sept.	39.75	48.64
Apr.	42.18	43.92	Oct.	41.18	50.01
May	43.11	46.05	Nov.	43.12	49.92
June	44.61	45.76	Dec.	44.65	49.89

EASTERN METAL MARKET REVIEW

[By Our Special Correspondent]

Features of the Year

The Eastern metal market enjoyed its full share of the general prosperity of the country in 1912. Consumption of all the metals was good and December prices, with the exception of those for lead, were substantially higher than those which prevailed at the beginning of the year. The high prices were no impediment to business when activity was at its height, but toward the end of the year when there came a natural tapering off in demand complaint was heard that prices were too high and they undoubtedly caused some restriction of trade. In copper the year reached its climax in August, the production of that month being 145,628,521 lb., or 65,013 gross tons, which broke all records for production. Great as the production in this month was and with stocks on hand at the beginning of the month of 50,280,421 lb., stocks at the end of August were decreased 3,579,047. The year also saw the price of copper just escaping the 18c. level. Tin importations exceeded those of 1911, prices touched and exceeded 50c. per lb. and the demand was fairly steady throughout, one reason being that 1912 was a banner year in the production of tin plates. The year in lead was marked in the last half by rather unusual competition and relatively the lowest price of any of the metals. The consumption of spelter, because of the heavy demands of the brass mills and galvanizers, was particularly good. Antimony was the last metal to respond to the general advance in prices. The year was notable also because the heavy and sustained business was carried on notwithstanding the proposal of early in the spring to reduce the tariff, while the presidential election with its prospect of a change in administration and policies, was practically ignored.

Copper

On January 1, copper stocks were 89,454,695 lb., the lowest in three years. It had been anticipated that the first month would show a further decrease in stocks, but great surprise was manifested when the figures showed that they had diminished no less than 23,174,052 lb. The following table, which lacks December production because the monthly reports of the Copper Producers' Association are not issued until the eighth of each succeeding month, gives the best available idea of copper production, deliveries, and stocks. The decrease noted in June production was ascribed to strikes. It will be noticed that in July production increased over 10,000,000 lb., while stocks increased only 5,945,417. Also that while deliveries were higher in October, they fell short of equalling the increase in production, and that in November there were decreases in both production and deliveries.

Copper Surplus

	U. S.	European.
January 1911	122,030,195	230,264,280
January 1912	89,454,695	178,329,920
February "	66,280,643	153,820,800
March "	62,939,988	141,125,680
April "	62,367,557	137,806,000
May "	65,295,368	134,176,000
June "	49,615,643	117,801,600
July "	44,335,004	107,817,920
August "	50,281,280	113,285,760
September "	46,701,376	112,743,680
October "	63,065,587	107,396,800
November "	76,744,967	103,803,840
December "	86,164,059	96,949,440

United States Production and Consumption

	Production.	Domestic deliveries.	Exports.
October 1911	118,255,442	64,068,656	60,084,349
November	111,876,601	68,039,776	67,049,279
December	122,896,697	65,988,474	79,238,716
Total for 1911	1,431,938,338	709,611,945	754,932,733
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	66,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600
August	145,628,521	78,722,418	70,485,150
September	140,089,819	63,460,810	60,264,796
October	145,405,453	84,104,734	47,621,342
November	134,695,440	69,369,795	55,906,550

According to United States Government returns the total imports of foreign copper in the first ten months of the year were 148,000 tons. In 1911 arrivals for the ten months ended with October, were 127,000 tons. The imports for 1912 are expected to prove record breaking, though a falling off in arrivals was noted in November and December. Exports in 1912 will not much exceed, if they equal those in 1911. The total exports in the first eleven months of the year were 298,491 tons, while for the similar period of 1911 they were 299,176 tons. Disturbed financial and business conditions resultant from the Balkan war had much to do with this situation.

Prices.—The year opened with electrolytic copper selling at 14.25c. per lb., New York, and strong at that figure though the domestic demand was moderate. It closed with the metal quoted at over 17c. and the market quiet. Prices, with the customary fluctuations, remained at just over 14c. throughout February, with the feeling improving steadily 14.37½c. was reached at the end of the month. March saw advances to 14.50c. and then higher by stages until 15c. was reached and exceeded, this being the first time in five years that copper had mounted to this level. About this time labor troubles abroad were regarded as a possible cause of curtailment and some harm may have been done. In April the price reached 16c. for electrolytic and in this month advances were announced in the price lists of brass and copper products. About the same price average was maintained throughout May, although toward the end of the month a strong upward movement set in. June brought prices ranging between 17.12½c. and 17.62½c. and a continuance of the good market, although in this month strike troubles at the works of the Standard Underground Cable Co. at Perth Amboy, N. J., and the National Cable & Conduit Co. at Hastings, N. Y., tended to cut down the consumption. It was believed, however, that this cut was offset by similar troubles at the Baltimore, Md., and Laurel Hill, N. Y., refineries of the A. S. & R. and Nichols Chemical Co., all of which were short-lived. The price range in July for electrolytic was between 17 and 17.62½c. with the demand continuing good. In August the metal went a few points higher and the large consumption and production already referred to took place. September prices were at or near the peg price of 17.75c. fixed by the copper producers as were those of October. In the latter part of the month well founded fears developed as to the effects of the Balkan war on European demand. Prices, though holding fairly well, showed a weaker tendency in November, in which month the exports were the smallest in two years. In December further reductions in price were made, copper selling down to 17.37½c. and even lower for small lots, and demand being quieter at home and abroad. As to the foreign market, much depended at this time on the outcome of the peace negotiations in London for the settlement of the war between Turkey and the Balkan allies.

The first week of December was extremely quiet and in the absence of any demand worthy of note prices sagged to 17.37½c. and reports were current of small sales at still lower prices. The copper producers' statement, out December 8, for November was favorably received by sellers as the increase in stocks (9,419,095) was less than had been expected. The second week of the month saw a still further softening of prices, including those for Lake copper, which had long stood steadfast. Then came a decided

improvement in demand and prices and more sales were made than in some time past. There were good transactions in electrolytic at 17.62½c. delivered Connecticut points cash 30 days, and small parcels were taken on the same basis at 17.50 cash f. o. b. N. Y. The end of the month found the metal firm at around 17.62c. cash N. Y. for Lake and 17.50 cash N. Y. for electrolytic, and there were no indications of a declining market. On the contrary as the year drew to a close a good buying movement was expected momentarily. An explanation of an apparent discrepancy between the November export figures of the copper producers' statement and those of the United States government is that the government figures at the end of November consisted only of those returns which had been received at the customs house, whereas those of the producers included copper which was aboard ship but which had not left the port. It was alleged in some directions that the producers had included December copper in their November exports, but this allegation proved to be without foundation. Exports for December to the 27th were 23,946 tons.

Tin

The most conspicuous feature in pig tin was the fact that prices advanced in the year to 50c. and over and though they sagged toward the end of the year they were not far away from the 50c. level from the last part of September on, and exceeded 50c. in December. The importations of the metal were large, totaling 45,515 tons between January 1 and December 1. Total deliveries into consumption in the first eleven months of 1912 were 45,450 tons as against 40,600 tons in the same period of 1911. The total visible supply November 30, 1912, was 12,348 tons as against 16,630 tons November 30, 1911, or 4282 tons less than in 1911 at the time named.

The year opened with tin selling at about 44.25c. and irregular, but a good demand soon developed. Prices were subject at times to violent fluctuations as a result of English price variations ascribed to manipulations in London, the controlling centre of tin. On January 3, for example, spot tin broke £10 in London with resultant effects in the New York market. In February tin was up to 44c. again. In this month a standard form of tin contract was adopted by the New York Metal Exchange in the endeavor to extend and broaden trading on the floor of this institution. The new contract has undoubtedly had a salutary effect, although the bulk of tin transactions are still outside of the Exchange. The price range in March was between 42.15c. and 43.37½c. and in April between 43c. and 44.75c. An unusual feature of the latter month was that Banca tin for prompt shipment was selling at 1c. per lb. higher than Straits, and Banca usually is a second choice. The range in May was 44.75c. to 46.12½c., and in June the price went to 48.50c. Both in May and June the big shipping strike in London caused trouble by delaying shipments, a difficulty which finally was surmounted by means of shipments from Holland ports. Prices in July fluctuated between 43.62½c. and 46c., and in this month it was currently reported that the United States Steel Corporation, the largest user of the metal in the United States, had bought heavily in Singapore, London, and New York. August prices were 45.12½c. to 46.25. It was on September 20 that 50c. was reached and before the month closed, the price mounted to 50.10c. Prior to it reaching 50c., the Steel Corporation was reported a heavy buyer. In October the price touched 50.40c. and in November and December prices hovered between 49c. and 50c., a lower tendency setting in at the end of the year. The dates of the six bi-monthly Banca auction sales to be held in Holland in 1913 have been fixed as follows: January 29, March 27, May 28, July 30, September 25, and November 27. The sales will amount to about 14,880 tons or about 2480 tons for each auction.

Spelter

Spelter was quoted at 6.35c. to 6.70c. in January in which month there was considerable talk of the scarcity of the metal. In February the price did not reach much higher limits and there was continued reports of scarcity of some brands. In March responding to the better demand the price went to over 7c., dropping again to 6.75c. and lower in April. In May and the early part of June prices were about 6.80c. to 6.90. It was in the latter month that the real upward movement began and 7.15c. was reached by July 1. In this month prices went to 7.35c. and the high cost of ore was mentioned as a cause. Prices in August hovered between 7.10c. and 7.25c., in September between 7.25c. and 7.65c., and between 7.50c. and 7.65c. in October. Reports were current in October of the importation of foreign spelter, while in early November the U. S. Steel Corporation imported 2000 tons at 1c. under domestic prices to be exported in product form with the advantage of the draw-back duty. In November 7.50c. was the average price, followed in December by subsidence in the demand and in prime western down to 7.30c. and lower.

Lead

The year began with lead quiet at 4.45c. New York, which price it held to the end of the month when there was a drop to 4c., where it remained through February and half of March. It was a price generally condemned as too low and there was relief on the part of sellers when 4.20c. was reached. The latter price prevailed throughout April, May, and into the early part of June, when the American S. & R. Co. sent its price up to 4.50c. Early in July there was a similar advance of 25 points to 4.75c., which the independents did not entirely follow. Early in August the largest interest lowered its price to 4.50c., but at the end of the month made an advance to 4.65c. Then came in quick succession advances to 4.85c. and then to 5.10c., the latter price prevailing throughout September. The rise to 5.10c. was due to the high prices prevailing for lead in London. English lead was quoted at £25, equal to 5.02c. New York and it was possible to buy American lead in New York at 4.85c., ship it abroad, and sell at a profit. In the latter part of October the prices of the independents dropped to 5.05 and this seemed to be the beginning of a period of keen competition in the metal. A factor in the situation was the new International S. & R. Co. Prices hereafter followed a declining tendency. The largest interest in early November reduced the price to 4.75c. and subsequently within the month quotations declined to 4.50c. Early in December the A. S. & R. Co. again reduced its price to 4.35c., but this was cut by independents to 4.32½c. and lower and the feeling became unsettled.

Antimony

Antimony was selling at 7.75c. to 7.87½c. for Cookson's, 7.60c. to 7.70c. for Hallett's and 7c. to 7.12½c. for Hungarian and Chinese grades at the beginning of 1912, and in the closing month at 9.87½c. to 10.25c. for Cookson's, 9.50c. to 9.75c. for Hallett's, and 9c. to 9.25c. for Hungarian and Chinese. The most substantial advances in prices came in the last quarter of the year, following the high prices of other metals. In January there was reported a scarcity of Hallett's, and before the month was over that brand was selling at 7.55c., while Cookson's was quoted lower at 7.37½c., thereby reversing usual conditions. In February prices were lower at 7.25c. for Cookson's, and 7.50c. for Hallett's, while in March much the same conditions prevailed, though Halletts was lower. In April there was a betterment, with Cookson's selling at 8c. and Hallett's at 7.62½c. Not much of interest occurred until early August when prices advanced out of sympathy with the other metals, and Cookson's touched 8.60c., Hallett's 7.87½c., and Hungarian and Chinese grades 7.75c. In October there was greater activity in the demand and prices advanced to the top notch of 10.50c. for Cookson5s, 9.75c. for Hallett's, and 9.37½c. to 9.50c. for Hungarian and Chinese. Since that time prices have sagged and shown no substantial recoveries. During December certain speculative influences unsettled the market and caused the import cost to be undersold. It is reported that more than one speculator who bought on the rise of the market is now trying to unload, but finds consumers pretty well supplied and the demand slackening. At the end of the month Cookson's was quoted at 9.87½c. per lb., Hallett's at 9.50c., and Chinese and Hungarian grades at 9 cents.

Aluminum

Aluminum in ton lots for re-melting, 98-99% pure, is now quoted at 26.50c. to 27.50c. per lb., and its position is strong. Early in 1912 when the price was in the neighborhood of 19c., a combine was formed abroad which embraced most of the foreign makers. Subsequently prices advanced on the other side and prices have followed. The sale of foreign aluminum contracted so far as the number of American sellers were concerned. Those who did have stocks of the metal sold advantageously in the narrower market. Prices advanced steadily with a demand so great that American producers could not keep pace with it and in some cases consumers were led to recourse to other metals, though the latter might not be so satisfactory. In other cases, metal was bought at high prices. Recently there has been talk of 'outside' producers in the European field, but nothing definite has appeared. Prices promise to keep up. At Whitney, N. C., the Southern Aluminum Co., is now erecting a plant which in the course of a few months is expected to produce at a rate of 25,000 tons per year. The company which is a New York corporation, backed by French capital, is identified with interests associated with L'Aluminum Francaise, of Paris. Its product is needed and should find a ready market.

METAL PRICES IN 1912

By E. G. Hothorn

Copper

Without following the monthly fluctuations and revamping the changes of the market during the year, it is worth while to point out that the most important development was the apparent realization on the part of large producers that the policy of selling copper around 12½c. was unwise. It is generally understood that the natural resources of the country have been heavily drawn upon as far as metals and especially copper is concerned, and this has caused a reversal of the former anxiety to sell copper regardless of price. Increasing demand from Europe and appreciation that stocks in the hands of consumers had decreased during preceding years, caused a steady advance. Speculators took advantage of the opportunity to push the market energetically, and as usual the swing carried prices to figures which would have been considered unwarranted a year ago. Finally demand became so urgent that repetition of the scarcity which marked the early months of 1906 and 1907 was feared. But for the Balkan war and the consequent financial tension in Europe, prices would probably have risen to 20c. or higher. Recent developments have had a salutary effect on such bullish enthusiasm. A feeling of pessimism is sweeping over the trade due to fears that the present market has again been artificially pegged, and that another collapse is due. Against this theory a number of weighty reasons present themselves: First, the steadily increasing demand per capita for copper in Europe; second, the prospect of a larger demand in the United States which so far has not been affected by the genuine boom, the demands to date representing only the present needs of the country; third, realization that new copper production of any consequence is far off, and that the output has probably reached its maximum, many mines being near the time when decreases rather than increases may be expected. While, therefore, the year does not close with fireworks which in America are alone considered valid indications of good times, the foundation is sound, and only a period of depression in Europe as well as in this country can affect the market disastrously. It may be argued that the advance from 12½ to 17¾c. was not justified, and that it would have been safer to keep prices around 15 or 16c. However, such theories do not take into consideration that in this country troughs of depression and frothy billows of enthusiasm regularly alternate, due to lack of poise in commercial affairs on the part of our people.

Pig Lead

While in other metals the course of the market has been in harmony with the general revival of trade, lead has undergone so much manipulation that buyers have been and are still floundering in the dark as to the real reasons for the depression which took place in February and March, the rapid advance of the summer and the subsequent still more rapid decline. All signs point to a large increase in demand for paint, lead-covered cables, and other uses, while production must have remained practically stationary. Though actual figures are not as yet available, it is well known that no new lead mines of consequence have been found in the United States during the last decade. The European price at one time during the year showed an increase of 80% compared with the low of 1907. The advance in other metals, notably iron, copper, spelter, and tin appears warranted and has been sustained, while developments in lead would imply that its advance was a matter of manipulation. Though I do not agree with this argument I feel convinced that stocks of lead have decreased during the year, and that the advance was forced on the leading group by the large demand. Consumers, however, are mystified and so pessimistic that purchases on their part are confined to the barest necessities. During the latter part of the year a new refinery which has been accumulating bullion for twelve months or more forced its output on a market which was unfavorably affected by fears of tariff reduction and disturbed conditions in general. It is useless to point out that lead is relatively and actually the cheapest of all metals. It is more than likely that no life can be expected until the policy of the new administration is clearly defined. On the other hand, I believe that tariff or no tariff lead is bound to feel the rapidly increasing world-wide demand for all metals and that production will remain stationary. The annual increase in United States output during last four years amounts to 60,000 tons, derived chiefly from Missouri. Notwithstanding this, however, the market closes flat, with prospects of still lower prices unless sentiment changes materially for the better. Europe reports that exceptionally large orders from Austria and Russia promise to offset a possible decrease of the German and English demand. The increase in German consumption this year will be 20% over the previous year; a rate that can hardly continue without interruption. No view of the market would be complete which did not take into consideration a decrease in lead production caused by the political troubles in Mexico and labor difficulties in Spain.

Spelter

The scarcity of this metal, which had become a matter of public knowledge at the end of 1911, became accentuated with each succeeding month of 1912, causing an unprecedented high level of prices. But for relief by importations from Europe, supplies would have run short. The plants making galvanized materials were better employed than ever before, while the demand for sheet zinc and brass showed an appreciable increase compared with the year before. I feel satisfied that statistics will show a substantial increase in production though shortage of gas interfered materially with the output. On the other hand I am convinced that when consumption becomes known, a larger ratio of increase will be shown than in any other metal. I figure that consumption of other metals has been about 10% larger than the year before, but spelter consumption must have increased fully 15%. The reasons are not only a large demand for galvanized sheets and wire in the United States, but also a heavy export demand. Higher prices of shingles and fence rails create automatically a larger demand for galvanized roofing and fencing. In this connection it is worthy of note that the European price of spelter has ruled at much higher levels than before. Exhaustion of zinc mines in other countries, notably Australia, foreshadows the time when Europe may have to supplement its supplies by drawing from the United States, where, fortunately, new districts promise to compensate the stationary supply from Joplin. At the close of the year none of the hesitancy to purchase, which affects other metals, is perceptible in zinc, and for the new year a large business is in sight.

Tin

During the past year tin has maintained its reputation as one of the most erratic and fluctuating commodities in the world. The extreme range in London has been from about £188 (40⅜c.) to £235 (51c.). The production of this metal is only about 120,000 tons per annum, of which in the neighborhood of 60,000 tons come from the Straits and the remainder from miscellaneous sources, principally the Dutch East Indies, with scattering quantities from Australia, China, South Africa, and Cornwall. America this year has used in the neighborhood of 50,000 tons, which marked a large increase over the previous high record, and in addition European deliveries have been larger. This simultaneous increase in demand all over the world has put a severe strain on the market, reducing supplies fully 5000 tons. This constitutes a reduction of 33⅓%. At the beginning of the year the visible supply was about 16,000 and at the end about 11,000 tons—equal to a little more than one month's supply. This close balance between supply and demand makes the market susceptible to manipulation, yet in a metal which is so important to the world industrially, and the uses of which are so multifarious and diverse, it is difficult to say to what extent present high prices are due to manipulation, and to what extent they are entirely legitimate. High as tin is at the present time, in periods of corners it has been even higher without apparently checking demand in the least. The price at which its use will be curtailed or the production expanded, has yet to be discovered, and best opinion is that should business both here and abroad continue upon the scale of 1912 and no new supplies be forthcoming, still higher prices than those now existing will be witnessed.

Platinum

[St. Petersburg Correspondence]

The world's supply of platinum continues to come mainly from Russia, and recent high prices have produced important changes in the old mining districts. For reasons which it is impossible to define, the price, in spite of a limited foreign demand, remains in the immediate neighborhood of the record level—a trifle under it, but no more. This has continued now for many months. Every piece of ground that would produce platinum has been worked, so far as is known. Placers previously considered of little value have been made profitable this year, and large houses that were content to work on a comfortably limited scale have extended their operations and are working, with and without dredges, on a scale hitherto unknown. The production cannot be stated. The metal is held in such a manner as to constitute a permanent enigma. Those who make it their business to speculate in platinum are content, either for their own account or perhaps on behalf of some one behind the scenes, to pay even higher prices to tributers than the official quotation on the Ekaterinburg metal exchange. This is continuously ascribed to speculators, but it may turn out that these speculators are the agents of foreign houses.

Meantime the great platinum question, namely, the regulation of the industry by the Russian Government, hangs fire. The principle, as is known, has been accepted by the Duma, but the act has several phases to go through before it becomes a law. Should it do so, which is more than probable, it is hard to see how the extension of foreign buying of existing stocks in Russia will tally with the interests of buyers, for it has never been suggested that the price at which platinum should be pawned with the Imperial Bank should be on the level of the present price quoted. An interesting development in connection with this is the step taken by the well known Tentelieff Chemical Works, and announced some time ago, in the formation of a platinum section of the works, which is equipped to deal with platinum almost as completely as is western Europe. It will be remembered that the crucial question in connection with the disposition of platinum has always been the capacity of the Russians to refine it. The Tentelieff company is a strong one—at least it is believed to be—and is presumably capable of spending the money to equip an efficient platinum laboratory. As the total quantity to be handled is by no means large, the step taken by this company might have the effect not only of disappointing the foreigners, but of materially modifying the results of the proposed law. From every point of view, this year was a great success financially, whatever it may be quantitatively. Incidentally, a feature of the metal exchange operations at Ekaterinburg has been the uniform absence of osmiridium.

The Bureau of Mines and the West

By J. A. Holmes

The Bureau of Mines is now endeavoring to expend wisely an initial appropriation of $50,000 granted by Congress a few months ago, and it is asking Congress at its present session to appropriate a still larger amount for investigations looking to the betterment of mining in the Western states. The Western mining men labored so long and so earnestly for national recognition and aid for the mining industry, that the present Director of the Bureau of Mines deems it eminently proper to keep in close touch with them concerning whatever investigations may be authorized by Congress and conducted by the Bureau relative to those phases of the mining industry in which the West is interested. And it may be appropriate at this time to set forth briefly the general prineiples upon which is based the policy of the Bureau of Mines.

1. It is not intended that the Bureau of Mines should undertake work in the interest of any private party; nor that its employees should compete with the private mining and metallurgical engineers and chemists of the country in doing work which the latter are prepared to do, and should be employed to do.

2. The Bureau of Mines has been established in recognition of the fact that there is in the mining, as there is in the agricultural industry of the country, a public welfare; and the Bureau's chief function is to conduct such inquiries and investigations as are likely to prove beneficial to the mining industry, and therefore to the general public.

The employees of the Bureau of Mines recognize fully the importance of the work that is being done by the private mining and metallurgical engineers, by the private assay laboratories and testing stations, and by the mining schools of the country. To these agencies the mining industry is indebted beyond all estimate for the progress it has made. It is believed and desired that the work of the Bureau of Mines, instead of interfering with, will increase and strengthen the work that is being done and that must be done hereafter by all these agencies. Such has been the result of the work of the Bureau of Mines (and of the Technologic Branch of the Geological Survey which preceded it) in relation to the fuel industries of the country; and it is believed that such will be the result of the Bureau's investigations in relation to the metal-mining industries. What the present management of the Bureau of Mines believes in, and most desires, is coöperation and not competition between its work and that of the other agencies that are laboring for the upbuilding of the mining industry. By supplying the Bureau with information concerning improvements with which they are personally familiar, and by giving it the benefit of their suggestions and advice—all of which will be welcome—the mining and metallurgical engineers and chemists of the country can render a most important service; and whenever, in turn, the employees of the Bureau of Mines can render any services that will be helpful to the industry and in keeping with its duty as a public institution, they will most gladly render such services.

Under its present authorization, the Bureau is concerned first of all with matters pertaining to safety and health conditions in mines and metallurgical plants. Next to these in importance are the problems that relate to waste or losses in the mining and treatment and use of mineral resources; following that various other problems having to do with the general development and wise use of these resources. The words "safety and efficiency" in mining and metallurgy serve as a good motto for the work of the Federal Government in relation to mining. As Director of the Bureau of Mines, I will be glad to receive from local mining and metallurgical engineers in the different mining districts information and suggestions.

Some of the subjects concerning which information and suggestions are desired especially, for the reason that they are already being studied by the engineers of the Bureau, are the following: (1) How to lessen the number of accidents in metal mining —the latest data available show the fatal accidents in metal mines for 1911 to be about 4 deaths for each 1000 men employed, which is a larger death rate than in coal mining, where in 1911 the ratio was 3.8 deaths for each 1000 men employed; (2) health conditions in metal mines and how these may be improved; (3) data concerning the need of better ventilation in metal mines, and the most efficient and economical methods of accomplishing the needed changes; (4) what explosives are being used in metal mines, and suggestions looking to greater safety and efficiency in their use; (5) examples and amount of waste or losses in different mining and metallurgical operations, and suggestions as to how such waste or losses can be reduced; (6) the success or failure attending the use of any new or special equipment or progress in the mining or treatment of ores or minerals under different conditions; (7) the nature and extent and methods of studying low-grade ores with special reference to the possibility of their successful treatment, and the same relative to ores carrying the rarer metals or rare minerals substances.

It is hoped that the work of the new year will bring the Bureau of Mines and the mining and metallurgical engineers of the West into closer coöperation relative to these and other mining problems, even incomplete solution of which cannot fail to advance the industry. The effort to secure federal recognition and aid for the mining industry has thus far met with but limited success. Full success will only come after further united effort. Even after this has been attained in degree proportionate to that given to agriculture, there will yet be need of research work by all available agencies found in the federal and state governments, mining schools, and private laboratories working in behalf of private corporations.

The Year in the London Mining Market

By T. A. Rickard

Introductory.—The year just closed has been full of interest, as is inevitable in a business so subject to the chances and changes of fortune. Whatever the drawbacks, it must be allowed that the industry, the business, or the game, as mining variously presents itself, is never dull. It is synonymous with risk as with gain, with vicissitudes as with luck, with trickery as with skill. Of all of these aspects we have had plenty of examples during the past twelve months.

Despite the alarums and excursions of war, the mining department of the Stock Exchange has gained in strength. Indeed, it has become obvious

that the real business of winning the metals is but little affected by organized murder in Tripoli or the Balkans, for the industry is largely centred in regions less subject to these outbreaks of barbarism. In one important mineral region, it is true, the swing of the pick has been stayed by the flash of the sword; yet even in Mexico the operations of the big mines have scarcely been curtailed, and if new ventures have been held in abeyance it is with the justifiable hope that an era of disorder is coming to a close.

Among the dramatic episodes of 1912 I must chronicle the culmination of two fiascos, the East Rand Proprietary and the Anglo-Continental. Both have been thoroughly ventilated in the press, so that it may be hoped the shock to public confidence may have been compensated by the salutary lesson offered to all but the incurably careless. The East Rand affair showed that big mines need big men to manage them, and that the superintendent of such a mine should be a man capable of telling his directors to go to hell if they ask him to subordinate his operations to the share-market. The Anglo-Continental proved that fairy tales are believed even by grown-ups and that old ways are not obsolete. The acceptance of wild reports cabled by nobodies, the delay in publishing those that recognized realities, and the subordination of mining operations to market manipulation recall some of the worst scandals of the past. It will all have been worth while if the experience impresses the public with one of the fundamentals of the business, namely, that the only opinion on a mine worthy of acceptance is that of a thoroughly competent engineer.

Transvaal.—The digging of gold ore is maintained on an undiminished scale. The Rand is still the premier goldfield of the world, and continues to make new records of production. The total yield for 1912 is estimated at £38,750,000, which is £3,710,000 more than the previous highest, in 1911. I believe the industry to be at its zenith. Production, it is true, still shows signs of expansion, but the profit, the basic purpose of mining, is decreasing, as the following statistics indicate.

Year.	Tons.	Yield per ton, shillings	Cost per ton, shillings	Profit per ton, shillings	Total profit.
1909	20,543,759	28.9	17.0	11.5	£11,794,376
1910	21,432,541	28.5	17.6	10.5	11,216,105
1911	23,888,260	27.6	18.0	9.6	11,414,863
*1912	26,100,000	28.5	18.9	9.6	12,300,000

*Estimated.

But these official statistics cannot be taken at their face value, since 'profit' is not the net resultant gain to shareholders, but an intermediate stage of bookkeeping. Of the 'profit' only 68% is now distributable in dividends, as compared with 75% available a few years ago, so that a supposed profit of £12,000,000 in 1912 actually means less gain to the shareholders than £11,000,000 of phantasmal profit in 1911.

While the average yield has been slightly increased lately, this must be taken in the light of the fact that a system of selective stoping has augmented the gold-contents of the ore from several important mines at the expense of their longevity. For many years the public, and some of the operators themselves, were fooled into a false sense of prosperity by a decrease in the cost per ton, consequent upon the extraction of gold-bearing rock that was so poor as not to yield a profit—only tonnage. Rock that was ore, theatrically speaking, was counted in the reserves. That fallacy was bound to be exposed. With the exposure came a reversion to an elementary principle of mining, namely, to exploit only

the rock that yields a profit. This, being translated, means selective stoping, the rejection of waste, and the diminution of the total tonnage extractable. Hence the present period of improved productivity is won not at the expense of realities but at the cost of the optimistic records made at an earlier period. Even today some of the companies include rock assaying 1.7 dwt. and 2 dwt. as 'unpayable ore,' a sickly phrase which is nothing if not delusive in a district where the operating cost is 4 dwt., and the total cost fully 5 dwt. per ton, without probability of a radical decrease in the near future.

Besides the declining yield, partly due to depth, the mines have been handicapped by scarcity of labor. This was felt acutely during the summer, but was mitigated later by the seasonal migration of natives. Further hindrance to production from this cause is likely to be alleviated by the closing of exhausted mines and by the cessation of destructive competition for labor between the principal groups of controlling operators. While the question of native labor is likely, therefore, to occasion less anxiety, that of white labor is beginning to be serious. In the earnest effort to cheapen mining by the increasing use of small stoping-drills, it has become necessary to employ a larger proportion of skilled white workers. These are beginning to manifest signs of organized unrest, which is sure, sooner or later, to take the form of a strike. Another effect of the machine-drill is to make the dust that is the immediate cause of phthisis, a disease now pitifully prevalent in the mines at Johannesburg. Much has been done to combat this disease and to compensate those who suffer from it. Ventilation, housing, and feeding, that is, the systematic care of the human machine, are receiving closer attention. Such measures may counteract the insidious effort of the labor-agitator, but the position is always delicate and precarious from an economic standpoint.

Two other factors apparent to the detached onlooker should be mentioned. One is the gradual withdrawal of certain big groups or financial houses from Rand mining, in consequence of the lessening opportunity for the flamboyant finance that accompanies an era of expansion. The chances for making money easily and quickly are nothing like they used to be. Scope for new enterprise is dwindling. The public is not so keen to come into the Kaffir game. And on top of this is the dearth of men built on a big scale, such as those who developed the mining industry of the Rand to its colossal proportions. Alfred Beit, Cecil Rhodes, and Herrmann Eckstein are no more; Louis J. Seymour is dead; engineers like H. C. Perkins, Hennen Jennings, George Webber, J. R. Williams, and J. Harry Johns have left the Rand. Not only has the industry lost this motive power, but the operators now dominant spend too much time in talking politics at Cape Town and in squeezing knighthoods out of the ministry at Westminster.

Among many signs of decadence, one fact is full of promise, namely, the development of the Far Eastern end of the Witwatersrand. This part of the great goldfield is marked first by a pronounced break in the outcrop and then by a sweeping curve southward outlining a synclinal basin that encloses a large area in which drilling and shaft-sinking have proved enormous reserves of valuable ore. The Van Ryn, Kleinfontein, and the two Modderfontein mines were among the first to win prominence for this extension of the Main Reef series. During 1912 the Brakpan reached a highly productive stage, while the Modderfontein Deep and Government Areas have given evidence of further potentialities. In this locality the flatness of the dip (5 to 6°) is such that it is practicable for a shaft 3500 to 4000 ft. deep vertically to cut the lode at a distance of three miles from the outcrop and to employ a system of endless-rope haulage highly favorable to cheap tramming. At the other end of the goldfield, the West Rand Consolidated has obtained an encouraging yield from the so-called Battery Reef series, a subordinate member of the gold-bearing conglomerates. This is likely to encourage another effort to explore the West Rand Estates, where an excessive inflow of water formerly stopped prospecting. Again, in the Central Rand a few mines have obtained better results, partly by selective stoping and partly by a genuine improvement in the orebodies. Of the big amalgamations, the East Rand Proprietary has been depreciated by bad management and unreasonable optimism. The Crown Mines, however, while also disappointing as regards immediate results, is in an improving position. Among the great mines of the world may now be included the Crown Mines, the New Modderfontein, and the Brakpan.

I have devoted a large part of my space to the Rand, for apart from its preëminence as a source of the world's gold supply, its varying fortunes profoundly affect the London market and the support that the British public gives to mining in general.

Rhodesia.—This part of the world produces £2,800,000 worth of gold annually, but it looms large in the speculative firmament. If the purpose of mining is to furnish counters for a dishonest gamble, then Rhodesia is a great mining centre. Truly, that fine country, christened after a man of noble proportions, has illustrated repeatedly how mining can be made a mixture of gaming and vaudeville, an African casino where belted knights of recent creation and reckless schemers of the most ancient type can disport themselves profitably before a deluded public. The present year began with a new shuffling of the cards, and a fresh call from the croupiers. But the game has lost its savor; it is not good enough: the public is weary of the hippodrome, that Rhodesian *petits chevaux* in which the racers are controlled by strings no longer invisible.

Mining in Rhodesia as conducted by London companies is a pitiful business. For three years I have watched it, at first without prejudice, then with surprise, and finally with disgust. The most regrettable feature is the fact that reputable engineers have lent themselves to the *opera bouffe*, and some of them appear not only to be lent, but actually sold to the *entrepreneurs* who finance the performance.

During 1912 a breathless effort was made to boom the Rhodesian market, but it failed utterly. You can fool some of the people some of the time. Two or three reckless operators subventioned the hireling

press, their dummies on important directorates tried to talk big, working capital was employed in buying the shares of affiliated companies, cryptic reports of discredited engineers were issued, but it all fell flat. I hope such methods may always fail. I hope that only legitimate methods may win public approval, and that only straight dealing may commend itself to those on whom, in the last resort, the financial groups depend for support.

A glance at the Rhodesian share-list shows the severe drop in quotations. It also serves as a reminder that the country possesses half-a-dozen rich gold mines, all of which have been kited to a market valuation that was bound to collapse sooner or later. Rhodesia, more than any other mining region, reminds me that more money is lost over rich mines than over poor ones, by exaggerating the value of the rich mine to many times its real value, which is a fraction of that engulfed by the poor prospect. Among the notable properties are the Shamva, Globe & Phoenix, Giant, Eldorado Banket, Lonely Reef, Eileen Alannah, and Cam & Motor. The last two are just coming to fruition. The Lonely and Eldorado are rich mines, both of which, however, must perform miracles to justify their recent appraisal. The Giant orebody is cut off by a dike: an unpleasant geologic accident known officially long before the shareholders heard about it. The Shamva is a big mass of low-grade ore from which a profit of barely £1,000,000 is assured, although the market price of the property has been to £2,875,000. Even the most promising of the younger mines, on which Rhodesia must depend for a revival, have already been overvalued in consequence of a mixture of ignorance and chicanery. The outlook is bad. The story of 1913 will be unpleasant.

Close to Rhodesia, but in the Congo Free State, is the celebrated Tanganyika Concessions, once the menace of the copper market. Was it not said three years ago that from Tanganyika would go "within three years" 60,000 to 90,000 tons of copper per year to London at a total cost of £25 per ton? That reads like a pipe-dream of a summer day. Even now the metallurgical problem at Katanga is a matter for experiment, and copper smelting is being conducted on a petty scale. Selected ore is being treated at a total cost that, as far as can be ascertained, is fully £50 per ton of refined copper delivered on the market. An awakening to realities is becoming apparent. With it is coming more serious attention to the difficulties incidental to all big copper enterprises, particularly in a tropical region several thousand miles from anywhere.

West Africa.—Here also the year has seen disillusionment. But a distinction must be made between the Gold Coast and Nigeria. The first is an old mining region and the scene of several successive periods of activity. The latest boom was in 1909, at which time it was fondly expected that "another Rand" had been uncovered along the Tarkwa ranges, and that another goldfield of the first rank would be developed in the African jungle. Here again the promoter and financier outstripped the engineer, but, it must be confessed, not without encouragement from the technical man. It was not that the gold content of the ore was exaggerated, although that was done; or that the banket proved patchy, for that was no man's fault; but the basic cause of economic error was the miscalculation of the total cost of mining. Comparisons were made with the Rand and other established centres of industry. The debilitating climate, the inefficient and insufficient labor, the unsympathetic colonial government, the unusual expenses of administration—these, and other items, were overlooked or disregarded. The time for a reckoning has come. It is now known that the total cost of making dividends is nearer £2 per ton than the £1 per ton confidently asserted three years ago. Several amalgamations and liquidations have occurred in 1912. The number of shares standing at par today is pitiful. Of these, the Prestea has been the subject of an administrative bungle that was ludicrous in its effrontery. This is a splendid vein of gold-bearing quartz and could be regarded as the making of a fine mine if the cost of operations had not been sadly underestimated and the management lamentably subordinated to market tactics. The one bright spot in the jungle is the Ashanti Goldfields, which has made a splendid showing this year, reducing the total cost from 43s. to 35s. per ton, and earning a profit of £214,425. It is also to be noted that three dredging companies are struggling under adverse conditions amid the tropical tangle of roots and floods to dig gold out of the river-beds; not without success, and with increasing skill, as well as hopefulness. The production of gold from West Africa in 1912 is estimated at £1,500,000.

The tin districts of Northern Nigeria have surpassed the Gold Coast this year as regards public interest. It has been a gay time for syndicates and schemers operating on the Bauchi and Kano tablelands. Early in the year the boom reached its zenith, puffed into bulkiness by the success of the Rayfield syndicate, the Nigerian Tin Corporation, and the Northern Nigeria Mining & Exploration company, all of them capitalized for small sums and doing a roaring business, not so much in tin-mining as in the printing of scrip for an eager market. By this I do not mean that the Rayfield, for example, did not find rich alluvium and produce tin profitably, but it is a fact that the 'calabashing' or panning of tin gravel by natives on tribute soon became only a detail in a picture the larger part of which was filled by Throgmorton street. The public bit greedily. Share speculation culminated soon after the Anglo-Continental Mines Co. had published reports stating that the lode, discovered in November 1911 could be traced for 5 miles, that it had an outcrop 30 ft. wide, and that the ore assayed 25% tin. The 300,000 shares rose to £8; they are now quoted at 12s. Only last week it was announced that work on the Jemaa lode had been finally abandoned. I have no space for details, but it is a pitiful story of reckless reports by incompetent men, unwarrantable optimism in London, unpardonable delay in publishing the opinions of reliable engineers, and between each of these factors a manipulation of the share-market that ended in transferring money from the many to the few. Of course, legitimate mining, the real search for tin and the actual washing of the gravel, suffered from this fiasco. It is

a marvel that the public was not frightened to a complete withdrawal. Fortunately, results have been forthcoming. The production of tin in Nigeria has risen from 1470 tons in 1911 to about 2000 tons this year. The inexperienced youngsters and the experienced fakers are giving place to mining engineers able to distinguish cassiterite from tourmaline, and a mine from a hole in the ground. I doubt whether a big industry will ever be developed, but with the rising price of tin, and the comparatively small amount of capital required, it is likely that tin-mining in Nigeria will continue to attract British capital during the coming year. Dredges are being introduced. Systematic ground-sluicing will replace 'calabashing' on some of the alluvial flats. The application of technical skill will increase the area to be exploited, the completion of branch railways will cheapen transport, and the organization of native labor will further reduce operating cost.

NORTHERN AFRICA, SHOWING NIGERIAN TIN FIELDS.

Australasia.—It is pleasant to turn to a brighter aspect of mining. You find that at Broken Hill. While the bonanza orebodies of 20 years ago have been largely exhausted, the Barrier district continues to be not only a big producer of lead and silver, but an important source of zinc. Besides its yield of metals, it has become increasingly the scene of metallurgical advancement. To this important district the rise in the price of lead and zinc, not to mention silver, has been a great help during the past year and promises to be a strong stimulant in 1913. The yield of zinc from the discarded residues of an earlier period has probably reached its maximum, but the extraction of the same metal from low-grade ore and the beneficiation of slime, hitherto intractable, promises to compensate. Broken Hill has had, and is having, a justifiable boom.

Among notable events is the Broken Hill Proprietary's exploitation of the great Iron Knob orebody, where each 100 ft. of deeper mining gives 20,000,000 tons of iron ore. This is situated on Spencer's Gulf and opposite the company's Port Pirie smelter. But the smelting of the iron ore is to be done at Newcastle, where 8 blast-furnaces are being erected. The New South Wales government provides land, wharves, and other facilities. The total expenditure to be incurred forthwith is fully £3,000,000. It is the beginning of large-scale iron-making in Australia. The other neighbors of this celebrated silver-lead mine are also doing well. The British Proprietary began the year with a flourish and the raising of fresh capital for a new equipment. It is estimated that 2,000,000 tons of ore exist between the sixth and tenth levels, but this estimate is not accepted confidently. The ore is low grade, averaging 12% lead, as against the 14% stuff now being broken. Fluctuations in the grade have provoked disquiet, and until the orebody is opened-up further, the real resources of the mine remain questionable. However, they are large, in any event. The North mine has 2,000,000 tons of ore assaying 15% lead, 14% zinc, and 7½ oz. silver. The level now being driven, at 1250 ft., will add about 1,000,000 tons to the reserve, for the ore-shoot is 100 ft. wide and 1000 ft. long, in two bodies. The South mine has about 3,500,000 tons of ore assaying 14% lead, 14% zinc, and 5½ oz. silver. This is found in one shoot including three orebodies, the aggregate length being 1200 ft. with a width of 125 ft., so that each 100 ft. of depth yields about 1,000,000 tons of ore. Both the North and South mines will be increasing their output, but, unless the British develops ahead of expectations, a diminution in the Broken Hill production of lead and zinc may be expected before long. The treatment companies are exhausting the old dumps of tailing. Of these metallurgical companies there are three: the Sulphide Corporation, which controls the Central mine; the Zinc Corporation, which lately acquired the South Blocks; and

the De Bavay company, which gets 45,000 tons of tailing per month from the North, South, and Block 10 mines. The last is now merged with the Minerals Separation, the company owning oil-flotation patents. All of these organizations are doing well. Further metallurgical developments are anticipated, particularly as regards the treatment of slime. This, of course, would add greatly to the efficacy of the processes, and therefore to the tonnage available.

The dominant factor at Broken Hill, next to the revolution in metallurgical methods, has been the gathering of evidence proving the existence of new lenticular orebodies outside the original ore-channel. The first of these was discovered in 1909 in the Central mine, and since then further discoveries off the original lode have been made in the Proprietary, British, South, and Block 10 mines. Of these, the orebody in the British is the most important, but the others also afford favorable indications.

The Australian copper group has become prominent this year, particularly in Queensland. The Hampden-Cloncurry started to produce copper at the rate of 700 tons per month. This is to be increased next year to 800 tons. The company has been aggrandized by the acquisition of the Dutchess, Trekalano, Macgregor, Mascot, and Answer mines. The Mount Elliott has similarly expanded by the acquisition of the Hampden Consols and several prospects. French participation, and gambling, has been prominent. About 120,000 shares out of the 150,000 issued are now held in France. The Herberton district, on the other hand, makes slight progress, so that the Chillagoe, Mungana, and other mines on the limestone-diorite contact are not prominent. The Mount Morgan plant is being reorganized under a new manager. It is also a feature of 1912 that a number of copper companies have suddenly shown a disposition to utilize the oil-flotation methods of concentration. I may mention the Great Fitzroy, Great Cobar, Lloyd, Mt. Lyell, and Mt. Morgan. Charters Towers had a flash in the pan. An effort was made to reopen the McArthur River district in the Northern Territory, but its inaccessibility killed enterprise. On the other hand, several of the older Victorian goldfields such as Bendigo, Ballarat, and Daylesford, have been revived by fresh discoveries of an encouraging character.

Labor troubles have stopped mining operations throughout New Zealand for half the year and hindered them for a longer period. This was notably the case at the Waihi, once one of the greatest gold mines in the world, but now fallen on evil days, for in 1911 the management made a belated confession that the orebodies had 'petered out' on the twelfth level. Sinking of the shaft and further exploratory work were about to be started when the mine was closed, owing to the strike of the miners. The shares quoted at £5½ in 1911 are now at £1⅝. The Talisman, a mine of rare vitality, continues to pay handsomely, but the shares are now largely held in New Zealand. The Consolidated group—Blackwater, Progress, and Wealth of Nations—on the West Coast is doing fairly well, although operations there also have been interrupted by labor troubles.

The big mines at Kalgoorlie are rapidly approaching exhaustion. Shares formerly quoted in pounds are now rated in shillings. The erection of large plants to treat low-grade ore has prevented too rapid a decrease in gold production, but in several cases it has only diminished the ultimate profit. The Great Boulder, the premier mine from the first days of this celebrated goldfield, is still doing fairly well, and is about to obtain a new lease of life by the acquisition of the Great Victoria, a highly promising mine at Southern Cross. The names of the Lake View, Oroya Brownhill, Hannan's Star, and Golden Links are perpetuated by new companies having interests in mines in distant districts, from Nicaragua to Siberia. This prolongation of mining organizations by the acquisition of new properties is an important development of London finance. It has been sanctioned lately by the shareholders in such famous old mines as the Waihi, the Lake View Consols, and the Camp Bird.

Elsewhere in Western Australia not much is doing. The Great Fingall is making a plucky effort to restore itself on the deeper development of a new shoot of low-grade ore. The Sons of Gwalia continues to find supplementary ore-shoots. The young mines, such as those at Yuanmi and Meekatharra, are doing only fairly well. The Bullfinch district, which was the excuse for flagrant booming two years ago, is almost forgotten in London.

America.—As quoted on the share-lists, the American list includes Canadian and Mexican properties. They have not been particularly prominent in London during the past year. The flotation of Boyle's concession and other claims in the Klondyke valley under the name of the Granville Consolidated has drawn attention to dredging in the North, but the interest will be largely technical until such time as results are forthcoming. The three mines at Treadwell, in Alaska, are doing well, especially the Alaska United, which is so placed as to receive the extension of orebodies from the Alaska Treadwell and the Alaska Mexican mines. The recent flotation of the Perseverance, under the name of Alaska Gold Mines, appears to have created some excitement in Boston, but it has attracted small attention here. The same may be said of Porcupine, in which a spasmodic interest was created two years ago. The Northern Ontario Exploration has proved disappointing and is quoted at a sad discount. On the other hand, two or three Cobalt issues have been prominent in London, notably the Casey Cobalt and Cobalt Townsite. The richness of the thin veins and the handsome profits announced periodically have aroused speculation and have prompted the flotation of the Aladdin Cobalt, United States Cobalt, and other companies that start life with names carrying a large responsibility. In Colorado the Tomboy purchase of the Revenue claims is proving satisfactory, and has added another bright page to an honorable record. Across the range, the Camp Bird is now practically exhausted, but its progeny, the Santa Gertrudis, in Mexico, is fulfilling the high hopes of its sponsors, the Grenfell group. This financial house is becoming increasingly influential, for it controls the two mines mentioned, as well as the Messina copper mine in the Transvaal. Another Mexican gold-silver mine is now being examined with a view to purchase with Camp Bird re-

sources, plus participation by the public in an issue to be made during 1913. The old Independence at Cripple Creek is still paying dividends, and promises to end a checkered career with credit to its last manager. The El Oro group is still vigorous, although R. T. Bayliss' report on the parent mine foreshadows its decadence. Deep exploration has proved disappointing. The Mexico continues to be surprisingly overvalued. The Esperanza has been helped by the opening of new stoping-ground on the San Carlos vein above the twelfth level. The Buena Tierra, controlled, like the El Oro Mining & Railway Co., by the Exploration Company, is well considered, although the revolution has hindered its operations, as those of other mines in Chihuahua. The Oroville Dredging is a disappointing venture that expects to mitigate its failure in California by the exploitation of new ground at Pato in Colombia. This dredging scheme has done scant credit to its promoters, and has served to illustrate most of the errors that can be made in a branch of mining now increasing in favor. The Natomas Consolidated, another Californian dredging enterprise, has some of its bonds on this market, and so far has been able to 'make good' on the promises of the prospectus. Californian oil schemes have not been so favorably prominent as had been hoped, but interest in that branch of mining is reviving.

South America has not obtained the attention it deserves as a mineral region, but signs are plentiful that greater activity is pending. Unfortunately, one or two 'lame ducks' cumber the way, such as the Capillitas, Famatina, and Poderosa—all copper mines. The last has done well, but was gutted in the haste to make shipments. However, the Collahuasi district is not finished. Bonds of the Braden copper mine are held in London, and not without a sense of comfort. The successful application of the oil-flotation method of concentration will add largely to the ore available. The South American Copper Syndicate has been able, most profitably, to reopen the old Quebrada mines in Venezuela. Apart from copper mines, the exploitation of gold-bearing gravel has been undertaken by the Aporoma, in Peru, and the Incahuara, in Bolivia, but with inadequate results. Several Bolivian placers are undergoing examination by British engineers, and more may be heard concerning them in 1913, especially if the Oroville Dredging makes a success of its Colombian venture.

India.—The most important event of the year in connection with Indian gold-mining has been the success of operations in the Anantapur goldfield. The grade of the ore treated by the North Anantapur company has increased substantially during the past twelve months, from 5 to 10 dwt. per ton. Recent developments have revealed the presence of a large orebody which at the 450-ft. level is as much as 57 ft. wide in one cross-cut, and averages 25 dwt. per ton throughout its length. The ore reserve has been greatly increased by this discovery and has warranted the erection of another 10 stamps, making the total 30. The Jibutil Mines of Anantapur, another of the John Taylor & Sons group in this district, is also doing well, and is now issuing further capital to complete the equipment. The good results at Anantapur afford a pleasant contrast to the failure at Dharwar. In the older district of Kolar the most important event is the improvement of the ore on the deepest levels of the Champion Reef mine, promising to revive its earlier glories. On the forty-third level in the Carmichael section the lode averages 25 dwt. over 6 ft. The Balaghat, the most northerly of the Kolar group, after a period

of depression, is yielding better results from development. At the Hutti mine, in Hyderabad, the deeper exploration at 2000 ft. has revealed the presence of profitable ore, so that the additional capital recently spent promises to place the undertaking on a sound basis once more. On the whole, this department is not the sport of bulls and bears, but pursues the even tenor of its way, the mines being more under the control of the engineers than is customary among British companies. The total output of gold from the Indian mines is estimated at 584,150 ounces, worth £2,260,000, as compared with 573,525 ounces and $2,150,050 last year.

Russia.—This department has been stimulated by the excellent developments at the Spassky, Kyshtim, and Atbasar groups of copper mines; and it has been enlivened by three new issues, the Sissert, Tanalyk, and Pioneer companies. Some of the derelicts from an earlier boom, such as the Troitzk and Orsk, still survive in the form of priority shares, but they are unimportant, save in a technical sense, for in each case difficult problems are being faced. The Lena Goldfields has declined rapidly, partly owing to bad Siberian management and partly to the exhaustion of the richest gravel. This enter-

prise, from a technical standpoint, is lamentable, for the cost of operations is 25s. per cubic yard and the estimates of the ground in reserve are next to worthless. These defects arise largely from a dual management, the English company being a shareholding company in an enterprise entirely controlled in Russia. The Tanalyk and Sissert are Anglo-Russian concerns. It has been proved that the Russians are eager to participate in these copper ventures; indeed, their eagerness causes the shares occasionally to reach a forced valuation and to place their British-American associates in a difficult position.

THE TRANS-CASPIAN COPPER REGION.

Apparently the Russians have only recently taken to speculation in mining and other industrial adventures. They are new to the game and are readily excited. Likewise our French friends, who have taken large blocks of shares in Spassky, Mount Elliott, Mexico of El Oro, Camp Bird, and other important mining companies. They play too easily into the hands of the crazy optimist and the reckless financier, so that even the sane and methodical controllers of some mines are surprised to find shares being transferred to Paris at a big premium. However, this international aspect of mining speculation, as centring in London, is a feature of growing importance. If recognized fairly and utilized honorably, it should add largely to the scope of our market. Incidentally, it is interesting to record the fact that one or two American financier-engineers have found it profitable to operate on this market, to coöperate with European capitalists, and to inject some of their energy and directness into large-scale mining operations in Siberia, Australia, and the Yukon. This, of course, is pleasing to me, for I regard mining engineering as cosmopolitan and finance as international in their manifold energies.

Miscellaneous.—A Cornish mining revival is explained by the rise in tin. It is of great local importance, but involves no large diversion of capital. The mines in the Malay States, such as the Tronoh, Gopeng, Pahang, and Kinta, have been prominent. A recent Bolivian flotation reminded me that Bolivia is an important source of a most useful metal, but the issue was regarded as 'a pig in a poke' and aroused small interest. In Burma, the Transvaal, and Tasmania the exploitation of tin-bearing alluvium has diversified the share-list, and if tin maintains its present price, as is likely, further issues are to be expected.

No great mineral discovery has been made in 1912; something of the kind is needed to compensate for the decadence of old districts; a great gold-field or a big orebody of the base metals needs to be uncovered, in order to excite the public imagination, not to its disillusionment, but to the appreciation of the fact that modern civilization is based on the intensified use of the metals. It runs on steel wheels, and lives in steel cages, it whispers over a copper or an aluminum wire, it gilds its ornaments and plates its utensils, it is conducted through lead pipes, it is veneered with tin, it paints itself with zinc and lead pigments, and commits suicide with lead bullets or steel shells.

To conclude, the London market remains a dominant factor in world-wide mining. Plenty of capital is available here, as of yore, for new ventures. But the public is less stupid than formerly. The code of financial conduct is higher. The ordinary ineptitude or the common trickery of an earlier decade is today labeled a fiasco or a scandal. Mining is recognized as being risky, as well as profitable. The profit must be proportioned to the risk. The casino of the Stock Exchange is well patronized, but the visitors expect a run for their money: they will pay the stipulated percentage of the tables, but they object to being robbed; they demand a square game. (Comparative quotations for 1911 and 1912 are given elsewhere.)

Electric Smelting.—Some claims have been made of success in smelting zinc ores in the electric furnace. One smelter in Norway has been operating on a small scale, but from the published reports it may safely be said that only such an extraordinarily low current cost as Norway can show made such operation commercially possible. Several experimentors in the United States have published reports of success along this line, and while there is no doubt that success will eventually crown these efforts, none have yet been operated on a scale competitive with the existing retort methods.

The United States Geological Survey and Ore Deposits

By George Otis Smith

While practically every activity of the United States Geological Survey touches the mineral industry, readers of the *Mining and Scientific Press* are most interested in the work on ore deposits.

The various kinds of geologic work overlap at many points but in a broad way the field activities of the metalliferous section may be classified as (1) the investigations of special problems in ore genesis; (2) summary regional reports, especially by states; (3) detailed studies of mining districts; (4) economic reconnaissance; (5) land classification; and (6) special examinations for other bureaus.

In the past the attention of the federal geologists has been concentrated principally on the detailed investigation of important districts and probably few well informed readers will question the scientific and practical value of the results obtained by the monographic treatment of the great mining districts. This work will be continued; for notwithstanding the fact that most of the more productive districts have been carefully studied, new ones are constantly springing into prominence and the continued activity of older ones demands that geologic reports made many years ago should be revised. In spite of these demands, however, the present policy of the survey is to devote more attention than heretofore to some of the other classes of work mentioned, especially to (1) the prompt reconnaissance examination of new districts, so that a general knowledge of the local geology may be made available to the prospectors at an early stage of their work; (2) reports dealing comprehensively with the geology and ore deposits of states or large regional units; and (3) special investigations of problems relating to ore deposition. In the way of investigating special economic problems independently of detailed areal work, the survey has admittedly done comparatively little of recent years. There is now in press, however, a bulletin on the subject of sulphide enrichment by W. H. Emmons and plans are on foot to study more exhaustively certain phases of this subject, particularly the enrichment of silver ores. There are also in active preparation summary reports on the geology and ore deposits of Utah and Idaho. A similar report on Arizona is planned but some additional reconnaissance must be done in that state before all of the material can be assembled.

That the detailed study of mining districts is still an important feature of the work is shown by the fact that the following reports are in various stages of preparation or publication: (1) The Randsburg district, Cal., by F. L. Hess; (2) copper deposits of Shasta county, Cal., by L. C. Graton; (3) the Ely district, Nev., by A. C. Spencer; (4) the Ray and Miami districts, Ariz., by F. L. Ransome; (5) the Tombstone district, Ariz., by F. L. Ransome; (6) the San Francisco and adjacent districts, Utah, by B. S. Butler; (7) the Central City district, Colo., by E. S. Bastin and J. M. Hill; (8) the Creede district, Colo., by W. H. Emmons and E. S. Larsen; (9) the Terlingua district, Texas, by H. D. McCaskey; (10) the Joplin district, Mo., by C. E. Siebenthal; (11) the Ducktown district, Tenn., by W. H. Emmons, F. B. Laney, and A. Keith; (12) the red iron ores of Tennessee, by E. F. Burchard. Besides these there are in preparation a complete revision of the Leadville monograph by S. F. Emmons and J. D. Irving, and of the Tintic, Utah, report by W. Lindgren and G. F. Loughlin. Plans for future work in the general class represented by the reports mentioned are not complete. Mention may be made, however, of the Santa Rita (Chino) and Magdalena districts, New Mexico, and the Jerome district, Arizona. The detailed study of the Homestake mine and vicinity, South Dakota, will be taken up next season by W. Lindgren and S. Paige. Reports in preparation or in press on the Patagonia and Nogales quadrangles, Ariz., by F. C. Schrader; on the Dillon quadrangle, Mont., by A. N. Winchell; on eastern Idaho, by J. B. Umpleby, and on various districts in central Nevada, by J. M. Hill, may be classed as economic reconnaissance. Here may be mentioned also a rather detailed reconnaissance of the Inyo Range, Cal., by A. Knopf and of the Fallon quadrangle, Nev. (including Fairview, Rawhide, and Wonder), by F. C. Schrader. The field work for these has not been completed.

Much of the work directed primarily to land classification yields collateral results that are published as economic reconnaissances, comparable with those just referred to. The principal work of this kind performed during the past season was (1) the examination of the Colville Indian reservation, Wash., by J. T. Pardee, and (2) of the Flathead Indian reservation, Mont., by R. W. Stone.

References to the publications of the survey on metalliferous deposits issued during the past year have intentionally been omitted from this sketch, which is intended to give a general idea of what is being done and, so far as possible at this time, of what is being planned for the future. In so brief a summary, it has been necessary to refrain also from mentioning minor pieces of work, for the most part of reconnaissance character, whose results as a rule appear in the annually issued economic bulletin. The loss which the survey has sustained in the resignation of Mr. Lindgren from the active supervision of geologic work to become the head of the geological department of the Massachusetts Institute of Technology is partly compensated by the gain to the educational world, and fortunately also Mr. Lindgren retains his position as a field geologist in the section of economic geology of metalliferous ores. Mr. Ransome, who succeeds Mr. Lindgren as the chief of this section, is well known throughout the West, having conducted Geological Survey investigations from the Canadian to the Mexican boundary. He will also be in charge of the areal geologic work of the survey west of the 100th meridian, an assignment that will insure the coördination of the general geologic surveys and detailed Western investigations.

Progress in Gold-Silver Ore Treatment During 1912

By Alfred James

Costs

It is singular that for the present year, as in 1906, fine sliming and the treatment of slime have still been the main centres of interest. It is difficult to believe that details of practice determined so long since, and even then capable of producing records not since materially modified, remain of chief interest. Readers of this review may have noticed that since 1906 costs have no longer been a feature in it; this is for the simple reason that they have not yet been notably bettered, at any rate at the mines then referred to. Thus in 1906 rock-breaking was stated to amount to 1.71d. per ton at the Lake View and 1.87d. at the Ivanhoe. At the latter mine the figure for the past year has been 3.93d. Milling at the Ivanhoe was 1s. 9d. per ton; it is now 1s. 8d. Roasting was 2s. 4d. per ton at the Great Boulder; it is now considerably higher. It would be interesting to know if the so-called improved furnaces are really improvements and, if so, why they cannot beat the Great Boulder 1906 record of 2s. 4d. per ton on roasted sulpho-telluride ore. Cyaniding by agitation was then 1s. 4d. per ton at the South Kalgurli, including 7d. per ton for KCN; has this cost for agitation treatment been since bettered locally? Dehne filter-pressing at 1s. 6d. has been undoubtedly cheapened, both in Africa and Australia, to 10d. and 1s., but the Ridgway filter, at that time stated to be giving high recoveries for 4d. per ton, is still preëminent with its total cost of 1d. per ton on a million tons of low-grade pulp and 2d. per ton on high-grade pulp (value say £3 to £4 sterling) not usually treated direct in filters of the submerged vacuum type. It would be as well to again collate costs: old figures become stale, and I shall welcome notes of actual cost per ton handled for crushing, milling, tube-milling, cyanidation of sand, cyanidation of slime, agitating, vacuum-filtration, and filter-pressing. It is a solace to think, however, that in spite of increased costs, the percolation of 1 dwt. sand is still carried on at a profit.

General Tendencies

The reference above to vacuum-filters reminds me of the possible temerity in referring by name to the filter of the best known exponents of the fixed submerged type, but decisions of local courts do not count with the industry to the same extent as the enthusiasm, energy, and skill displayed in forcing this submerged filter on the market. Long ago it was hoped that the pioneer work of G. P. Moore, and the irrespressible enthusiasm and skilled energy of Charles Butters, might result in a combination that would benefit the industry the whole world over, and yet leave room for a liberal reward for the combination. What the courts may or may not decide does not modify the feeling of which that hope was the expression; and if the combination went further and included Askin Nicholas, C. W. Thompson, H. P. Barry, G. Ridgway, and J. V. N. Dorr (surely all pioneers in their way) it would be still more solid.

A feature of the year has been the reported closing down of the last surviving chlorination plants. The expression at the World's Columbian Exposition twenty years since, "Cyanide is king," has surely been amply justified. A practice probably doomed to speedy disappearance is that in Africa of having separate sets of vats for the collecting and possible preliminary leaching of the sand prior to the main treatment. If the new Rand mills, such as the Geduld, be considered, it will be found that reliance is placed on a single set of vats, and this surely is justified by the results of the Princess and East Rand plants. At the latter E. H. Johnson shows some of the highest extractions on the Rand.

Decantation, too, is dead as a process to be adopted at new mills. These are all designed for filtration. Indeed, it is only too evident that Africa is awakening from the benumbing mechanical influence that, up to recently, seemingly confined its metallurgical aspirations to the better preparation of the sand for leaching, and the feeling of satisfaction with local standards is giving way to the keen desire to know more of the successful work of American, Mexican, and Australasian confrères in the solution and recovery of the precious metals, and to adopt such methods locally. Thus the Rand has now in active harness its F. L. Bosqui in addition to its W. A. Caldecott and E. H. Johnson, W. R. Dowling and M. Torrente; Rhodesia, which has ever been on the alert, has brought over A. W. Allen from Mexico in addition to its many celebrated Australian specialists, and even recently sent one of its Australian experts to Cripple Creek to decide some point of advanced practice in which it wished to indulge. This is surely as it should be. The day has gone when men of note can go to New Zealand, Australia, Mexico, and the United States, and come back only to decry what they have seen. Surely the better the expert the greater his capacity for recognizing what is good in outside practice.

Generally, progress for the year has been along developed lines, with no brilliant surprises. Possibly the work of our friend Charles Butters at the Nipissing (to be referred to under 'Amalgamation') is the most daring technical exploit of the year.

Changes on the Rand

On the other hand, owing to the attractiveness of the newer practice of tube-milling to −200-mesh, simple clean classification, air-agitation, slime-filtration, and zinc-dust precipitation, it has been easy to lose sight of steady progress on older lines, such as is evidenced in the design and construction of the mill of the Roodepoort United Main Reef G. M. Co. At a period when new mills on the Rand were under a cloud (relieved later, it is true, by the starting up of the Brakpan and Modder B), the Roodepoort

mill demonstrated how heavy stamps and high duty could be combined with economy in design, in power, and in working costs. Even the huge and carefully planned Randfontein mill, with its cleverly designed scheme for handling ore, must yield in attractiveness to the Albu mill, in which may be noted the soundness of the judgment which has enabled S. H. Farrar, F. Bulkeley, and M. Torrente to avoid extravagances noticeable elsewhere and yet to include just those things (big steel bins, almost vibrationless heavy stamps, tube-mills of large diameter and specially determined length with simple linings, and tailing-wheels) which make it one of the most cheaply operated mills on the Rand. Why should local engineers put in power-eating centrifugal pumps with most costly monthly renewals (£60 per month or more), with uneven delivery of pulp to the spitzkasten, and with an awkward tendency to go wrong with coarsely crushed pulp, when tailing-wheels at less than £10 per month for repairs do all the work with a steady flowing discharge on even the coarsest crushed material?

The Roodepoort mill crushes 20 tons per head per day, and does this readily with only one feeder per battery. This mill is stated to operate for 14 kw-hr. per ton for everything from breaker stations to clean-up and blacksmith-shop, as against the 23 to 30 kw-hr. stated to be usual in African practice. In other words, it crushes and beneficiates 1000 tons of ore per day with about 700 hp., and a peak load under 1000 hp. The mill consists of 100 stamps of 1900 lb., only 50 working. The tube-mills are 6 ft. in diameter and 16 ft. long. Stamping costs 11d. per ton. Milling (complete), including sorting, crushing, stamping, tube-milling, amalgamating, and retorting (everything up to the cyanide plant) costs 1s. 6d. per ton.

The group (Albu) responsible for this mill is also responsible for many of the improvements in Rand practice, including the Denny Bros.' abandonment of long (30-day) percolation of coarse sand particles, the introduction of tube-mills, and of the filtration of slime; and it has thus demonstrated that keenness to investigate and adopt new methods (proved elsewhere) may go hand in hand with economy in first cost and in working expense coupled with large outputs and low power bills. Undoubtedly, up to the present the Roodepoort mill may be regarded as the best example of a modern mill on the Rand of the type general to the field; that is, without air-agitation or slime-filtration.

But, as stated above, this type of mill is now moribund. S. H. Pearce, at the latest Crown Reef mill, takes the precaution of a final air-agitation for his slime prior to filtration in the Butters filter, which has produced so great a change in Rand methods. E. H. Johnson, at the East Rand, was one of the first to approve of filtration and the first to adopt continuous agitation in Pachucas. But the 'Doctor' of the Rand must be F. L. Bosqui; one almost fears to state how low the Bantjes recovery was before he took it in hand, or how great an improvement he has effected in City & Suburban results. African 95% total recoveries have always compared most favorably with those obtained elsewhere. Mr. Bosqui has been evening up the laggards, in one case by recovering increased gold from the slime, and in another case by adopting more modern methods for the treatment of the coarse classified sand.

While writing of Africa, I cannot but wonder at the paucity of practical result of the Mines Trials Committee's work. Local inventors have from time to time declaimed its methods, but the industry may well ask the reason for there having been so little fruit for so much effort; so little result in an industry obviously decadent in solution and recovery methods, until the arrival of fresh blood from America infused fresh energy. The Mines Trials Committee recommends relatively large payments to local promoters of tube-mill cones, nozzles, feed, or lining ideas; but what has it done to encourage foreign inventors to bring in the fresh ideas so much needed in the industry? The Nissen stamp has been forced to a successful issue by an outside group, only by the aid of the unwearying and continuous attention of the inventor, who went to the expense of jeopardizing his other interests by residing on the Rand. But the amount of business up to the present given by the Rand to the inventor will probably not pay his traveling expenses, and if ever the Nissen stamp is adopted by the Rand at its mills yet to be designed, it will be because of the enterprise of Rhodesia in widely adopting it.

Whatever the standpoint of the industry, it may be confidently asserted that any non-publication of results on the ground of communicating useful ideas to non-contributors is a most suicidal policy. Have the contributors really benefited in any single point? The fact is that the secrecy of the committee avoids that effective criticism which alone can lead to the highest and best results. Let the committee either be disbanded or reorganized, with power to immediately publish the results of its investigations.

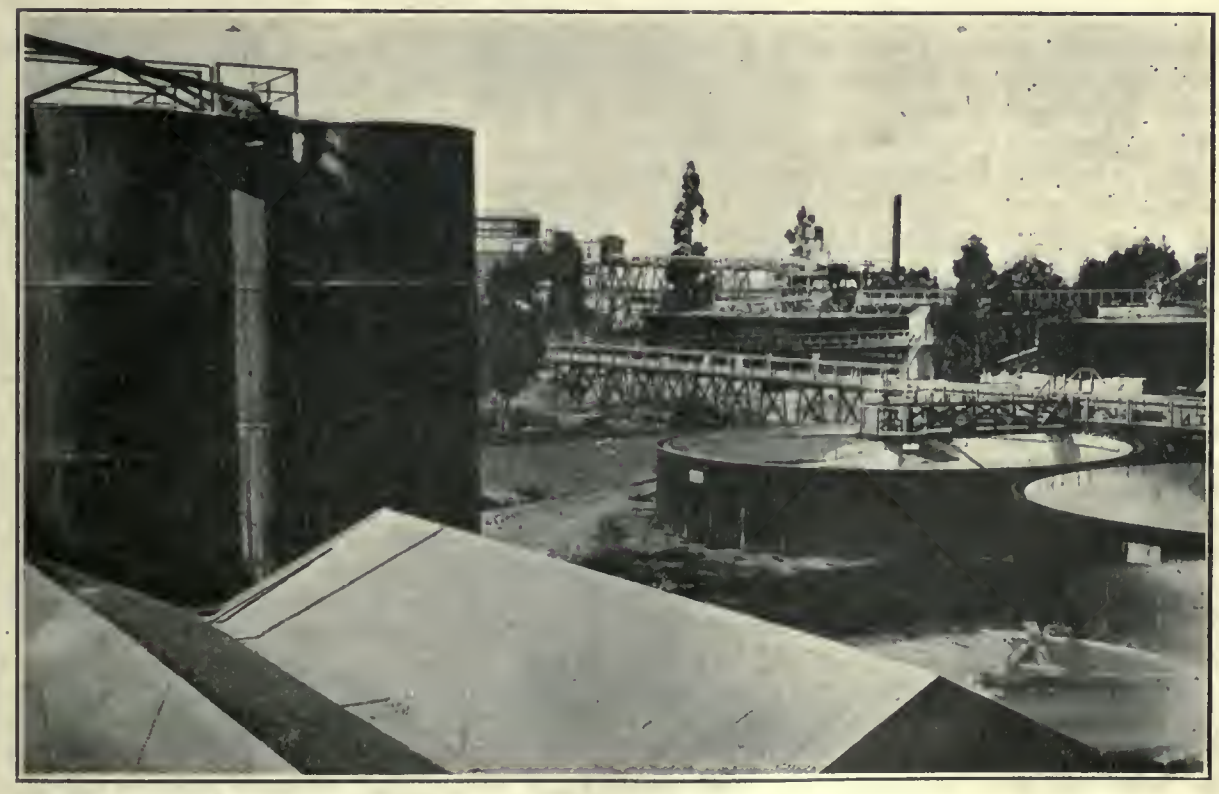
Other Countries

From Africa to India is a far cry. Some delay has taken place in the introduction of the newer methods (tube-milling and slime-filtration) referred to last year, but come they surely will. From New Zealand comes the story of a tailing plant, perhaps the largest in the world, ably described by C. A. Banks,[1] who incidentally explains how the injurious carbonaceous content is cleared off by vanners. If only those undertaking similar work would be guided by the successful results so frankly described, much avoidable loss would be saved. Thus a similar project in South America has twice invited and experienced failure through relying on pumps for dredging of the submerged tailing. A. W. Allen's article[2] shows how the greatest success has been achieved by using an air-lift in place of the pumps. The antimonial problem at the Gwalia Consolidated, in Australia, does not yet appear to have been solved, although it has been before many of the leading metallurgists of the day. The latest idea is apparently to work on lines similar to A. Richards' tin volatilization process.

From Mexico there is but little to chronicle this

[1] *The Mining Magazine*, August 1912, p. 121.
[2] *Ibid*, April 1912, p. 284.

ROODEPOORT UNITED MAIN REEF G. M. CO. MILL.



MODDER B CYANIDE PLANT.

year. The disturbed internal condition of the country is naturally responsible for a setback, but the Santa Gertrudis has signalized the first year with its new plant by paying a good dividend. It has also increased the capacity of its mill to 850 tons per day, which is a good criterion of the success of its methods, referred to in detail in the review of last year. From the United States there is word of new mills containing much of interest, even though there may be no departure from the methods described last year. The Colburn mill, which was watched with especial interest, has apparently had a setback. Good news is at hand of A. L. Blomfield's work at the Golden Cycle mill; it is hoped soon that the technical press may contain an account of the interesting sand-feeder used in the cyanide vats. Phillip Argall has been continuing his very successful work at Stratton's Independence,

beneficiating refractory low-grade telluride ore at the remarkably low cost of $1.50 per ton. A. J. Clark and W. J. Sharwood's description of the metallurgy of the Homestake[3] is a valuable contribution. Attention is specially invited to the notes by Whitman Symmes[4] on the Mexican mill, Virginia City. The criticism of equipment and methods of a mill employing such up-to-date apparatus as Trent agitators and Oliver filters and zinc-dust precipitation is valuable and corroborative of impressions gained elsewhere. At Tonopah important improvements have been made and the Tonopah-Belmont mill is widely praised, though no detailed account of its work has been published.

Details of Practice

New Mills.—As stated above, there have not been many new mills designed this year; perhaps Rhodesia has been the most active centre. There the Shamva mill uses 56 Nissen stamps, 9 tube-mills, and the Butters filter (336 leaves). The Falcon uses 36 Nissen stamps. The Cam & Motor includes roasting furnaces, Argall driers, and vacuum-filters. The Antelope also has Edwards furnaces and Dehne presses, with ball-mills and pans. The Bell has roasting furnaces, ball-mills, tube-mills, and Dehne presses. The tendency is wellnigh universal for new mills on the Rand to have 1900-lb. stamps, 10% tube-mills of size settled by M. Torrente (that is, wider and shorter than the Rand mines pattern), Brown agitators, and Butters filters. The practice is gaining ground of direct fall from stamps to tube-mills, thus obviating the present custom of elevating the very coarsely crushed pulp so destructive to pump linings. The new Van Ryn Deep mill is to have the usual gravitation stamps and the Butters filter. In Mexico, the Pozos and the Angustias have Pachuca vats and probably vacuum-filters (Moore type); Paterson agitators and Oliver filters are being also adopted. The Palmarejo new mill has been delayed by the revolution, but as no description of this has yet appeared, and as certain features are still novel (notably the sectionalization of stamps so heavy as 1250 lb. for mule-back transport), some reference seems not out of place. Limited by the water-power available (only 600 hp.) and by the difficulty of transport, advantage was ultimately taken of the most approved methods. The employment of such heavy stamps was found possible without the necessity for light cam-shafts by limiting the length of the latter and having three stamps only to a mortar-box. Samples are automatically taken between the feeders and the mortar-boxes and conveyed by belt to the sampling-floor. As originally designed, concentration took place both before and after the tube-mills, but it was found possible to do away with the coarse sand tables and to rely entirely on the slimers. Dorr classifiers were originally specified for the tube-mill feed, but were ultimately displaced by Bell cones with sight regulation. The percentage of tube-mills (16 ft. by 4 ft. 4 in.) to stamps is 16.6. The tube-mills are sectionalized by the system of longitudinal channels originally tried with so much satisfaction at Redjang Lebong, in Sumatra. Neal's discharge is provided. A conveyor keeps the tube-mill floor supplied with pebbles or ore. After concentration the thickened slime pulp flows to six standard Pachucas, followed by two storage decanters. Filtration is by Merrill press, with clarifiers for decanted and other solutions. Precipitation is by Merrill press in two circuits with provision for a final flow through zinc shaving, as at El Rayo. Precipitate is melted in revolving tilting furnaces of the Kalgoorlie type. In Australia the new mills, the Bullfinch, the Corinthian North, and the Ora Banda, are all on filtration (Ridgway) lines.

Agitation.—S. D. McMiken has shown[5] how at the Komata Reefs he is able to run ten Pachucas, 38 by 10 ft., with 8 hp. Modifications in internal air-lift pipe lengths failed to improve the extraction. In South Africa the Pachuca has been adopted at some of the best known mines, notably the Robinson, Crown, Brakpan, Modder B, and East Rand. Demonstration runs have also been made by the Trent and Hendryx agitators. The published results of the latter show high recoveries in a very short time, with a very low consumption of cyanide. It is to be wished that W. E. Hendryx had carried his demonstrations further, so as to show precisely what advantage the industry would obtain were it to agitate the total product in an agitator in place of percolating the sand as at present.

Generally, experience in gold-ore treatment, as contrasted with silver-ore treatment, indicates that the fine grinding of sand and the agitation of the finely ground product do not yield enough higher results over ordinary percolation to justify the extra cost of equipment and treatment as slime product. Therefore the gold mines find it pays best to still separate the sand and percolate it. Mr. Hendryx' results show a residue of 0.05 dwt. from agitated slime as against a residue of 0.281, 0.35, 0.25, and 0.55 dwt. for sand and slime mixed. If it be assumed that half the mixed residues are slime at 0.05 only, it brings the sand residue to a very high figure.

The collapse of the Way-Arbuckle agitating plant has been so fully referred to[6] as to need no further comment, except as to the extraordinary condition of affairs which could permit the occurrence of a foreseen and foretold disaster of such magnitude; the loss has been reported to have been as much as £200,000. A contribution to the technology of the subject is that of J. E. Alley.[7] He shows how packed concentrate, settled into a cement-like mass, may be easily started up in a Pachuca by a method even simpler than that at the Alaska Treadwell referred to last year. In filter plants of the Butters type, where considerable storage room for pulp has to be provided, the provision of an efficient agitator in large mills has long been a pressing problem. The Australian type of agitator seldom exceeds 25 ft. diam. Hoyle's Esperanza classifier, a most likely type, could be 40 ft., or even 50 ft., but at the Modder B there is at the Butters plant a pulp stock-tank 60 ft. in diameter with smooth-running.

[3] *Bull.* Inst. Min. & Met., Nov. 1912.
[4] *Eng. & Min. Jour.*, Oct. 12, 1912, p. 701.
[5] *Mexican Min. Jour.*, Nov. 1912, p. 19.
[6] *Mining and Scientific Press*, August 16, 1912, p. 185.
[7] *Ibid.* July 27, 1912, p. 118.

under-driven, effective agitation, taking from 8 to 12 hp. at 4 r.p.m. This agitator (Central Mining & Investment type) is undoubtedly the best for the purpose which has yet come under my notice.

Amalgamation.—Since the Waihi G. M. Co. adopted amalgamation on plates set in a row away from the battery, this practice has progressed far and wide. In Africa the area of plates has been cut down by as much as 75%. Amalgamation now takes place only after tube-milling: the wear and tear of the coarsely crushed pulp on the after battery-plates is thus avoided. H. Stadler, who from time to time interjects some able criticisms on local practice, is not satisfied with the efficiency of the abbreviated plate area, but the Caldecott group is keen on the advantages they claim to thus derive. Undoubtedly the most daring practice is that introduced by Charles Butters at Nipissing.[8] No less than 40 tons of mercury is in circulation and the ore, containing native silver, argentite, and arsenides of cobalt and nickel, is ground in a tube-mill with mercury in greater weight than that of the ore charge and with 5% KCN solution. Air is introduced and a 98% extraction is reported in 9 hr. The silver in solution is precipitated by zinc shaving, and the mercury amalgam collected, retorted, and melted, with a resultant product of 999 fine. "It is well known that grinding in an iron mortar or pan with an excessive quantity of mercury will usually result in total extractions with even the most refractory ores,"[9] and it was this fact that induced the Cassel company, in the early days of cyanide, to standardize the two amalgamation tests ('ordinary'=plate amalgamation, and 'forced'=pan amalgamation) given on the page above quoted, as it was found that with other proportions the tests were liable to give results not comparable with those actually obtained in practice. In applying this procedure to general practice, I should have anticipated a large accumulation of sickened mercury. But sickened mercury may be retorted or even purified by other means, and it is to be hoped that ere long Mr. Butters will publish some description of the results of his undoubtedly bold, even if not ultimately successful, venture. Clark and Sharwood, in their valuable paper, already cited, refer to the exceedingly slight penetration into the plate of the amalgam coating, and this is confirmed by McMiken, and Halse.[10] On the other hand, comment has been heard frequently on large amounts absorbed by plates, and as to plates being practically eaten through by amalgam. It would appear that unless plates are specially soft, the gold accumulation scarcely penetrates below the skin of the plate, even though the latter may be eaten through with mercury.

Classification.—W. A. Caldecott's cone and table, worked together, make probably one of the best products for cyaniding ever fed into a vat. In Africa, until recently, full advantage has not been taken of this fact, and even at the Simmer the product is fed with cyanide solution into collecting-vats and transferred into leaching-vats. It is obvious that with such product collecting-vats are an unnecessary expense (they already existed at the Simmer), and H. A. White, at the Princess, has shown how good are the results obtainable by direct treatment of the product. But cones are troublesome; they require continuous attention, and thus even the Caldecott table does not excite an enthusiasm for cones in comparison with the automatic simplicity and perfection of the continuous work of the Dorr classifier. But a further advantage of the Caldecott table is the dryness of the product—under 15% moisture—which enables the balance of solutions (15 to 20%) to be maintained with something in hand. Classifiers of the Dorr and Hoyle types just exceed the point, say 20 to 25%, and make draining the vats or some intermediate step necessary. Argall claims with his Ovoca classifier, working so successfully at Stratton's Independence, to give a drier product as a result of the compression of the pulp between his two spirals and to come just within the point, say 18 to 20%, and this type has accordingly been adopted in the most recent design of a large mill for Queensland.

Crushing.—The good results of the Nissen stamp have been confirmed in practice. New mines on the Rand, with their heavy stamps and open-front mortar boxes, show, with the notable exception of the Roodepoort United Main Reef mentioned above, an extraordinary vibration of cam-shafts, and in at least one case, of stems. The smooth running of the Nissen stamp at the City Deep has caused much favorable comment, and has undoubtedly been a factor in its adoption in the new Rhodesian mills. The tendency is to employ wider mesh screening. At the Modder B, one of the latest mills, it is found that, with eighty 1600-lb. stamps, 8-mesh screening gives 11 tons per head per diem, and 3-mesh 16 tons. A useful table of variations in output for different mesh screens is given in 'Rand Metallurgical Practice,' Vol. I, p. 75. The most recent mill to start on the Rand is the Consolidated Langlaagte, with its 100 stamps of 1900 lb. each. It is probably the first mill in South Africa designed to produce more slime (60%) than sand (40%), and is thus a notable indication of the trend of local practice now that more efficient slime treatment (by filtration) is admitted to be available.

Tube-Milling.—Recent mills in Africa have the tube-mills set diagonally to the centre-line of the mill, to economize space and to afford a more convenient belt drive. The expensive Citroen gear of the City Deep type, with its direct drive, has not been generally adopted. Belt drives appear to be preferred for the majority of the new mills. Ribbed liners of the Osborne type, and liners made up of concrete blocks studded with steel projections (old drill ends) are displacing silex. They are stated to have the advantage of longer life and of collecting amalgam scoured off the plates. Indeed, the relining of a tube-mill is now found to add as much as 400 or 500 oz. to the output by the recovery of the amalgam collected by the old liner.

Authoritative tests will still be required on the loss in efficiency caused by the employment of ore in place of selected pebbles, and the money loss or

[8] *The Mining Magazine*, June 1912, p. 452.
[9] James, Alfred, 'Cyanide Practice,' p. 33.
[10] *Trans.* Inst. Min. & Met., Vol. XVII, p. 486.

gain resulting from such loss of efficiency as against the crushing in place of pebbles of some, it may be, 8000 or 10,000 tons of ore per year.

Filtration announcements have been less assertive than usual. Merrill, Kelly, Sweetland, and Burt have not been so much discussed; the Moore and Butters filters about maintain their positions, with the Oliver coming into wider use in spite of the condemnation of its washing capacity expressed in Whitman Symmes' article, already cited. In Africa the good results of the Butters filter have undoubtedly caused excitement, even though they are not accepted as convincing by some engineers who are possibly at a loss to give valid reasons for their non-conversion. Expense of equipment is one of the excuses put forward: smallness of margin of recovery over decantation is another. An article in the *South African Mining Journal* of January 6, 1912, might therefore be referred to. At the Bantjes the extra cost was given as 3.4d. per ton treated, the extra extraction as 0.6 dwt., or say 2s. 6d., showing a gain of over 2s. per ton. This is, of course, an exceptional instance. At the New Modder, out of a total cost for slime treatment of 13¼d., the separate cost of the Butters is 4d. per ton, the total gain in extraction 11%, or say 8d., less 4d., equaling a gain of 4d. At the Crown Mines, for an extra cost of 3.6d. there was an extra extraction of 0.2 dwt., or 10d. From Australia come accounts of the Ridgway reciprocating unit. It has apparently been adopted by all the latest plants irrespective of groups, and by such well known, but differently controlled, companies as the Great Boulder, Associated Northern Blocks, and Sons of Gwalia. It claims a wide range of material from roasted sand to Bullfinch kaolin ore. It has been found there that the fixed submerged filters, when run on high-grade ore, tend to an extraordinarily great accumulation of gold in the wash water.

Heating Solutions.—W. A. Caldecott and W. R. Dowling heat solutions to 90 to 120° with waste steam at Knights Deep slime plant, circulating them through two 6-in. centrifugal pumps at a cost of 25 hp. for 2000 tons per day. They claim good and clear settlement of solutions in the slime-plant, with a consequent increased (20%) tonnage treated.[11] A. H. Jones[12] shows the improved results obtained by him with solutions heated to 90 degrees.

Precipitation.—Reference is again made to Whitman Symmes' paper, cited above, for a note of his difficulties when using zinc dust and his method of overcoming them. The Merrill zinc-dust method has not bulked so largely in the technical press of late. F. A. Vestal[13] gives his experiences at the Empire mines. Doubtless further progress will ere long be reported, although reversion to zinc shaving is reported by the Esperanza Mining Co., which after long use of the zinc-dust method now passes its gold-bearing solutions, after they come from the Merrill zinc-press, through zinc shaving. It will be remembered that this is H. Colbath's practice at El Rayo, described in this review for 1910. A. J. Wyly refers to his precipitation at Simau with zinc shaving. One box containing 1200 lb. of zinc shaving precipitates daily 140 tons of solution containing 0.04 to 0.4% KCN, 0.6 to 20 dwt. gold, 1 to 10 dwt. Ag, so perfectly that the outflow assays 'traces' only.

Roasting.—It will have been noted that some of the latest Rhodesian plants are built on Kalgoorlie roasting lines. The long hearth Edwards duplex furnace has been adopted for antimonial ores. This may be a grave mistake. The volatilized antimony tends to condense on the cold ore at the far end and thus to accumulate until the furnace is put out of action. It would appear better practice to choose a furnace in which provision is made for taking off the volatilized antimony before it comes in contact with the fresh charge.

General

During the year an attempt has been made in the *Johannesburg Star*, and later in the special anniversary number of the *South African Mining Journal*, to raise a fund for the benefit of those pioneers who, having spent the best part of their lives in introducing and taking charge of the working of the cyanide process on the Rand, now find themselves, after over twenty years' service, without that provision for their old age which they might have anticipated had the industry not succeeded in upsetting the MacArthur-Forrest patents and thus terminated the interest of the company which alone would have been able to grant pensions to the pioneers. It is not much to ask that in return for the free use of the cyanide process, and the special equipment, such as zinc boxes, designed for this purpose, a small sum per box used should be set aside as the nucleus of such a fund. It is stated that, not long since, an employee bearing an honored name in metallurgy, after some twenty years' service in perhaps the richest and most famous mine, was found dead the day after he had received notice to quit. It is hoped this fund will prevent the recurrence of such an incident, which redounds neither to the honor nor the gratitude of the Witwatersrand gold industry.

Portuguese Dredges

The Union Construction Co. has designed a tin-dredge for Portugal, which is being built by Fraser & Chalmers of London. The dredge is to be equipped with 5-ft. buckets, and will be built on lines somewhat similar to the tin-dredge which has proved so successful on the Seward Peninsula. An item of interest to dredge construction companies is the news that the Union Construction Co. has entered into an arrangement to act as consulting engineers for Fraser & Chalmers, Ltd., in the building of dredges for gold and tin, and it may be expected that a number of decided changes and improvements will be made in foreign construction

The Bucyrus Co. is building a 7½-ft. dredge with steel hull for the Andrada Mines, Ltd., of Portuguese East Africa. It will be shipped to Beira early in 1913. It is understood that there is a barren clay overburden of from 2 to 15 ft. and the gravel is 5 to 20 ft. deep. It may be decided to first hydraulic the overburden.

[11] 'Rand Metallurgical Practice,' Vol. I, p. 223.
[12] *Mining and Scientific Press*, Jan. 27, 1912, p. 176.
[13] *Ibid.* Nov. 9, 1912, p. 588.

Concentration by Flotation

By Edward Walker

Experience gained during the past year has tended to prove the superiority of the flotation process operated by the Minerals Separation, Ltd. as compared with the Elmore and the De Bavay processes. I cannot say anything of the Potter-Delprat process, because this is worked solely by the Broken Hill Proprietary, and the results are never published. The simplicity of the Minerals Separation plant and its consequent cheapness is one of the points in its favor, and the second is that the presence of slime does not interfere with its efficiency. As regards the first point, it has a great advantage over the De Bavay process, the plant used in connection with which is costly. The Minerals Separation company has found that the rapid churning of the pulp in contact with oily substances has been of the greatest importance in improving the practice. This action has the effect of thoroughly incorporating air-bubbles and oil, and so making a permanent froth which holds the sulphide particles tightly. In this connection I may remind your readers that the pathway among rival patents in connection with flotation processes is full of snares, and that a passage along it requires exceedingly skillful steering. In this particular case the adoption of the apparatus for rapid agitation brings Minerals Separation in possible conflict with J. D. Wolf, who in his English patent 4793 of 1903 and United States patent 787,814 describes an apparatus of this kind. It is true that Mr. Wolf was the loser in an action at law some years ago, but the point on which that lawsuit turned was in connection with a different phase of the flotation principle.

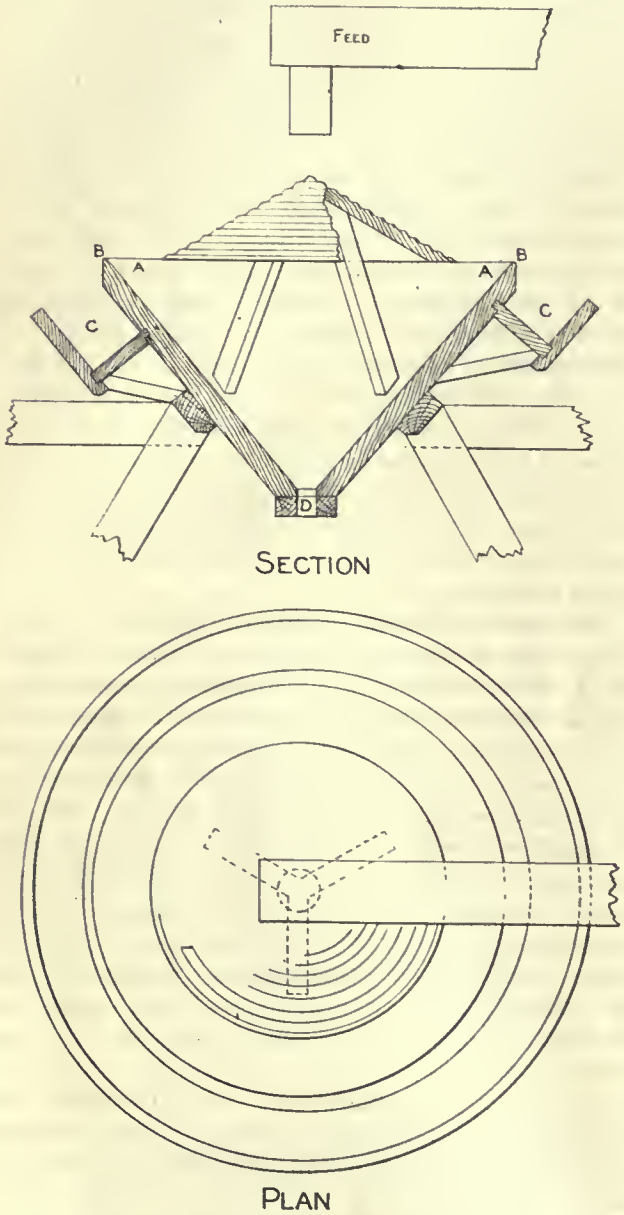
Several references have been made during the past year in various periodicals to the action taken in the United States by Minerals Separation against James M. Hyde for infringement of their patents, consequent on his erection at the Butte & Superior mine in Montana of a plant that bears close similarity to that of Minerals Separation. In fact, his patent differs only in trifling details from those of the Minerals Separation covering this particular type of machine. A large amount of evidence has been taken on commission in London in connection with this lawsuit. Mr. Hyde's general line of defence is that the Minerals Separation process does not disclose any previously unknown principle or mechanical method of carrying such principle into effect. The Everson patent of 1885 is held to have disclosed the combination flotation effect of oil, acid, and bubbles, and the Wolf patent is taken as covering the rapid agitation method. As a matter of fact, the discovery made by Minerals Separation was the efficacy of minute amounts of oil or analogous substances when used to produce a froth by means of rapid agitation. The virtue of the smallness of the amount of oil was discovered by Sulman & Picard.

The dispute between Minerals Separation and the De Bavay company has been settled during the year without recourse to the courts of law. It has been generally held by people acquainted with the facts that the De Bavay process infringed every other flotation patent ever granted. The owners of the De Bavay patents in Australia, where the process was developed, strengthened their position by acquiring the rights of the Potter hot-acid process. As the Minerals Separation process uses a hot solution containing acid, it was presumably reckoned an infringement of the Potter process. This fact must have formed the basis of settlement, and have acted in the negotiations as a powerful offset against the alleged infringement on the part of the De Bavay. Otherwise the controllers of the latter would never have secured 45% interest in the royalties earned by the Minerals Separation in Australia. Moreover, there is little likelihood of the De Bavay process being applied anywhere else than at the North, South, and Block 10 mines at Broken Hill, as it is obviously of inferior efficiency to that of the Minerals Separation company.

Reference to patent litigation would not be complete without mention of the fact that the appeal to the Judicial Committee of the Privy Council from the Australian judgment relating to the dispute between Elmores and Minerals Separation has not yet been heard. In this Australian lawsuit, Elmores sued the Sulphide Corporation, alleging that the Minerals Separation process infringed their patents of 1898 and 1901 for the use of oil and for the addition of acid to increase the attraction of oil to the mineral particles. The court held that there was no infringement, and it is from this judgment that the Elmores are appealing. It is obvious that until this case is finally settled, the use of oil cannot be said to be freed.

The De Bavay company has never permitted the publication of details with regard to their process, and the first appearance of anything approaching a true description is to be found in Theodore J. Hoover's book on 'Concentrating Ores by Flotation.' The disinclination of the company is due to long-standing disputes as to the ownership in the several countries of the patents governing the use of oil, aeration by agitation, acid, and surface tension, and also presumably to the fact that it was impolitic to let outsiders know the exact procedure. The earlier De Bavay patents pointed to the application solely of the principle of surface tension without the use of oil, acid, or aeration, but since then the value of oil and aeration has been recognized. But the surface-tension idea was not new, as it was described by Bradford in 1885. In the De Bavay process as now applied, the zinc tailing is first de-slimed, then agitated with a cold acid solution to remove oxidation products and so thoroughly clean the sulphide surfaces. Subsequently it is washed to remove all trace of acid. After this washing is complete, a small amount of scum of sulphide particles remains on the surface of the water; this is drawn off and sent to vanners for recovery of lead sulphide. The tailing

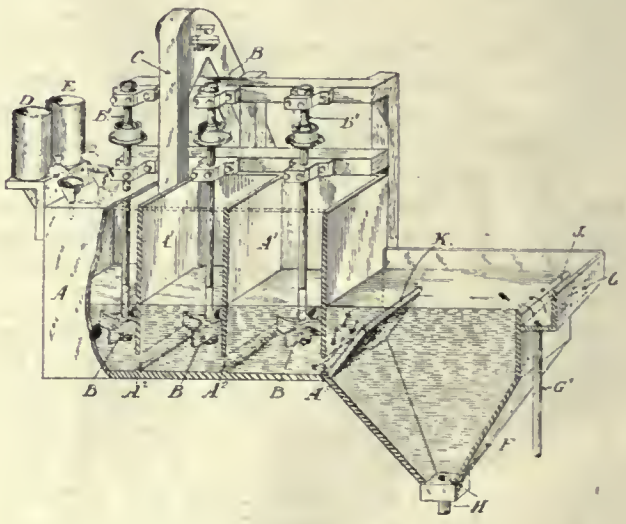
that settles is transferred to an oiling vat, where it is again agitated with water to which a definite proportion of oil has been added. The oil is a mixture of 1 part of castor oil to 4 parts of low-grade kerosene; 2 to 3 lb. of this is used to 1 ton of tailing. Some chlorine gas is also introduced. The oiled pulp



DE BAVAY FLOTATION APPARATUS.

is elevated in a montejus by means of compressed air to the first tier of separating cones. One of these cones is shown in the accompanying illustration. The pulp is fed to the top of the cone and flows down over a series of corrugations to the water-level *A*, where some of the sulphides float and pass over the lip *B* into the launder *C*. The remainder falls to the bottom of the box, passing through the orifice *D* to a second cone, where a further amount of the sulphides float on the surface of the water. The tailing goes subsequently to third and fourth cones, where the process is repeated. The function of the chlorine gas is obscure. The subjecting of the pulp to compressed air is apparently an essential part of the operation. If so, the process is analogous to other oil-and-aeration processes. Mr. Hoover draws attention to the high initial cost of the plant. The capacity of each cone-unit is low, and the plant is both large and high, and covers much ground. The new plant of the Amalgamated Zinc company at Broken Hill to treat 1800 tons per day cost no less than £200,000.

At the November meeting of the Institution of Mining and Metallurgy, H. Livingstone Sulman gave a practical demonstration of the 'agitation-froth' process, as the Minerals Separation has officially christened the method. He exhibited the small testing plant, and showed how the agitation of the oiled pulp by means of rapidly revolving beaters churned air into it and caused a mineral froth to rise to the surface. I take this opportunity of illustrating the method as adopted in the treatment-plant, and I cannot do better than reproduce the drawing that appears in Mr. Hoover's book. This diagram is the most convenient for explaining the process, though many improvements in construction and detail have been introduced. The apparatus consists essentially of three mixing and agitating compartments *A*, the last communicating with a modified spitzkasten *F*. The interiors of the three compartments are connected together by apertures A^2 in the bottom of the partitions A^1. Oil is fed through *E*, acid through *D*, and the ore-pulp through *C*. The agitators *B* are driven rapidly so as to create the froth, which when the pulp emerges over the baffle-plate *K* in the spitzkasten floats and passes over the lip *J* into a launder. The pulp is kept at a temperature of 70° C. Full de-



MINERALS SEPARATION APPARATUS.

tails of the plant and the results are given in Mr. Hoover's book,* to which I refer your readers, with the remark that this book is the most important published in connection with metallurgy since the early books on the cyanide process.

Of the other flotation processes, that of the Murex is the only one to attract attention. This is not strictly a flotation process, for the removal of the sulphides is effected by magnets after some magnetic substance such as magnetite has been added as an emulsion to the pulp. The process has given satisfactory results at the Cordoba copper mine in Spain, where the large proportion of calcite had vitiated any process involving the use of acid. A large plant is being erected at the Whim Well copper mine in the northern part of Western Australia.

*'Concentrating Ores by Flotation,' by T. J. Hoover, p. 221. *The Mining Magazine*, 1912.

Zinc Production and Smelting in 1912

By R. G. Hall

The year has been an especially prosperous one for the miners of zinc ore—and not been without its compensations for the smelter men. It opened with a recession from the high price of spelter of the latter half of 1911. At no time, however, did the price fall below 6c. per pound, and it continued to increase with occasional recessions, until the latter half of the year brought record prices of close to 7½c. at St. Louis. While at this writing it is impossible to more than approximate the total production of spelter for 1912, it can safely be said that it will be of record-breaking tonnage and be probably not far from 340,000 tons from domestic ores alone.

Ore Production

The production of ore has kept pace with the increasing demand and the price for spelter, so that the older districts are today operating and producing ores at a rate in many cases unsurpassed in their history. It has, however, been much of a disappointment that the increasing prices for metal and ore have not led to discovery of any new districts of importance in the Rocky Mountain country.

Joplin District.—The output of the Joplin district for 1912 will be approximately.

	Tons.
Blende	295,000
Calamine	19,000
Total	314,000

The production will be probably somewhat above any year's production hitherto, and the price paid also establish a new high record, at least for the last half of the year. The shipments by weeks, all grades, as given by Zook's Car Report, and prices of spelter, St. Louis and London, are given opposite.

Wisconsin District.—The production of the Wisconsin district for 1912 will be approximately 100,000 tons, showing some increase in production for this field also. The prices paid follow closely those in the Joplin district.

Montana.—The production of Montana for 1912 was almost entirely from one mine, the Butte & Superior. The total for this property during the year will approximate closely 30,000 tons of concentrate averaging 46 to 49% zinc content. Early in June the Butte & Superior company gave up the use of the concentrator at Basin and started the first half of its new mill with a nominal capacity of 500 tons daily. This mill is equipped with jigs and tables followed by the Hyde flotation process on the tailing. The latter process is said to have been discarded and the mill is now being rearranged.

Colorado.—The production of Colorado made an immense increase for the year; practically all of it from the carbonate deposits of the Leadville district. No reliable statistics are at hand, but it is

Nevada.—Practically all the zinc ores shipped from Leadville will approximate 175,000 tons of all grades. For a long time the smelting companies refused to accept carbonate ores much below 30% zinc, but during the last half of the year a considerable tonnage of 22% was contracted for and some was said to have been sold down to 18%. The total tonnage of zinc sulphide ores in Colorado probably changed but little from 1911. The Empire Zinc Co. increased the size of its mill at Canon City. The ore supply for this mill comes for the most part from its own Col. Sellers mine at Leadville. The United States Zinc Co. at Pueblo, and a mill in Denver are the only others operating on Leadville zinc ores. The Wellington at Breckenridge and the Eagle at Red Cliff continue to be considerable producers of zinc concentrates. Crude ore and concentrate are produced by various other concerns, but the tonnage is small.

JOPLIN PRODUCTION AND ZINC PRICES

Week.		Tonnage produced.	Average base price.	St. Louis spelter price.	London spelter price.
January	6	3,970	$43.00	$6.155	£26.750
"	13	2,430	45.50	6.275	26.750
"	20	3,980	45.50	6.325	26.750
"	27	4,980	45.50	6.310	26.750
February	3	5,160	44.50	6.300	26.250
"	10	5,260	44.50	6.250	26.375
"	17	5,340	44.75	6.330	26.875
"	24	4,850	46.50	6.375	26.750
March	2	5,320	47.50	6.434	28.675
"	9	5,130	52.75	6.550	26.500
"	16	5,540	53.50	6.640	26.500
"	23	5,430	50.00	6.460	26.125
"	30	5,400	50.00	6.350	25.375
April	6	6,170	53.50	6.320	25.375
"	13	5,640	52.75	6.405	25.250
"	20	5,320	51.75	6.475	25.750
"	27	5,280	52.00	6.575	25.750
May	4	4,600	53.75	6.550	25.750
"	11	5,270	55.25	6.475	25.750
"	18	5,630	51.50	6.500	25.750
"	25	5,440	55.00	6.575	25.875
June	1	5,350	56.25	6.575	25.875
"	8	5,670	56.25	6.650	25.875
"	15	5,780	56.25	6.675	25.750
"	22	4,760	55.00	6.700	25.750
"	29	5,280	55.00	6.800	25.750
July	6	4,460	55.50	6.825	25.875
"	13	5,640	57.00	7.000	26.250
"	20	5,800	58.75	7.015	26.175
"	27	5,820	61.25	7.025	26.250
August	3	5,760	59.25	6.925	26.250
"	10	6,560	56.00	6.850	26.175
"	17	6,440	54.50	6.750	26.250
"	24	7,580	55.00	6.850	26.500
"	31	5,820	54.50	7.000	26.675
September	7	6,180	56.00	7.125	26.750
"	14	6,800	60.00	7.250	26.750
"	21	6,329	61.75	7.345	27.000
"	28	6,340	60.50	7.375	27.250
October	5	7,230	59.50	7.350	27.500
"	12	6,570	57.50	7.325	27.675
"	19	6,540	56.00	7.290	27.675
"	26	7,160	56.00	7.275	27.500
November	2	6,390	55.00	7.215	27.500
"	9	6,320	54.50	7.200	27.375
"	16	6,750	54.50	7.275	27.250
"	23	7,080	56.50	7.275	26.750
"	30	6,860	56.75	7.175	26.250

Arizona.—The zinc produced by Arizona in 1912 came for the most part from the one property, the Golconda, and allied properties in Mojave county.

New Mexico.—The zinc shipped from New Mexico come mostly from the Magdalena district. The Tri-Bullion property continued the principal producer, with about 7500 tons of concentrate. The mill built by the Ozark company for dry concentration proved unsatisfactory, and that is now being replaced by another process. Zinc ore continues to be produced from other parts of the state, notably the Silver City and Pinos Altos district, and while the total is small, progress has been made.

Nevada.—Practically all the zinc ores shipped from Nevada were carbonates from the Good Springs dis-

trict. These ores occur in many cases associated with lead carbonate, but a successful separation has been worked out so both metals can be recovered.

Idaho.—The Coeur d'Alene district, as usual, supplied the bulk of the zinc produced in Idaho in 1912, the Success mine being the leading producer. The Morning mill continues to use flotation and the McQuisten tubes for recovering the zinc from the lead-mill tailing, and the mill has been enlarged. This and other properties increased their output some in 1912.

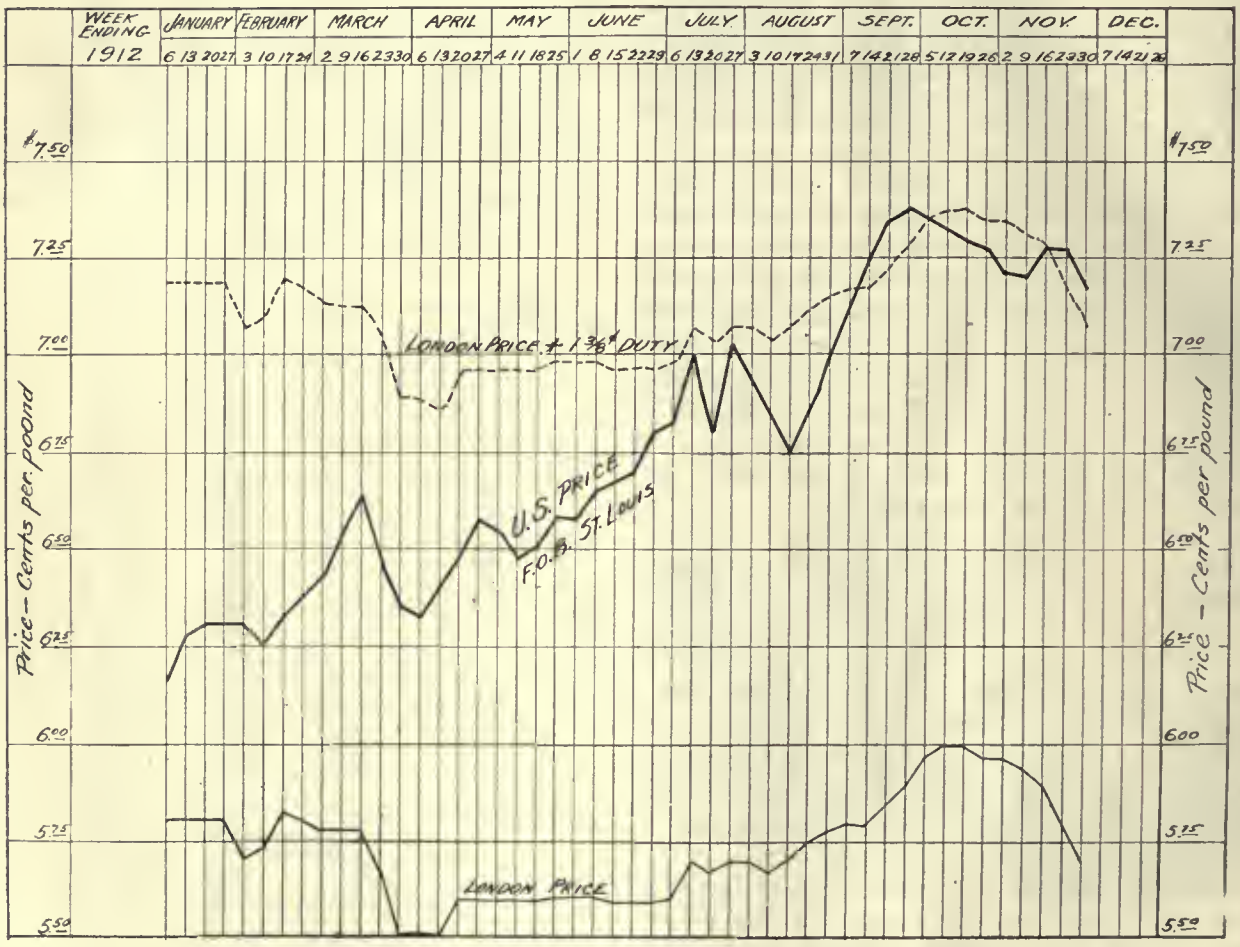
California.—One mine at Keeler shipping carbonates, continued to be the only producer of note this year. There is a mill at Needles producing a small tonnage of concentrate from ores mined mostly in Arizona.

Tennessee.—That zinc occurs in considerable quantity in eastern Tennessee and southwestern Virginia has long been known, and in the early '90s a considerable tonnage was mined and shipped. The crude ore is low in grade and difficult to treat because the blende is finally disseminated through the rock, but the recent rise in prices has attracted renewed attention to the district and large scale production is predicted. Among the concerns especially interested may be mentioned the American Smelting & Refining Co., and the American Zinc & Lead.

Mexico and British Columbia.—Most of the ores shipped to the United States for smelting are smelted in bond and the metal exported again. The disturbed condition of Mexico has prevented many properties from operating, and the actual import of zinc ores from there has been relatively small in 1912. Imports from Canada have not been large in recent years and show but little increase this year.

Zinc Smelting

New Construction.—No new developments have taken place in the methods of smelting during the year. Additions or new works have been built in the Oklahoma gas field. The Tulsa Fuel & Mfg. Co. has completed or nearly completed seven furnace blocks in Collinsville, and the Bartlesville Zinc Co. has completed, or has under construction, at the same point 12 blocks. Against that there has been a decrease of available capacity, notably in the Kansas field owing to shortage of natural gas. The supply of gas in both states available for smelting purposes is being rapidly curtailed, partly owing to the exhaustion of old fields, and partly to the increasing demand for the gas for domestic purposes in relatively distant towns of both Kansas and Missouri. Of the several coal smelting plants in this district, only one was operated with anything approaching continuity, and it is relatively small. The obsolete character of the plants, and the increasing price of coal in the immediate neighborhood renders permanent operation impossible. A number of the gas-burning plants have been supplementing their gas supply by the use of fuel oil, but during the year the price of oil for fuel purposes has been advanced sharply and that supply rendered unprofitable.



PRICES OF SPELTER IN 1912.

Illinois, on the other hand, has shown marked activity in the construction of new works. New works in course of construction and partly in operation at the close of the year are those of The American Zinc Co., 4000 retorts, and the Lanyon Zinc & Acid Co., 1600 retorts, both at Hillsboro. All these smelting furnaces are of the familiar Hegeler type, non-regenerative, 800 retorts, and the roasters are seven-hearth Hegeler type, also, all fired with semi-producers. The Edwards furnaces for roasting at the Lanyon plant at Hillsboro proved unsuited for the work and have been dismantled and replaced by Hegelers. The Granby company has under construction near St. Louis a smelting and acid plant, which will probably be in operation late in 1913. Additions are being made to the plant of the Mineral Point Zinc Co. at Depue, and to that of Hegeler Bros. at Danville.

In the Eastern territory the Grasselli Chemical Co. has completed new roasting plants at New Castle, Pennsylvania, and Canton, Ohio, and has added to the capacity at Meadow Brook, West Virginia.

Smelting Furnaces.—No marked advances have been made in the metallurgy of zinc during the year. With one exception, all the smelting furnaces built during the year were of the familiar Hegeler type; long, unregenerating furnaces, with from 300 to 400 retorts to each side, four and five rows high. The exception was the plant of the Mineral Point Zinc Co., which is erecting the regenerative or Siemens type furnaces. An interesting consideration at the present time concerns the relative advantages of the two types of furnace. Granting that the metallurgical results are equally good from the two types, the advantages and disadvantages of each may be summed up as follows:

Hegeler type:

(1) The construction cost is low, as the furnace is a simple enlarged flue, with no regenerative chambers or expensive gas producers.

(2) The labor cost is low, owing to the method of operation, which may be called end to end charging, and progressive operation of the furnace.

(3) The quality of fuel used may be of the lowest grade, as in the furnaces and producers that I first developed and which are in successful use in Illinois, only the cheapest grade of screenings is used.

(4) The disadvantages of the greater quantity of fuel, which may be serious in the case of higher fuel costs. This may be offset by the use of waste-heat boilers where there is a demand for a steam supply in excess of that normally required for zinc works.

Siemens type:

(1) High construction costs, due to regenerative chambers and costly producers.

(2) High labor cost, due to the bottom to top method of charging.

(3) Higher grade coal, as until recently, at least, the use of low-priced screenings has not been attended with success. It would seem that some of the new types of continuous feed, automatically poked producers may possibly solve this in favor of this type of furnace.

(4) The advantage of a very much smaller consumption of coal per ton of ore charged, the amount being in most cases only 50% of that used on the Hegeler type.

The type of furnace to be selected is therefore to be determined by the labor conditions and the permanent ore supply.

Roasting.—In roasting furnaces, for coal fire and with an acid plant attachment, only the Hegeler kiln is being constructed today. The one case where another furnace was tried it proved a failure, and it is probable that for practice in this country at least, the Hegeler kiln is established for some time, notwithstanding high labor and maintenance.

Concentration.—In the concentration of zinc ores in the Joplin and Wisconsin fields the well known practice of jigs and tables, supplemented in the latter district with magnetic methods for the removal of the iron, has not been changed. In fact, the results obtained by this method have been remarkable, both in cost and in efficency of operation. The same degree of success, however, has not been met in the concentration of the more complex ores of the Rocky Mountain region, as there the mixtures of minerals encountered, and their extreme fineness and condition of dissemination in the rock, have rendered necessary a complexity of method and a refinement of operation making a low cost and high recovery impossible. I have been engaged in the solution of a concentration problem where the principal constituents of the ore are (1) galena, (2) pyrite, (3) chalcopyrite, (4) blende (both in the true sphalerite or 'rosin jack' and the so-called 'black jack'), (5) fluorite, (6) calcite, (7) quartz, (8) country rock. All except the last contain silver and gold. Success in concentrating this ore was only attained by methods specially adapted to the ore itself, and only after many costly experiments.

Flotation.—The progress of flotation methods for concentration of zinc ores has not been great in the United States. One mill at Murray, Idaho, is floating zinc sulphide from the lead-mill tailing, and producing a zinc product of good grade. It is there supplementary to wet concentration. There is likewise a small mill in Utah working on zinc ore. The largest plant up to date in this country making use of flotation is that of the Butte & Superior, and this has not been conspicuously successful; in fact, it is said that the mill is being remodeled and flotation discarded, at least for the present. I have made flotation experiments on most of the important zinc ores of the country, and can say without hesitation that many of them are adapted to beneficiation by the process: but, and here is the most important consideration, the methods adapted for the work must be varied to suit the ore in question, and this variation cannot be predicted in advance, nor from any chemical or visible characteristic of the ore. In some cases the mineral will be floated in a scum or foam; in others advantage may be taken of surface tension. This much can be said, however, that for the separation of a pure, or nearly pure, zinc sulphide from most of the various rock or gangue materials, the process is one of great promise when in competent hands, and designed to omit the particular ore.

Federal Administration of the Public Lands

By W. C. Mendenhall

*The Department of the Interior has a wide variety of functions to perform. It includes in its organization such widely diversified bureaus as the General Land Office, the Office of Indian Affairs, the Pension Office, the Patent Office, the Geological Survey, the Reclamation Service, and the Bureau of Mines, and under its jurisdiction fall the National Parks and Monuments and various eleemosynary institutions within the District of Columbia. It is associated in the minds of the Western public, however, primarily with public lands and the natural resources which are a part of these public lands. In general, this association is correct, although there is one important exception to the general truth that the Department of the Interior has administrative responsibility for the public domain. This exception relates to the National Forests. Their administration has been transferred by Congress to the Department of Agriculture, so that the Department of the Interior has no responsibility except in the administration of such laws as affect title to the forest lands.

Responsibility of the Departments

It is constantly to be remembered as well that the Department of the Interior, like all of the executive departments, is an administrative organization. It is not a law-making body, and has therefore but little opportunity for the expression in its administrative action of such opinions and beliefs as its officers may hold upon conservation or other policies. It acts purely by the mandate of Congress, and its functions are to carry out the will of Congress as expressed by statute. Congress, in turn, it must constantly be remembered, is representative of the people of the United States and is presumed to have expressed the will of the people in the statutes which it has enacted. The great mass of the work done by any Department is simply the administration of the ordinary statutes which impose certain duties upon the officers charged with their enforcement, without granting to those officers any choice as to the law itself. Wher., therefore, an attempt is made to define or to discuss the policies of the Department, it is to be borne in mind that only in the administration of those statutes which grant discretionary powers or permit of various constructions and leave to the Department or its officers a choice between different types of action, is there opportunity to develop and to express a Departmental policy. Whenever the Department administers rigid statutes which grant to it no discretion, then a discussion of the action of the Department becomes a discussion of the action of Congress, whose laws the Department is enforcing; for, of course, policies are expressed chiefly in law-making and, to a minimum extent, in law administration.

*Abstract of an address prepared for the California Miners' Association with the approval of the Secretary of the Interior.

The chief differences that might be expected in Departmental administration are differences in the zeal and energy with which the laws are enforced, but to my mind there is actually little difference in these respects between any two recent administrations. The secretaries and assistant secretaries are always earnest and busy men, devoting themselves energetically, and often at great financial sacrifice, to the problems of the Department. Usually, however, the particular type of problem that is to the fore differs from one administration to another. Under the administration of Mr. Hitchcock, for example, the chief problem in the public mind and before the Department was that of the prevention of land frauds. Under Mr. Garfield and Mr. Ballinger the principal problems, perhaps, were those which arose in connection with the Reclamation Service and the public coal-lands. Mr. Fisher, as secretary, is endeavoring to solve important problems connected with the public water-powers and the mineral lands generally, but in all cases the actual task has been that of administration of the law as it is. If past laxities are discovered and corrected, a protest of greater or less volume, depending upon the publicity that can be secured by those who are fostering the protest, is usually heard. They are apt to take the position that the Secretary for the time being is adopting radical policies, or placing new and unwarranted construction upon the laws.

Lands, Minerals, and Water

The principal public resources with whose administration miners are concerned, and with which the Department of the Interior deals, are the public lands, the minerals within those public lands, and the waters which flow over them. The agricultural lands are disposed of under the various homestead laws, the desert land act, the Carey Act, and the Reclamation Act, and the various selection acts under which certain sections are granted to states for the support of schools or other purposes, or to railroads to assist them in construction, or to those who have served the Nation in some particular way, as the old soldiers who are given special homestead rights that do not belong to other citizens. These selection acts give rise to the 'scrip' which is purchasable, and can be used by the purchaser as well as by the original beneficiary. The laws under which these agricultural lands are distributed provide that they shall be non-mineral in character, and it devolves upon the Department to determine whether they are of the character contemplated by the law. The questions involved here are, generally speaking, not questions of policy, but of fact. To be sure, the facts may be difficult of determination and may involve matters of judgment, but nevertheless a conclusion once reached by the appropriate Departmental officer as to the actual facts in the case, the operation of the law thereafter is automatic.

One of the most important of the laws affecting the mineral resources and one whose administration requires the exercise of discretion by the administrative officers is the so-called withdrawal act passed on June 25, 1910, and amended in important particulars August 24, 1912. This act authorizes the President to reserve public lands for power-sites, irrigation, classification of lands, or any other public purpose to be expressed in the order of withdrawal, and the lands thus withdrawn cannot be acquired except under the mining laws applicable to metalliferous minerals. This power has been widely exercised by the President. Lands believed to contain coal have been withdrawn from entry until they could be examined and their coal value determined. Lands believed to contain valuable phosphate deposits have been withheld from entry pending the passage of an act for their disposition. Oil and gas lands have been similarly treated. Water power sites outside of the National Forest, and to a very limited extent within them, have likewise been withdrawn pending appropriate legislation. In the case of coal lands for whose disposal there exists an adequate law, restoration has followed withdrawal as soon as the necessary examination could be made and prices based upon the quantity, depth, and quality of the coal present could be placed upon the lands. After restoration the lands are open to acquisition precisely as if never withdrawn.

Coal Lands

I believe that the great majority of the citizens of the United States approve unqualifiedly of the present administration of the coal land law in connection with the withdrawal act, but protests are still heard occasionally from those who continue to believe that government lands containing highly valuable coal deposits should continue to be sold as they were prior to 1906, at the lowest possible legal price. Mr. Fisher's own attitude in this matter, which is the attitude of Mr. Garfield and Mr. Ballinger whose policies he is continuing, has been clearly set forth in certain correspondence with F. W. Mondell,† who has opposed, not the principle of valuation, for that seems too well established for opposition even by the most emphatic opponents of the present administration of the public coal lands, but the application of that principle by the placing of prices which in a few instances are as high as $400 or $500 per acre.

In considering the coal-land policy it is also essential to remember that returns from sales of government lands, whether mineral or nonmineral, are added to the Reclamation fund and thus are utilized in irrigation development in the West. I assume, however, that no one is strongly opposed to the present coal-land policy. Its net results seem to be what they are intended to be, namely the prevention of large purchases of valuable lands at low prices for speculative holding, without discouraging purchase for immediate development whenever market conditions shall require that development. It is to be remembered also in considering the government withdrawal policy in its relation to coal lands that by virtue of the acts of March 3, 1909, and June 22, 1910, these lands even during the period of their withdrawal are not withheld from agricultural use. Settlement proceeds upon withdrawn as well as upon unreserved lands, the difference being that surface title is granted on the reserved lands whereas title without reservation of mineral is granted in the case of the unreserved lands.

†*Mining and Scientific Press*, Oct. 7, 1911.

Phosphate Lands

The situation in relation to the phosphate lands of the West differs from that which prevails in the coalfields. The discovery of the Western phosphate fields is a relatively recent event and Congress has not as yet decided upon legislation that will be appropriate for the encouragement of the phosphate mining industry. In the absence of any adequate legislation the lands are simply withheld from entry awaiting such disposition as Congress may make of them. No law permitting surface entry on those withdrawn lands exists so that their withdrawal takes them out of the range of agricultural settlement. This is a matter of regret to the Department, but the interference with agriculture is nominal rather than real, because the great body of the lands really valuable for agriculture that have been included within the phosphate reserves were entered or patented before the phosphate withdrawals, and are therefore unaffected. The remaining lands in most instances have little agricultural value. Perhaps here and there a subdivision exists which should be available for agricultural entry. It is withheld from such entry so long as the withdrawals are in force, and it is presumed they will remain in force until adequate legislation providing either for the leasing of the phosphate or for its sale upon some such plan as that provided for coal lands shall have been enacted.

Oil and Gas Lands

The oil and gas situation, except in the state of Utah, is not unlike the phosphate situation. As is well known, oil lands are acquired under the anachronistic placer law devised in California for the acquisition of alluvial gold deposits. This latter is most inappropriate as a provision for the acquisition of deep-lying fluid and gaseous deposits, and in aid of more appropriate legislation the known oil and gas lands in the public land states have been withdrawn from entry. This withdrawal, like that of the phosphate lands, prevents agricultural settlement except in the state of Utah. Congress at its last session provided a separation act by which surface title upon oil and gas lands can be acquired in that state. The bill as first drawn was universal in its application, but during its consideration a strong protest was received from certain of the California oil interests against permitting agricultural entry upon the surface of the California oil lands. It was stated in this protest that the California lands were desert in character; that they had no agricultural value, and that they were useful solely in the development of the underlying fluid and gaseous fuels; that to permit agricultural entry would merely permit further complications in an already compli-

cated situation so far as titles are concerned. Because of this attitude on the part of the California citizens, the law as finally passed was limited in its application to the state of Utah. Whatever interference there may be with agricultural entry by the withdrawal of oil lands is therefore to be attributed to the opposition of the people themselves.

Partly as a result of the withdrawals and partly in recognition of the need of more adequate legislation, a number of measures have been proposed in Congress for the disposition of the oil-bearing public lands or of the deposits within those lands. The Department when called upon for reports upon these measures has recommended the passage of a leasing act. It advocates first a provision which will authorize the issue of exploratory permits that will safeguard the permittee by giving definite rights upon the territory included within his permit during the period preceding discovery. It is believed, for instance, that the permit should be granted for a short fixed period to a definite area with due conditions as to diligent prosecution of exploratory work, the permittee being protected in his exclusive possession during the life of the permit, if these conditions are fulfilled. At present the oil operator does not come within the cognizance of the federal law until he applies for patent. He can not legally apply for patent, indeed has no legal location, until he has made discovery, and in the deep territory of the California oilfields discovery may involve a year or two years' work and the expenditure of several thousand dollars.

Temporary Prospecting Permits

During prospecting he has no adequate protection under the law either for the property included in his claim or for the capital that he has invested in the attempt to develop it. This is theoretically a most anomalous situation and has been made workable at all only by the fact that operators and prospectors here by a sort of unwritten law mutually agreed to respect one another's filings. But even this extra-legal device is not by any means always effective. It is not rare even now in the California oilfields to be held up by a gun-man who is protecting a claim from possible jumpers, even though the protector may himself be of this class. Everyone agrees that this situation should be corrected, and it is believed that it would be corrected by a provision for an exploratory permit to be followed later by a lease or title. It is the Secretary's belief that lease, not title, should be granted. Much the greater part of the oil development in the United States is effected on the leasehold basis, and were the Government to grant title, lands which it patented to the oil claimant would in a large proportion of cases be developed not by him but by a lease from him. By leasing directly at a moderate royalty the Government would retain ownership and the highly desirable power to readjust to future conditions as they may develop, which power it surrenders when it grants title in fee. The income which it would receive would undoubtedly be greater under the leasehold system than under the present system, and this increased return is a matter of consideration, although it is not regarded by any of the advocates of government leasing as the principal reason for the advocacy of the system. Its chief argument is control, the power which that control gives to regulate and perhaps prevent monopoly, all of which in turn is intended to benefit that friendless waif, the universal victim of all commercial exploitation—the ultimate consumer.

Water Powers

Another phase of what may be considered government policy, in that it represents the exercise of administrative discretion under a statute, is the withdrawal of lands valuable for water power by virtue of the authority contained in the withdrawal act. These withdrawals, like so many administrative acts, are bitterly opposed in some quarters and equally earnestly advocated in others. They, like the oil and phosphate withdrawals, are made in aid of legislation. The statute books at present contain no law which provides adequately for the acquisition and the utilization of these lands. The only law providing primarily for power development is the act of February 15, 1901, which merely authorizes the Secretary of the Interior, in the public lands outside of the forest reserves, and by a later act, the Secretary of Agriculture within the forest reserves, to issue permits revocable at will. Government officials recognize fully that a permit of this type does not offer satisfactory security to the large capital investments necessary in the construction and operation of a modern power plant. The present Secretary of the Interior upon many occasions has earnestly advocated the passage of a law which will permit the issuance of a permit for a definite period of years with provisions for readjustment of rates at appropriate intervals, in order that capital may be relieved of the menace implied in the fact that its basic title must in terms be revocable at will. No such law, however, exists, so that the Department is reduced to administering water powers as best it can under the present law. The Department of Agriculture has had in existence for a few years a set of regulations based on this law, under which power developments are provided for within national forests, and large capital investments have been made on the terms laid down.

New Regulations

On August 24, of this year, the Secretary of the Interior approved a similar set of regulations for power development on public lands outside of national forests and more recent hearings have been held in Washington at which all of the more important power interests were invited to send representatives, the purpose of these hearings being to secure criticisms of the regulations and to determine as fully as might be their practicability. Pending their preparation, permits were not issued on the public domain outside of the national reserves, except in special cases. With their approval, however, the issuance of permits will be resumed and power developments can continue on practically the same terms as those which now prevail in national forests. Meanwhile, the lack of provision for ade-

quate tenure in the power act has resulted in many attempts to secure power rights on the part of those who contemplate developments under other laws.

The irrigation act of 1891 has been a favorite vehicle for power applications. Numbers of applicants have appeared before the Department and have filed their maps of rights of way for conduit lines and reservoirs under the irrigation law of 1891, which inspection by engineers clearly indicated were desired not for irrigation development as this act requires, but for power development. The Department in such cases has of course been compelled to refuse the applicant the rights for which he asks and many of the attacks upon the so-called water-power policy of the Department have been fostered by those who have thus been refused the Department's sanction in their attempt to use the irrigation law for a purpose for which it was not intended. Another law to which resort has frequently been made is the building stone placer law. Filings are often made under this law upon areas valuable as intakes for power canals, or for the construction of power houses and the power purpose of the applicant is clearly manifest. The duty of the Department in the administration of the laws enacted by Congress compels it to refuse to aid in this misuse of the laws of the nation, even while recognizing that the attempts are due at least in some cases to the fact that the laws now in force are scarcely adequate for the accomplishment of the legitimate purpose of the applicant.

Attitude of the Secretary

Mr. Fisher's general attitude on the question of the principles that should control development of water powers is set forth in his testimony before the National Waterways Commission on November 23, 1911. There he stated that he believed that the Federal Government should retain control of the whole general subject, both as it relates to water power in the navigable and in the non-navigable streams of the federal domain, basing his opinion upon the fact that so many of the streams are of interstate and national character that the Federal Government can not escape the obligations which rest upon it, for if it does not exercise jurisdiction no adequate jurisdiction can be exercised, the states being limited in their action by their own boundaries. Mr. Fisher set forth in this hearing and at the hearing on the water-power regulations during November of the present year, his belief that there need be no conflict, rather that there should be close co-operation between the states and the nation, each operating within its appropriate sphere in water-power control. His attitude appears to be that the states should control service and rates, and that the territorially broader federal powers should be invoked chiefly to assist the states, and for use in those cases where the state does not act or cannot act because state boundaries are crossed and jurisdiction is lost. In other words, the two powers, state and federal, will supplement each other to the final end of securing the safety and certainty necessary for development and the protection necessary to the final user of the power.

(To be Continued)

Tin Dredging on Seward Peninsula

In 1912 the dredge of the York Dredging Co. on Buck creek had a good season, slightly in excess of 175 tons of concentrate being shipped as against 93 tons in 1911. This concentrate averaged 68% metallic tin. From the success of this boat and the high prices of tin prevailing, considerable interest has been excited on Buck creek and in other areas in Alaska supposed to contain tin in profitable quantities. New discoveries on Tuttle river will be more carefully investigated during 1913 with the view to building a dredge. The York dredge has only between two and three years' life on ground owned or leased by the company, but it is not improbable that a satisfactory arrangement will be made with the owners of adjoining property which will give the dredge several additional years.

THE BUCK CREEK DREDGE.

In addition to dredging cost, the cost of handling tin concentrate is a matter that is not always clearly understood by those interested in prospective tin areas, some figuring the quoted price of metallic tin as directly applicable to the concentrate recovered and also overlooking many of the charges for transportation and sale. To those desiring more careful calculation the following information furnished by Walter Johnson will be of interest. On a shipment of practically 16 tons of concentrate, the cost of freight, insurance, brokers' charges, etc., amounted in round figures to $40 per ton, divided as follows:

Freight to Nome	$10.00
Freight Nome to Seattle	4.00
Freight Seattle to Liverpool	8.50
Sale charges at Liverpool	7.50
Insurance	10.00
	$40.00

This equals 2c. per lb. of concentrate. This would be about 3c. per lb. of metallic tin. The cost of dredging at the York dredge averaged 26c. per yd. The ground is from 4 to 6 ft. deep. In addition to operating cost the prospective investor should of course consider the cost of the property or the royalty, and of amortizing the plant. Aside from this operation, only minor amounts of tin were produced in the United States in the year just closed.

Secondary Sulphide Enrichment of Ores—I

By C. F. Tolman, Jr.

Considerably more than one-half of the copper of the United States is won from ores whose commercial grade is the result of 'secondary sulphide enrichment,' and none of the larger mines of the Southwest could pay dividends had the grade of their ore not been raised by this process. Since this enrichment is caused by the chemical action of water, trickling downward from the surface through fractured or porous rocks or concentrated in the stronger fissures, the geologist or prospector will investigate the character and structure of the rock which he suspects of having undergone this process. A decomposed porphyry or schist allows a diffused downward circulation which penetrates the entire mass of the rocks, and if the descending solutions are copper bearing, and a precipitating agent is present below the water-level, we may confidently expect a more or less horizontal sheet of disseminated copper ore, the upper surface of which will generally be at the level of the ground-water. Strong fissures in a less permeable country rock will develop lode deposits rather than blankets, the strength of the fissure and the force of the downward flow governing the depth to which these deposits will extend. No trained engineer or experienced prospector would expect to find a disseminated chalcocite deposit in a limestone, because (for reasons explained later) precipitation occurs as layers around kernels or masses of original sulphides and not around innumerable sulphide specks as in the schists or porphyries.

Topography governs both downward percolation of water and the amount of rock exposed to leaching above the water-level, and therefore the investigator may be called upon to study not only the relation of the present topography to subsurface drainage, but to reconstruct past topographies, and to determine whether or not the rates of erosion and leaching have been so adjusted that a considerable thickness of copper-bearing rock has been worked over.

General Nature of Process

The process involves the oxidation and solution of the sulphides above the water-level as well as the deposition of the sulphides below that level, and therefore it is necessary to examine the specking, staining, etc., of the surface rock in order to determine whether or not such specks are the remains of metallic sulphides or whether they are the residues of iron-bearing silicates such as biotite, hornblende, etc., the leaching of which could not give rise to copper enrichments.

On the other hand, secondary sulphide enrichment has been assumed in cases where it has not occurred, and the exhaustion of rich sulphide ore at moderate depths below the water-level has been predicted where such prediction was not justified by the evidence or verified by later developments.

In view of the importance of the subject, it would seem that the methods of investigating secondary sulphide enrichment should be made available to prospectors and mining engineers. The literature (see selected bibliography) does not adequately present either the theory of this subject or its practical application. The value of W. H. Emmons' paper on the outcrop of orebodies[1] published in this journal has encouraged me to attempt a similar practical presentation of the criteria by which the value and extent of secondary enrichment may be judged.[2]

Definition of the Process

Secondary sulphide enrichment involves three processes: (1) The oxidation of the metallic sulphides; (2) the solution of these chiefly as sulphates, chlorides, or bicarbonates; and (3) the precipitation of the metals in solution in the form of secondary sulphides (*a*) by reduction of the sulphates to metallic sulphides by carbonaceous matter, or (*b*) precipitation by means of hydrogen sulphide, or (*c*) reaction of the metallic salts with the unoxidized sulphides below the water-level, the latter going into solution as sulphates (or other salts) and the former precipitating as sulphides. In the broadest sense secondary sulphide enrichment includes deposits of any sulphide precipitated in any way out of the descending meteoric waters which owe their metallic content to the leaching of the overlying rock. Under this definition we would include replacement of organic material by copper, iron, lead, and zinc sulphides, copper sulphide deposits in the sandstones of the Permian[3] and Triassic in various parts of the world, and of copper, lead, zinc, vanadium, uranium, radium, arsenic, antimony, and other minerals in the La Plata sandstone of Colorado and Utah.[4] The circumstance, however, that the leaching is followed by prompt precipitation directly under the leached zone, separates these deposits from the lead and zinc deposits of the Mississippi basin,[5] where there is considerable migration of solutions before precipitation and the close relation of impoverished to enriched areas is not evident.

Secondary sulphide enrichment becomes of greater economic importance in a more restricted sense; that is as an enrichment of a low-grade sulphide orebody.

[1] Emmons, W. H., 'Outcrop of Orebodies,' *Mining and Scientific Press*, pp. 162-163, 1910.

[2] Since this article was sketched, I have learned that W. H. Emmons is writing a small treatise on secondary sulphide enrichment to be published by the United States Geological Survey. We shall expect a monograph worthy of the importance of the subject. F. L. Ransome has completed his detailed studies of the Ray disseminated copper deposits and the re-survey of that portion of the Globe Quadrangle embracing the Miami-Inspiration ore-zone. These publications, with the detailed report on the region covering the Chino mines, New Mexico, will furnish data of greatest importance to those engaged in the critical study of secondary enrichment.

[3] Tarr, W. A., 'Copper in the Red Beds of Oklahoma,' *Economic Geology*, Vol. 5, pp. 221-226, 1910.

[4] Lindgren, W., 'Copper, Silver, Lead, Vanadium, and Uranium Ores in Sandstone,' *Economic Geology*, Vol. 6, pp. 569-581, 1911.

[5] Bain, H. F., 'Sedi-genetic and Igneo-genetic Ores,' *Economic Geology*, Vol. 1, pp. 331-339, 1906.

the added metallic content coming from the leaching of the upper portion of the vein itself, or from a system of veins, or from a general metallic impregnation of the overlying rock.

Original, Primary, and Secondary Minerals

In any ore deposit, there may be present three sorts of minerals; (*a*) the original minerals of the rock, (*b*) minerals introduced by vapors and waters of deep seated or igneous origin, and (*c*) those contributed by descending surface waters. In this paper these will be called respectively original minerals, primary minerals, and secondary minerals, although unfortunately this nomenclature has not always been adopted. The processes of ore formation are often continued and complex. Veins may be repeatedly re-opened and the activity of the mineralizing waters renewed, and the deposit may receive repeated enrichment from ascending solutions. It is unfortunate that these have been called secondary enrichments.[6] They should be spoken of as primary enrichments, leaving the secondary for the rearrangements caused by meteoric waters.

Zones Developed by Reworking Deposits

The processes of oxidation, solution, and precipitation develop five zones (Fig. 1), in approximate orientation with both the surface of the ground and the underground water-level, although all of them may not be distinctly developed at each locality. These are as follows:

I. The Surface Zone of Complete Oxidation.—Here oxidation has been carried to an extreme. The so-called iron cap often appears at the surface and is composed of limonite and hematite, often with much residual silica. Residual gold may be concentrated here, a relative enrichment in respect to that metal being brought about by the removal of the soluble mineral constituents of the deposit. Silver chloride is often present, especially in desert regions[7] where the ground-water is rich in chlorine, forming the relatively insoluble silver chloride and other haloid compounds. Occasionally the somewhat insoluble lead silicates, carbonates, and sulphates are found in the surface zone, and less often the insoluble oxidized compounds of zinc and copper. These extremely oxidized crusts may grade into the next zone, or the oxides may continue to the water-level.

II. The Zone of Complete Leaching.—A few feet below the surface, or a score of feet at most, there is generally found a thoroughly leached and decomposed zone containing either lean ore or only traces of the metals which form soluble salts, although the gold, and less often the silver, may continue through this zone.

III. The Zone of Oxide Enrichment.—Just above the sulphide zone the minerals may be only partly oxidized, occurring as native elements, oxides, carbonates, and silicates, which, when brought farther up in the oxidized zone by the erosion of the surface, may then go into solution under further attack by the oxidizing solutions. If the water-level is being slowly depressed, the upper portion of the enriched sulphide zone will be attacked continually, and very rich oxidized ores may thus be developed. Especially in limestone, rich oxidized ores are apt to be formed, because the limerock tends to neutralize the free sulphuric acid formed from the oxidation of pyrite and which is the most active of the reagents causing the complete decomposition of the oxides. The carbonic acid gas forms the somewhat insoluble carbonates that collect with the oxides in this zone. This zone may be lacking where leaching has been long continued and the rock is pervious to descending waters.[8]

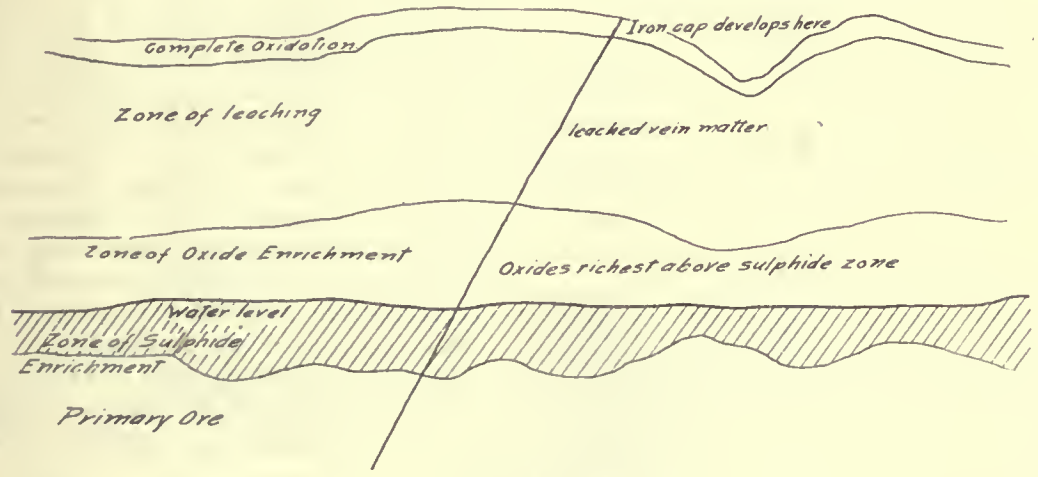


FIG. 1.

IV. The Zone of the Secondary Sulphides.—In most cases the upper limit of the zone is the water-level. Some have gone so far as to assume that this boundary always holds, but important exceptions are noted later. The position of this zone therefore is determined by the underground water-level and varies from a few feet to 400 to 500 ft. below the surface for semi-arid and elevated regions, and the zone may be depressed exceptionally to depths exceeding 1000 ft. where conditions of open fissuring exist.[9]

[6] Kemp, J. F., 'Some New Points in the Geology of Copper Ores,' *Mining and Scientific Press*, pp. 402-403, 1907.

[7] Keyes, C. R., 'Origin of Certain Bonanza Silver Ores of the Arid Region,' *Trans.* Amer. Inst. Min. Eng., Vol. 42, pp. 500-518, 1911.

[8] Lindgren, W., 'Copper Deposits of the Clifton-Morenci District, Arizona,' Prof. Paper 43, U. S. Geol. Surv., p. 25.

[9] Hough, George J., *Mining and Scientific Press*, p. 40, 1912.

The thickness of the zone is extremely variable, the rich chalcocite forming a crust at water-level only a few inches thick in some of the copper mines in eastern United States, while at Butte the zone has an extreme thickness of nearly 2000 feet.[10]

V. The Zone of Primary Sulphides.—The zone of secondary sulphides is bottomed in a most irregular manner, enrichment often penetrating to great depths along a vein, the structural features of which permit a deep descending circulation, while a neighboring vein may develop only a thin or perhaps no secondary deposit.

Even in a permeable, thoroughly fractured rock the dying out of enrichment is so gradual that for practical purposes an artificial line is drawn, ore carrying less than a certain percent of copper being considered as primary ore, although it may show specks of secondary sulphides. Although difficult to define the boundary is none the less real. Below this boundary further variations in value will be those of the primary mineralization which may or may not be of economic value.

Chemistry of Secondary Sulphide Enrichment

The exact chemical equations governing the oxidation, solution, and secondary precipitation are not known and perhaps will never be written.

Any equation given for a reaction of this character can only be a generalized statement of final results, much as the equation $H_2O = 2H + O$ written to explain the hydrolysis of an acidulated water solution does not take into account the complicated reactions that have been proved to take place. Knowing the end products of the reaction and the most important mineral constituents in the solution, we choose the simplest chemical equation expressing the reaction.

OXIDATION

The first process in the chain of events that culminate in the precipitation of the secondary sulphides is the breaking up of the insoluble sulphides which takes place above the water-level, where moisture and oxygen can attack them. The order in which these yield the oxidizing action has been variously stated: Ries[11] giving the order of decomposition as arsenopyrite, pyrite, chalcopyrite, blende, galena, chalcocite, and tetrahedrite. Beck[12] gives marcasite, pyrite, pyrrhotite, chalcopyrite, bornite, millerite, chalcocite, galena, zincblende. No one order covers a majority of cases, but many changes will be brought about by variations in the attacking solutions, which may be acid, neutral, or alkaline. Oxygen from the air may be assisted by strong oxidizing agents such as ferric salts and where a mixture of sulphides are attacked, the composition of the mixture is important. A notable exception to the given order is found in the disseminated chalcocite deposits in altered porphyry. Descending solutions attack the sooty chalcocite dissolving out the copper and leave behind a residual pyrite zone.[13]

Galena is especially resistant to oxidizing attack because it tends to develop a film of insoluble lead sulphate that protects the interior of the crystal, and the result is that, especially in arid regions, residual galena is found at the surface.

The relative resistance to oxidation and solution may be a factor of importance affecting the development of the secondary sulphide deposit. If decomposition is slower than mechanical erosion the latter may sweep the sulphides away before their metallic contents are leached and carried downward. The chemical and physical composition of the gangue minerals may be more important than that of the sulphides. Many contact deposits containing copper sulphides are intergrown in such a dense gangue of garnet, epidote, and quartz that the oxidizing solutions have great difficulty in getting at the sulphides.

Oxidation of Pyrite.—Pyrite is the predominant sulphide of most primary ore deposits, and therefore its oxidation products form the chief reagents by which the enrichment processes are brought about. The oxidation of pyrite may be written in the following simple manner:

(1) $FeS_2 + 4O = FeSO_4 + S$

(2) $FeS_2 + 6O = FeSO_4 + SO_2$

(3) $FeS_2 + 7O + H_2O = FeSO_4 + H_2SO_4$

These three reactions correctly represent geological conditions, although the oxygen may not come directly from the dissolved air, but from oxidizing agents. For instance, as suggested by equation (1) sulphur has been found in many orebodies at the water-level and at the bottom of the zone of oxides.[14]

Mr. Gormley proved in the laboratories of the Anaconda Copper Co., Butte, Montana, that SO_2 is actually produced in the oxidation of pyrite. The presence of H_2SO_4 in mine water, as a result of the rapid oxidation of pyrite, exposed to oxygen by means of mine workings, is so well known that further mention is not necessary.

Oxidation of $FeSO_4$ and the Role of Ferrous and Ferric Salts.—The oxidation of ferrous sulphate to ferric sulphate is concisely represented by the simple equation

(4) $2FeSO_4 + H_2SO_4 + O = Fe_2(SO_4)_3 + H_2O$

Excess sulphuric acid is generally present as shown in the preceding paragraph, and the oxygen comes directly from the atmosphere, as this reaction takes place above the water-level. Ferric sulphate is not particularly stable, especially close to the surface, but at deeper horizons ferric sulphate with ferric chloride, and perhaps mixtures of other ferric salts, stay in solution, becoming active oxidizing solutions at depth below the surface. The breaking up of the ferric sulphate at the surface is perhaps assisted by the evaporation of the solution, the product being a mixture of the various hydrated oxides of iron and hematite forming the well known 'gossan' or 'iron cap', as follows:

(4a) $2Fe_2(SO_4)_3 + 9H_2O = 2(Fe_2O_3).3(H_2O) + 6H_2SO_4$

The oxidizing action of ferric sulphate below the surface is generally recognized. For example, ferric

[10]For the latest data on the question as to what portion of the Butte chalcocite may be primary, see Chas. T. Kiel's 'Conditions of Mineralization in the Copper Veins at Butte, Montana, *Economic Geology*, Vol. 7, pp. 35-83, 1912.

[11]Ries, H., 'Economic Geology,' p. 336.

[12]Beck, F. (Weed), 'Nature of Ore Deposits,' p. 337.

[13]Tolman, C. F., 'Morenci Mines,' *Mining and Scientific Press*, pp. 390-393, 1909.

[14]Lakes, A., 'Vulcan and Mammoth Chimney Mines.' *Trans. Amer. Inst. Min. Eng.*, Vol. 26, pp. 440-448, 1896.

sulphate reacting with pyrite may be expressed

(5) $FeS_2 + Fe_2(SO_4)_3 = 3FeSO_4 + 2S$. and

$2S + 6Fe_2(SO_4)_3 + 8H_2O = 12FeSO_4 + 8H_2SO_4$

It is well to remember that in the presence of water one molecule of ferric sulphate may break up into two molecules of ferrous sulphate, one of H_2SO_4 and free one atom of oxygen to attack oxidizable substances.

An important action of ferrous and ferric salts is their rôle as solvents and precipitants of gold. Discussion of this reaction is made necessary by the valuable contribution of W. H. Emmons.[15] It appears that some chlorine and manganese salt must be present, and the reversible reaction may be written

(6) $Au + 3FeCl_3 \leftrightarrows AuCl_3 + 3FeCl_2$

Looking at the right hand member of the equation it will be seen that if there is any ferrous salt (or any other reducing agent for that matter) the reaction will take place toward the left, and gold will be precipitated immediately, on account of its insolubility. If, however, a strong oxidizing agent, such as a manganic salt, is present, the ferrous salt will be destroyed as soon as formed, the solution of the gold continuing as long as the ferrous salt is oxidized. Theory suggests, however, that gold will not be carried very far down, for reducing agents, such as carbon, organic matter, or sulphides, will soon be encountered, and the gold precipitated immediately. This reaction is especially important in bringing the small amounts of gold, distributed in an eruptive rock, and containing manganese, to the surface. Among many examples that I have noticed, the best one of such action is to be found in the 'gold mirrors' of the 'Gold Mountain' fake in the Galurios mountains, Pinal county, Arizona. This deposit is in a sheared rhyolite, containing manganese, as shown by the stain on weathered surfaces. The gold occurs as plates along cracks, startling in appearance. The discoverer of the mine was employed by the management to break the rock along the cleavages, and thus expose the gold mirrors to the prospective investors. The water circulation in the body of the rock is shown beautifully by the concentric streaks of brown and white. The sketch opposite is taken from my note book (Fig. 2). The concentric rings are brown to black from concentrated iron and manganese, and where the manganese stained band intersects the surface of a fracture, the gold plate is precipitated either by evaporation or reaction with solutions in the fissure. For further discussion of the solution and precipitation of gold, the reader is referred to the contributions of Mr. Emmons cited above.

SECONDARY SULPHIDE SOLUTIONS

History.—Secondary sulphide enrichment is popularly supposed to have been discovered by C. R. Van Hise (from the theoretical side), and S. F. Emmons and W. H. Weed[16] (from the observational side during their examination of the Butte ore deposits). The idea, like most so-called discoveries in science was really slowly evolved, and not discovered by these men. The process was certainly outlined as early as 1893 in the text-book on ore deposits by Fuchs and de Launay,[17] and was recognized as a factor in the formation of Southwestern ore deposits[18] before announced by Weed. The idea was but the extension of the long accepted fact of the precipitation of sulphides from sulphate solutions by reducing agents, such as bituminous matter, H_2S, etc. On the chemical side, Stokes says[19] that the precipitation of soluble metallic salts, by insoluble

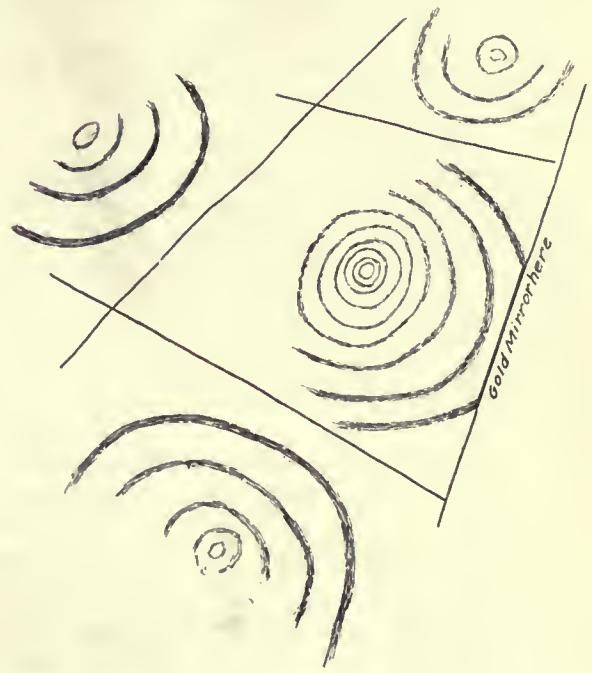


FIG. 2.

sulphides, was investigated as early as 1837 by Anthony, and later in an exhaustive research by Schürmann, the latter established the famous 'order of precipitation' of the sulphides, the importance of which will receive notice later. This should be called 'Schürmann's Series'. In 1899-1900 I produced artificial chalcocite by treating nearly barren pyrite with a solution of copper sulphate and SO_2, the latter, as stated above, being formed as a first product of pyrite decomposition and the experiment imitated Butte conditions as closely as possible. The result was that beautiful films of chalcocite were precipitated on, and probably in part replacing, the pyrite, and these results formed the basis of H. V. Winchell's[20] contribution to the subject.

Subsequent chemical investigation has brought out little to add to the fact, thus proved, that the reaction takes place. Stokes[21] giving the most probable equation by which the reaction takes place, and Wells[22] showing there is a tendency toward the com-

[15] Emmons, W. H., 'The Agency of Manganese in the Superficial Alteration and Secondary Enrichment of Gold Deposits,' *Trans.* Amer. Inst. Min. Eng., Vol. 42, pp. 4-73, 1911.

[16] Weed, W. H., 'Enrichment of Mineral Veins,' *Bull.* Geol. Soc. of Amer., Vol. 11, pp. 179-206; Emmons, S. F., 'Secondary Enrichment of Ore Deposits,' in 'Genesis of Ore Deposits, *Trans.* Amer. Inst. Min. Eng., pp. 433-472; Van Hise, C. R., 'Treatise on Metamorphism,' U. S. Geol. Surv. Mon. XLVII, Chap. 12.

[17] Fuchs, E., and de Launay, L., 'Traité des Gîtes Minérary et Métallifères,' Vol. 2, pp. 230-234.

[18] Graton, L. C., U. S. Geol. Surv. Prof. Paper 68, p. 316.

[19] Stokes, H. N., 'Data of Geochemistry,' U. S. Geol. Surv. Bull. 491, p. 612.

[20] Winchell, H. V., 'Synthesis of Chalcocite and its Genesis at Butte,' *Bull.* Geol. Soc. Amer., Vol. 14, pp. 269-276.

[21] Stokes, H. N., 'Experiments in the Solution, Transportation, and Deposition of Copper, Silver, and Gold,' *Economic Geology*, Vol. 1, pp. 644-650.

[22] Wells, R. C., 'The Fractional Precipitation of Sulphides.' *Economic Geology*, Vol. 5, pp. 1-14, 1910.

plete precipitation of one mineral before the precipitation of the second takes place.

The so-called secondary sulphide reaction consists in an interchange of bases between a salt (generally a sulphate) of the heavy metals and a sulphide (generally pyrite).

These may be grouped under the following heads:

1. The valence of the precipitated metal is not changed. The precipitant is a mono-sulphide.
2. The valence of the precipitated metal is not changed. The precipitant is a di-sulphide.
3. The valence of the precipitated metal is changed. The precipitant is a mono-sulphide.
4. The valence of the precipitated metal is changed. The precipitant is a di-sulphide.

Under the first head the reaction is one of simple substitution and an example may be written

(7) $Ag_2SO_4 + ZnS = Ag_2S + ZnSO_4$

Reactions of the second class are complicated by the fact that pyrite is a di-sulphide. Take the precipitation of Zn sulphide by pyrite. If we assume that an ion of zinc replaces one of iron we have an excess of free sulphur, or if we write the equation so that all the sulphur unites with the zinc we have an extra ion of SO_4 or in the presence of water $H_2SO_4 = O$. These relations are expressed as follows:

(8) $ZnSO_4 + FeS_2 = ZnS + FeSO_4 + S$

(9) $2ZnSO_4 + FeS_2 + H_2O = 2ZnS + FeSO_4 + H_2SO_4 + O$

While examples of free sulphur in the sulphide zone are known, in most cases the reaction seems to produce the sulphide and sulphuric acid. In the presence of water three oxygen atoms will oxidize one atom of sulphur into sulphuric acid, therefore if we multiply equation (9) by three and add to the product equation (8) and one molecule of water we obtain

(10) $7ZnSO_4 + 4FeS_2 + 4H_2O = 7ZnS + 4FeSO_4 + 4H_2SO_4$

Emphasis is laid on this reaction, because those written by Van Hise[23] and copied in several textbooks on ore deposits, assume the presence of free oxygen, in order to oxidize the sulphur called for in equation (8). It is not probable that free oxygen exists in the zone of secondary sulphide enrichment, certainly not at depth in this zone, and they are not good from the geological point of view.

The further complications arising under cases 3 and 4 are caused by the fact that cupric sulphate is generally precipitated as cuprous sulphide (chalcocite). There are probably many different reactions taking place to produce this result. For instance Stokes[24] has shown that a reversible reaction takes place as follows:

(11) $2CuSO_4 + 2FeSO_4 \leftrightarrows Cu_2SO_4 + Fe_2(SO_4)_3$

Now if any H_2S is present (from the attack of H_2SO_4 on pyrite), the cuprous sulphide Cu_2S (chalcocite) will be precipitated since it is more insoluble than CuS (covellite). The reaction however favored by Stokes, and which may be given his name, may be deduced in the same way we obtained the balanced reaction between pyrite and $ZnSO_4$.

(12) $2CuSO_4 + 2FeS_2 = Cu_2S + 2FeSO_4 + 3S$

(13) $4CuSO_4 + FeS_2 + 3H_2O = 2Cu_2S + FeSO_4 + 3H_2SO_4 + 3O$

Multiplying equation (13) by 3 in order to have the right amount of oxygen to oxidize the sulphur and adding thus to equation (12) we obtain

(14) $14CuSO_4 + 5FeS_2 + 12H_2O = 7Cu_2S + 5FeSO_4 + 12H_2SO_4$

This reaction best expresses the facts as shown in disseminated copper deposits where $CuSO_4$ acts directly on pyrite to form chalcocite, without the formation of residual sulphur. For those secondary sulphide deposits where free sulphur is formed equation (12) is suggested.

There is another equation worth considering, as it was the one I selected as best expressing the reaction governing the formation of chalcocite in the Butte experiments. Since it was found necessary to add SO_2 to produce a satisfactory and rapid precipitation of chalcocite, and as there was reason to believe that this gas was present in the strongly acid solutions at Butte, this gas was assumed to react with the extra oxygen shown in equation (13) which becomes the following:

(15) $4CuSO_4 + FeS_2 + 3SO_2 + 6H_2O = 2Cu_2S + FeSO_4 + 6H_2SO_4$

Weed[25] describes an unusual case where ferric oxide and chalcocite are deposited simultaneously. A reaction covering this case would read

$6CuSO_4 + 2FeS_2 + 4H_2O = 3Cu_2S + Fe_2(SO_4)_3 + 4H_2SO_4$

The ferric sulphate then breaks up into ferric oxide as discussed above.

So far it has been assumed that the copper is in solution as copper sulphate, and that there is an excess of H_2SO_4. This is undoubtedly the case at Butte where the solutions are concentrated and the country rock is granite, but in the disseminated deposits where the pyrite is scattered through an altered sericitized porphyry, or schist, and especially in deposits in limestone, it is probable that alkali and lime carbonates neutralize the solutions, and change the copper sulphate into copper bicarbonate which is somewhat soluble. In an interesting investigation, the results of which have not as yet been published, R. H. Forbes has followed the migration of copper from the tailing from the Clifton, Arizona, concentrators out through the soil of the farms along the Gila river, up into the farm produce and the trees, and from the latter into the mistletoe, which concentrates the copper in itself by robbing the tree of sap and breathing out the moisture, which is of course free from copper. He states[26] that the copper passes through the soil as a carbonate.

Mention[27] has already been made of experiments showing the prompt neutralization of acid solutions when digested with limestone from the Bisbee mines, and the orebodies at this locality show in a beautiful manner how the limestone is eaten away by descend-

[23] 'Treatise on Metamorphism,' pp. 1161-1164.
[24] *Loc. cit.*, p. 647.
[25] Weed, W. H., U. S. Geol. Surv. Prof. Paper 74, p. 164.
[26] Personal communication.
[27] *Mining and Scientific Press*, p. 360, 1909.

ing carbonates of copper, to enrich the pyritic lenses below the water-level.

In the disseminated chalcocite deposits there is a large amount of secondary silicification, and as silica is more soluble in alkaline than in acid solutions, a prompt neutralization is indicated. Further copper silicates and carbonates are found to underlie the sulphide ore, at the Miami, Arizona, orebody; the explanation appealing to me is that the brecciated zone which dips under and cuts off the sulphide ore, contained little or no pyrite, and hence these compounds were deposited rather than the sulphide.

The above discussion is justified by the practical importance of these conclusions. If solutions carrying copper carbonates and silica do not encounter sulphide precipitants, they will not form sulphide deposits at any depth.

The chemistry of copper bicarbonate solutions has not been investigated, but it may be remarked that $Cu(HCO_3)_2$ may be substituted for $CuSO_4$ in any of the equations given above and equivalent results be obtained, iron carbonate forming instead of iron sulphate.

Order of Precipitation of Various Sulphides.—Schürmann's series[28] gives the order in which sulphides are precipitated as follows: palladium, mercury, silver, copper, bismuth, cadmium, antimony, tin, lead, zinc, nickel, cobalt, ferrous iron, arsenic, thalium, and manganese.

This may be interpreted as follows: A solution of silver sulphate will precipitate silver sulphide upon contact with copper sulphide, or any member of the series to the right, but it is difficult for silver sulphide to precipitate copper sulphide. The order will not hold under all conditions, for by 'mass action,' a strong solution of a metallic salt may cause a precipitate at the expense of a member of the series to the left. The order, however, is an important one, the silver in a secondary sulphide enrichment almost invariably being at the top of the zone, the copper extending to depths, and at times zinc sulphide appearing at depth below the copper. Lead sulphide and its oxidized products almost invariably hug the surface in spite of its position in the Schürmann series, because of the insolubility of most of the oxidized products of lead, which makes the downward migration very slow. Zinc on the other hand is often completely eliminated from the oxidized zone by leaching, leaving perhaps a 'free-milling' gold ore at the surface, which changes promptly at the water-level to a refractory zinc ore.

Mineralogy of Secondary Sulphides.[29]—The reader will readily appreciate the importance of determining the 'critical minerals' of the secondary sulphide zone, *if such exist.* However, as there is only one mineral, covellite, that up to date has been described only as secondary, and as this is not a common mineral and as some future investigation may find even this mineral to occur as a primary mineral, a group of minerals characteristic of the zone must be recognized before we can come to a decided conclusion, and final proof will be found in connection with structural, textural, topographic, and other relations discussed below.

This statement that covellite occurs only as a secondary sulphide should be modified on account of its occurrence as a fumarolic mineral in volcanic vents, but as such deposits would not be mistaken for secondary enriched sulphides, this exception is of little importance. Its limited distribution, however, is of little value as a diagnostic mineral, and Kemp[30] considers this scarcity as a proof that reducing conditions obtain in this zone. The interesting feature about the occurrence of covellite is that it forms large ore deposits only in copper veins carrying enargite, and yet not in all enargite veins, for at Butte some of these enargite veins carry extensive covellite ore deposits, while others do not. Lazerovic[31] states that enargite ($Cu_2S.As_2S_5$) forms As_2O_5 on oxidation, and that this strong oxidizing agent causes the precipitation of the cupric sulphide. There was reason to expect that this important subject would be discussed in Weed's report on the Butte district, but unfortunately it was not done.

Chalcocite (and silver-bearing chalcocite, stromyerite, and acanthite) is the great secondary sulphide ore, although it probably occurs as a primary mineral in some localities[32]. It is believed that the 'sooty chalcocite' so common in enriched orebodies is always secondary.

The significant minerals, that is those more often secondary than primary, are given by Ransome as follows: stephanite ($5(Ag_2S)Sb_2S_3$), polybasite ($9(Ag_2S)Sb_2S_3$), argentite (Ag_2S), bornite ($3(Cu_2S)Fe_2S_3$), pyrargyrite ($3(3Ag_2S)Sb_2S_3$), and proustite ($3(Ag_2S)As_2S_3$). Other minerals occurring both as primary and secondary are pyrite (FeS_2), marcasite (FeS_2), chalcopyrite ($Cu_2S.Fe_2S_3$), bornite ($3(Cu_2S)Fe_2S_3$), galena (PbS), blende (ZnS), tetrahedrite ($4(Cu_2S)Sb_2S_3$), and enargite ($Cu_2S.As_2S_5$).

The gangue minerals of this zone are those formed by descending acid solutions, or by alkaline or lime bicarbonate solutions, and are chiefly as follows:

Chalcedony, opal, copper stained chrysoprase, and quartz, kaolin, gypsum, anhydrite (at Bor, East Servia), and fluorite. Calcite is lacking where the solutions are acid.

Gold Production, Federated Malay States

In 1911, 241.8 oz. of gold was exported from Negri Sembilan, 1309.5 oz. from Perak, 7677 oz. from Pahang, making a total of 9228.3 oz., valued at $174,100, as against 16,767 oz., valued at $326,525, in 1910. Severe drought during the first 9 months of 1911, followed by abnormal rains, caused considerable loss in the mining industry. Scarcity of firewood is causing the rapidly increasing use of coal. More activity in prospecting was evident in 1911, while the installation of machinery in mines is being gradually undertaken and opens a large market for this product.

[28] *Liebig's Annalen*, Vol. 249, p. 336, 1888.

[29] This discussion is founded on W. Lindgren's and W. H. Emmons' tables of minerals, and F. L. Ransome's discussion of the criteria of secondary sulphide enrichment. See bibliography at end of second part.

[30] *Economic Geology*, Vol. 1, p. 19, 1906.

[31] 'Die Enargite-Covellin-Lagerstätte von Cuka-Dulkan bei Bor in Ostserbien,' p. 357, 1912.

[32] It occurs in the Bonanza mine, Alaska (?), the Vergilina district, Virginia, some primary chalcocite at Butte (?), and is reported in a pegmatite dike.

Review of Gold-Dredging in 1912

By Charles Janin

The United States Outside California

The year 1912 was a rather quiet one for gold dredging in the United States outside of California. From what information is available, I have prepared a table to accompany this review, showing the location of 22 dredges that operated or were being constructed during the year. Some of these boats proved unsuccessful and were shut down after a short run—notably those at Kennedy Placers, Montana; Mystic, South Dakota; and on the Chestatee river in Georgia. While the exact figures for the total yardage handled by all the dredges during the year is not available, it can be closely approximated for the purpose of this review at 14,500,000 cu. yd., divided as follows: Montana, 6,000,000; Idaho, 5,000,000; Colorado, 2,500,000; other dredges, 1,000,000, the latter figure probably being in exeess of the yardage aetually handled. These figures seem small in comparison with the total yardage handled by the California dredges during 1912, which will closely approximate 68,000,000. Details regarding operations in California are given on another page.

DREDGES IN THE UNITED STATES OUTSIDE OF CALIFORNIA

State.	District.	Company.	Manager or superintendent.	Cap. of buckets.	Builder.
Idaho	Idaho City	Boston & Idaho G. D. Co.	John A. Miles	15	Yuba Construction Co.
"	" "	" " "	" "	5	Risdon Iron Works.
"	" "	Moline D. Co.	E. F. Blaine	5	" " "
"	Solomon	Kirtley Creek D. Co.	N. Dieckerman	9	Yuba Construction Co.
"	Pierce City	Harper Co.		5	N. Y. Engineering Co.
"	Placerville	Sprague Co.	Harker	3¼	Risdon Iron Works.
Montana	Ruby	Conrey Placer M. Co.	Charles Kammerer	7½	Marion Steam Shovel Co.
"	" "	" " "	" "	7½	" " " "
"	" "	" " "	" "	16	" " " "
"	" "	" " "	" "	?	" " " "
"	Iron Mountain	Kansas City Commercial Co.		7½	" " " "
* "	Kennedy Placers	California D. Co.		5	Risdon Iron Works.
"	Magpie Gulch	Magpie Dev. Co.	A. Morrison	5	Union Iron Works.
Colorado	Breckenridge	Reliance G. D. Co.	B. S. Revett	5	Bucyrus Co.
"	" "	French Gulch G. D. Co.	A. J. Relling	5½	" "
"	" "	Colorado G. D. Co.		9½	" "
Wyoming	Shoshoni	Shoshoni G. D. Co.	S. F. Zlliox	3½	Marion Steam Shovel Co.
*South Dakota	Mystic	Castle Creek H. G. M. Co.		5	Stearns-Roger Mfg. Co.
†Oregon	Powder River	Powder River Dev. Co.	Rowe Derby	9	Yuba Construction Co.
"	Foote Creek	Champlin G. D. Co.	Champlin Bros.	5	Allis-Chalmers Co. (rebuilt)
‡Nevada	Spring Valley	Federal Mines Co.	J. H. Hart	5	Risdon Iron Works.
Georgia	Chestatee River	Sewell D. Co.		3	Bucyrus Co.

*Idle. †Under construction; will be at work early in 1913. ‡Moved to new ground and will commence operations early in 1913.

Montana.—Details of operations of the dredges at Ruby are not available at this writing. The old dredges of the Conrey Placer M. Co. and Poor Farm Placer Co.,* which have been operated for years, required considerable repairs during 1912. It was also neeessary to replace the big screen on No. 4, the 15-ft. dredge which was built during 1911 so the yardage handled fell somewhat short of expeetations. The operating costs were also higher than normal. The two companies are under the same management and operate and own dredges. No. 1 dredge has 7½-cu. ft. buckets and handles about 90,000 yd. per month; No. 2 has 9-ft. buckets and averages about 100,000 yd.; No. 3 now has 9-ft. buckets and probably averages about the same yardage as No. 2; No. 4 averages between 225,000 and 250,000 yd. per month.

The Magpie dredge in Lewis and Clark county is reported as doing good work. The dredge of the Kennedy Placers in Missoula county was shut down. Some new areas were being examined in the state during 1912 with a view to building dredges if conditions were found favorable. The results of these investigations are not yet known.

Idaho.—The principal gold dredging operations in Idaho are those of the Boston & Idaho Gold Dredging Co. at Boise Basin. These were described by J. H. Miles in the *Mining and Scientific Press* of September 14. The company operates two dredges, the new 15-ft. boat built by the Yuba Construction Co. has been doing excellent work averaging over 300,000 cu. yd. per month. The ground is about 32 ft. deep and is exceptionally favorable for obtaining high yardage and low operating cost. The 5-ft. Risdon dredge of the same company handled an average of 68,000 yd. per month. The Kirtley Creek dredge is said to be doing good work. This has 9-ft. buckets and is operating near Solomon. The small dredges at Pierce City worked part of the time, the Sprague, a 3¼ Risdon dredge, is said to have had a good season. A new dredge is planned for the Quartz Creek region in this district in 1913 by W. J. Harris and others of Spokane.

Colorado.—Three dredges worked in the Breckenridge district in Summit county during the year. The dredging season averages about eight months, from the latter part of March to the first of December. The cost of dredging at the French Gulch dredge, a 5-ft. Bucyrus boat, is from 5½ to 6c., handling about 70,000 cu. yd. per month. The Colorado

*Described by Hennen Jennings in *Mining and Scientific Press*, January 6, 1912.

Gold Dredging Co. has a 9-ft. Bucyrus dredge and handles about 150,000 yd. per month, the cost of dredging being about 5c. per yd. The Reliance dredge handles about 70,000 yd. per month. The two smaller boats are known to have been making money this season.

Nevada.—The 5-ft. Risdon dredge of the Federal Mines Company, which was shut down after operating for a short time in Spring Valley, Humboldt county, was moved to a new area in the same district and will commence operations early in 1913.

South Dakota.—Castle Creek dredge at Mystic, South Dakota, which was built by the Stearns-Roger Manufacturing Co., during 1911, for Denver men, has been shut down. The ground did not contain sufficient gold to make the project a financial success.

Wyoming.—The Shoshoni Gold Dredging Co. is operating a 3½-ft. Marion dredge near Shoshoni, Wyoming. No information is given out by the management concerning operations.

Oregon.—The only dredge operating in Oregon is the Champlin boat on Foote creek, Jackson county. This dredge was sunk in December 1911, but was raised and again put in commission. The Powder River dredge near Sumpter is fast nearing completion and will commence operations in January 1913. This is a 9-ft. boat built by the Yuba Construction Company.

Georgia.—The 3-ft. Bucyrus dredge of the Sewell Dredging Co. was shut down during the year. The ground did not contain sufficient gold to pay operating expenses.

Alaska

†The total gold production from dredge operations on the Seward Peninsula for 1912 will approximate $1,250,000. There were in operation or under construction a total of 39 dredges. A number of these had a successful season, though as pointed out in my previous article, some of the boats operated at a loss. The Wild Goose dredge on Ophir, which averaged 2300 yd. per day for the last 40 days and about 2000 yd. per day for the entire season, had a successful year. The Blue Goose, working part of the time on leased ground and part on claims owned by the company, is reported to have made a large clean-up. This dredge averaged about 1000 yd. per day and will be somewhat remodeled during 1913. A new bucket line of 60, 3-cu. ft. close-connected buckets is being designed by the Union Construction Co. to replace the old line of 5-ft. open-connected buckets which actually only held 4 cu. ft. The old tumblers will be used; additional power will be supplied, probably by a gas-engine using distillate to supplement the wood-burning steam plant, though the management may decide to remodel the entire present plant. With the contemplated improvements an increased yardage will be obtained in 1913.

Among the boats built during 1912 the Kimball & Saupe dredge built for C. Flodin at Eastfork on the Solomon river had a good run. The returns from Shovel Creek dredge built by the Yuba Construction Co. for Newton Cleaveland and others and operated by Cory C. Brayton were also encouraging. This dredge has 2½-ft. buckets and averaged about 1000 yd. per day. The fuel used was about 240 gal. of distillate per 24 hours, costing 25c. per gallon at the dredge. The Ruby dredge built by the Union Construction Co. and in charge of William Colley had a successful run of sixty days averaging 87% running time and handling 65,000 yd. while dredging to a depth of from 5½ to 14 ft. This dredge is equipped with 2¾-ft. buckets. The consumption of distillate was 132 gal. per day with a 90-hp. engine. The Johnson dredge, built by the Union Construction Co., gave some trouble when first started, but afterward did good work. The 3-ft. Inmachuck dredge erected by the same company, handled over 65,000 yd. in 50 days, digging to a depth of from 9 to 12 ft. This dredge is equipped with two 50-hp. Union gas-engines and used 210 gal. of distillate per day. The cost of oil was about 40c. per gal. at the dredge, but this it is expected will be reduced to 30c. by taking advantage of winter hauling and utilizing present drums.

The little 1¾-ft. Ernst dredge on the Nome beach, is reported to have cleaned up $20,000 for the season. As this dredge did not start until the latter part of July, the owners are naturally pleased with the results which may encourage further attempts at beach dredging. This is a Barnard dredge, but was put together by William Colley of the Union Construction Co. The Kelliher dredge, built by the Union Iron Works in 1912, operated successfully. Some of the ground had to be thawed, as it was solidly frozen. The Nome Exploration Co. boats, better known as the Powell dredges, operated part of the season. It is stated that the Wonder dredge made a good recovery, but not sufficient to make any material change in the financial standing of the company at Nome. Construction work was continued on the new 9-ft. boat on Flat creek and this dredge will be finished in 1913. Work was commenced on the hull of the Greenberg or Holyoke dredge before the last steamer left Nome. This work will be continued during the winter and the machinery for the dredge will be taken in on one of the first boats in the spring of 1913. The oil-burning system which was tried on the Three Friends dredge in the summer of 1912 did not give the results the management anticipated, very little saving being effected over the use of coal. Some days as high as 60 barrels of oil were consumed. It is possible that the stockholders of this company may at least realize that the steam plant, which might be a credit to Noah's Ark, but hardly to the management of a modern dredge, should be replaced by an up-to-date plant. The operating cost of this dredge was probably the highest on the peninsula for 1912.

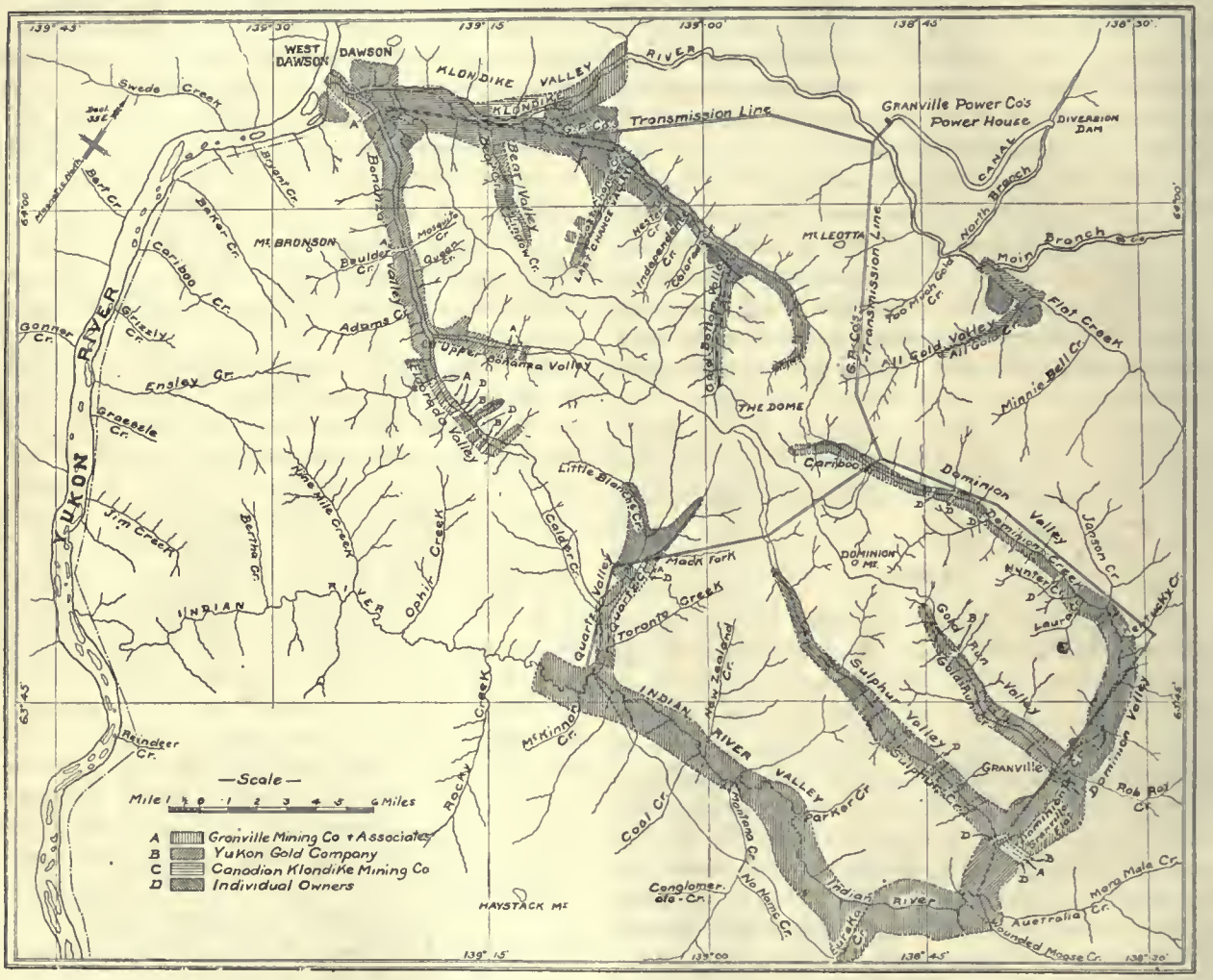
In addition to the dredge mentioned in my previous article, there are several dredges proposed for 1913. E. C. Julian is figuring on a new boat for St. Michael's creek below his present dredge. It is stated that the Osborne dredge will be remodeled;

†The progress of gold dredging on the Seward Peninsula was discussed in the *Mining and Scientific Press* of September 28, and to that article the reader is referred for a general discussion of the season's work. Here is given a very brief summary of operations since Mr. Janin's departure from Nome.

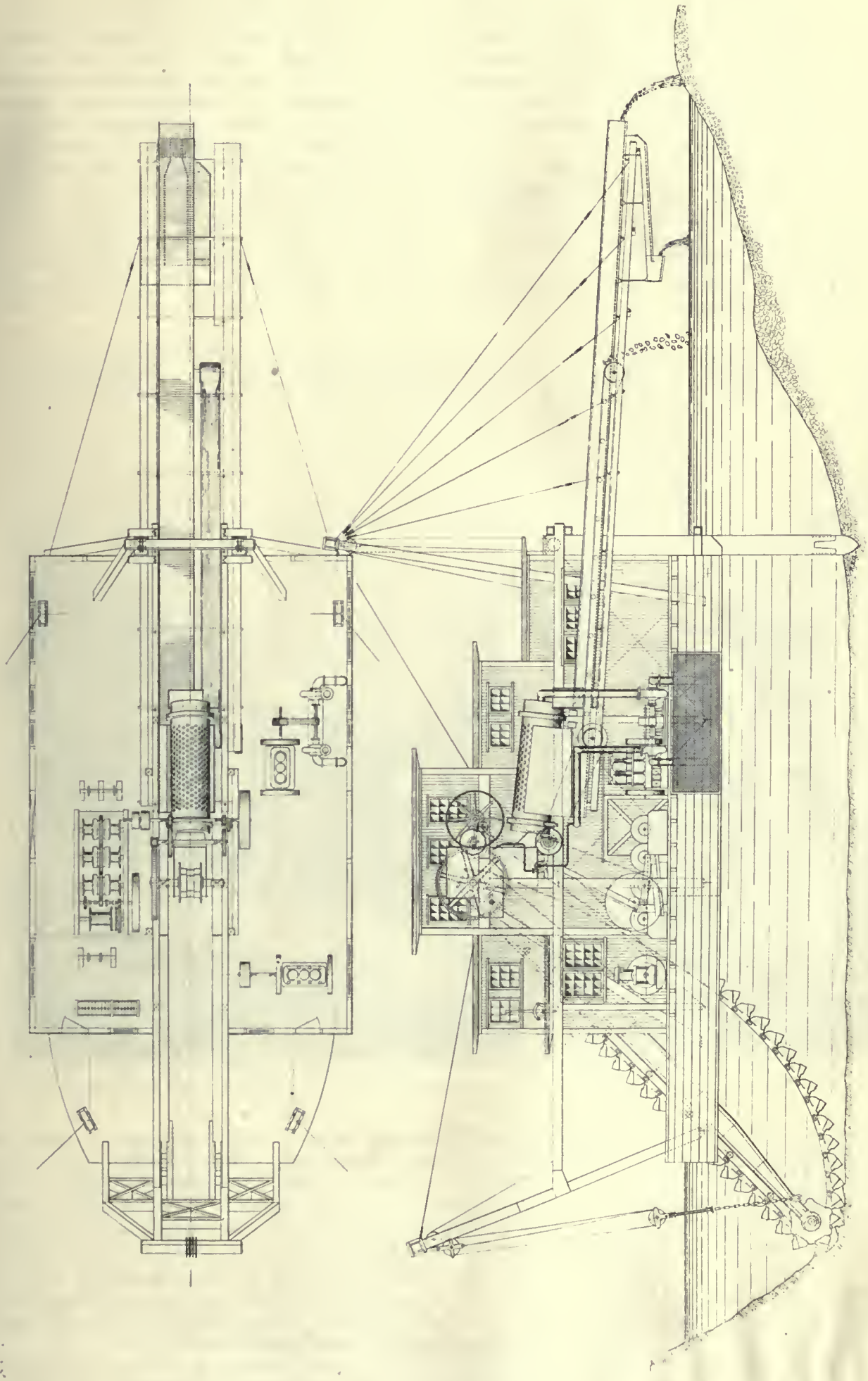
the hull thoroughly overhauled and the old engines and steam plant, which have caused so much delay and expense, replaced by gas-engines. The present system of gold saving tables will be taken out and replaced by a short screen with 2½-in. perforations for coarse rocks. The under size from this screen will pass to a flume 42 in. wide, extending about 40 ft. behind the dredge. A short stacker will extend about 25 ft. outboard and drop the coarse rocks inside the line of tailing from the flume. The Middaugh dredge on Saunders creek, which was idle during 1912, has been dismantled and the machinery will be hauled over the snow to ground near the junction of Hobson creek with Nome river, where a new hull will be built in the spring. The Union Construction Co. has charge of this work. There are several other dredges planned for the coming season. The flume type of dredge, of which a drawing is shown, has proved satisfactory in Alaska, and there seems to be a good future for boats of this type. These boats have a small initial cost and a low operating and repair cost. Some are built without the screen shown in the drawing, the buckets dumping directly into the flume. The Kimball and Saupe dredges on Shover, Eastfork, and Ophir creeks are of this type. These boats do good work where there is not much clay. It is found, however, that the addition of the screen with 2½ or 3-in. perforations assists greatly in washing the gravel, and the dredge is more adaptable for all classes of ground. As pointed out in my previous article, there is a good future for small dredges in Alaska, and there is much competition between different dredge construction companies to secure this trade. The Yuba and Bucyrus companies had an engineer, C. T. Nicholson, investigating the needs of that territory during the past year, and are now figuring on several new boats which may be built in 1913. The Union Construction Co. has booked orders for several boats for 1913. The other companies have not yet reported.

Yukon Territory

The Klondike goldfield extends southeast from Dawson. The best known and most productive parts of it cover a parallelogram of about 50 miles long by 20 wide. The accompanying map shows the known workable areas of the Klondike goldfield as figured by the engineers of the Granville company, and the division of the field with regard to ownership. The first large company in the district was the Yukon Gold Co., which owns extensive areas on Bonanza and Hunker creeks and has a capitalization of $17,500,000. This company began equipping its properties in 1906 and at the present time has 9 dredges in operation in addition to hydraulic plants. The dredges of the Yukon Gold Co. handled for the season of 1911 a total of 4,151,249 cu. yd., having an average value recovered of 64.35c., and an operating cost of 35.43c. per cu. yd. Seven of the



THE KLONDIKE GOLDFIELDS.



NEW TYPE OF DREDGE FOR ALASKA; DESIGNED AND BUILT BY THE UNION CONSTRUCTION COMPANY.

dredges averaged 171½ days as compared to 159 days for 1910. Figures for the total season of 1912 are not yet available but up to September 30 the dredges handled 4,408,300 cu. yd. with an average recovery of 66c. per yd. It is said that the operating cost was reduced to about 30c. per yd. The total yardage for the season will be somewhat in excess of 5,000,000. The following summary of dredging results will be of interest:

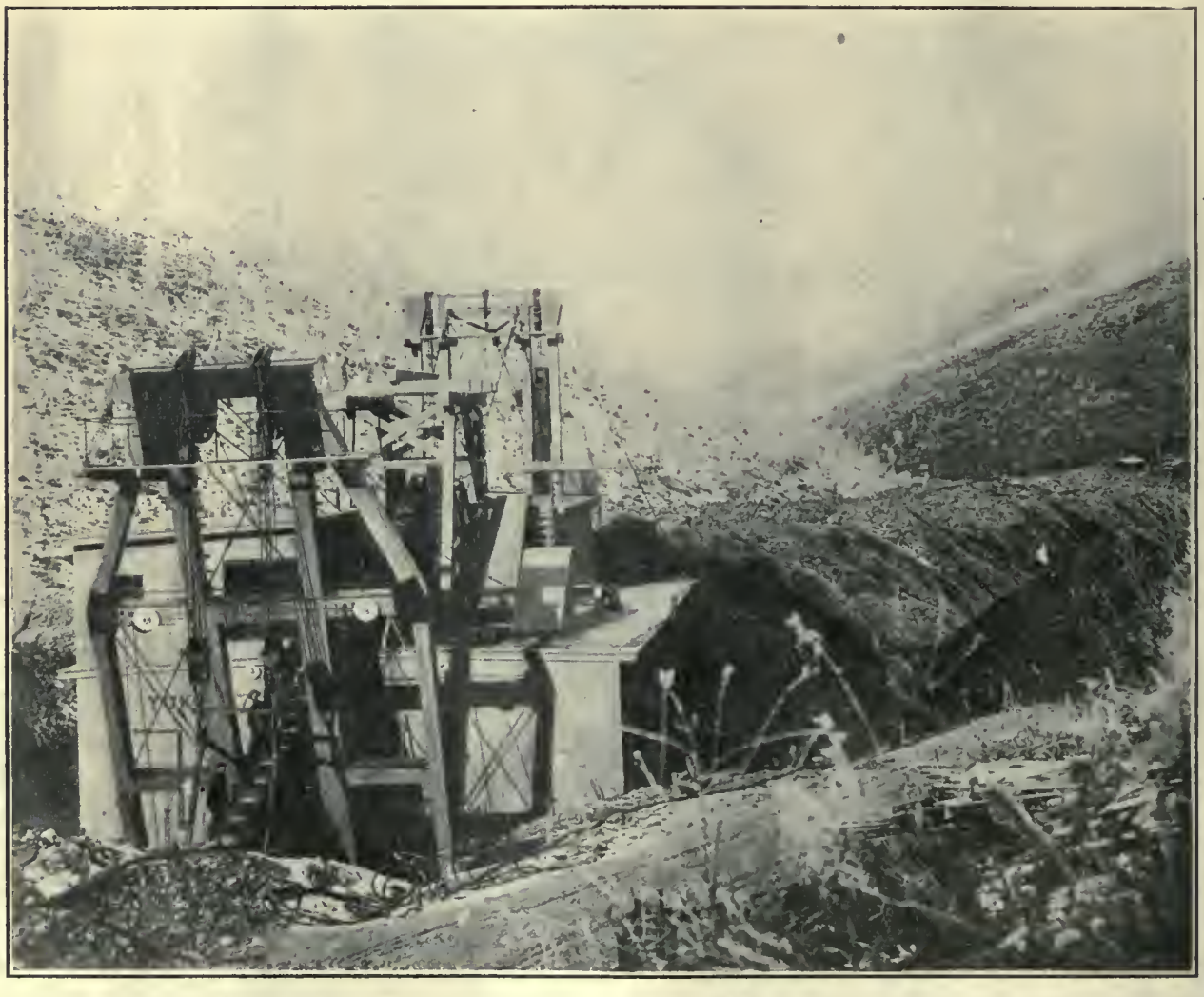
Year.	1909.	1910.	1911.	1912.
Cu. yd. handled	2,381,880	3,249,788	4,151,249	*4,408,300
Recovery total	$1,363,722	$2,150,723	2,671,845	$2,917,700
Per yard, cents	57.24	66.18	64.35	66.
Cost, cents	31.91	31.09	35.43	†30.
Operating season, days	132½	159	171½	

*To September 30 only, about 5,200,000 yd. for season.
†Approximation.

There are 8 dredges now on the property, two of 5-ft. and six of 7½-ft. capacity. Dredges No. 8 and 9, 7½-ft. Bucyrus boats, are equipped with steel hulls and frames, but the housing is of timber. The ground average 4 to 20 ft. deep. Dredge No. 1 was moved last year to Flat creek, Iditarod, where a successful season in 1912 is reported. Most of the ground so far worked at Iditarod has proved rich.

The Granville Co. has consolidated a number of properties. It was promoted by H. C. Hoover, A. C. Beatty, and A. N. C. Treadgold in 1912, and has a capitalization of £2,500,000, of which £1,000,000 is in convertible 6% debentures. The Granville company controls a large area as shown on the map. It is under the management of H. C. Hoover, A. C. Beatty, H. H. Webb, and others. Mr. Treadgold is managing director. The engineers first estimated that in addition to large areas of lower grade gravel there was a total of 300,000,000 cu. yd. that would average 30c. per yd., which could be treated at 12c. per yd. On account of the low operating cost obtained by Boyle dredge, it is now claimed that the cost can be reduced to 8c. or less per cubic yard. The company owns the Granville Power Co. which has a hydro-electric plant of 6000 kw. capacity and is capable of further increase to 10,000 kw. when needed. The Granville company has entered into a long term contract with the Yukon Gold Co. under which the latter agrees to pay a minimum of $85,000 annually for power. The power produced in excess of the amount sold the Yukon company will be divided equally between the Granville and the Canadian Klondyke companies. The Granville company has provided funds for two additional dredges for the latter company which will be in operation in 1913. The Granville will receive a substantial income from its holdings in the Canadian Klondyke Co., in which it owns $1,500,000 in 6% debentures and 29% of the shares. The debentures can be converted into 20% of the share capital of Canadian Klondyke Co., and it is likely that this will be done.

The Canadian Klondyke Co. has two dredges in operation. According to the report of J. W. Boyle dated April 26, 1912, these have handled a total of



YUKON GOLD CO. DREDGE No. 7, BUILT BY MARION STEAM SHOVEL CO.; ILLUSTRATING CHARACTER OF GROUND WORKED AT DAWSON.

5,346,956 cu. yd., with a gross recovery of $1,434,321.82 or an average of 26.93c. per yd. In regard to working costs Mr. Boyle says that by stripping the ground and using heating appliances for the protection of the machinery during the excessive cold weather, it proved possible to lengthen the operating season and reduce the cost of No. 1 dredge, which has 7½-cu. ft. buckets, from 23.2c. per yard for 1905 to 11.3c. in 1911. The No. 2 dredge, with 16-ft. buckets, operated for 5.98c. per yard. These figures are exclusive of overhead and general charges, which approximate 1c. per yard additional. The Marion Steam Shovel Co. is building two additional 16-ft. boats for the Canadian Klondyke Co., and it is claimed that the four boats will be able to handle 7,000,000 cu. yd. annually, at a cost of 6c. per cubic yard. For the purpose of determining the value of the valley property, 830 holes have been sunk between the mouth of Bear creek and the mouth of Bonanza creek and from the results obtained the management claims in excess of 100,000,000 yd. of gravel that will yield an average of 22c. per cubic yard. While exact figures are not at present available, it was expected that during 1912 a total of 3,000,000 yd. would be dredged, with a profit of approximately $450,000. The profit during 1911 was about one-half this amount.

In addition to these companies there is a small Allis-Chalmers dredge of about 1000 cu. yd. daily capacity in operation on the Canadian Forty Mile creek and a small Risdon boat on the American Forty Mile.

Changes in the Bituminous Coal Industry in 1912

By George H. Cushing

It does not require much penetration to see that a process of solidification is going on rapidly in the bituminous coal trade. Such progress has been entirely obvious. The report of the United States Bureau of Census, covering the data for 1909, and published within the year, was to the effect that something like 45% of the mine owners of bituminous coal mines are engaged in manual labor in and about their mines. This, of course, referred to the number of shafts rather than to the percentage of output, but nevertheless it portrayed a primitive condition. It meant very many small mines competing for distant and local tonnage, producing according to crude ideas, and selling without regard for an exact accountancy. It meant strict obedience to the law commanding competition and it meant disorganization of the industry in its most striking form.

Since the data upon which the Bureau of Census based its report were collected, the members of the coal trade have recognized both the extent and the effect of this disorganization and have tried to correct it. This was on the theory that disorganization once recognized is speedily ended. The known avenues of escape from this condition were only two: The removal of certain mines and mining companies from the commerical markets as the result of integration of business; and the physical amalgamation of companies to reduce the number of those who were appealing for small orders from small buyers. Both of these avenues have been followed and the result, at the conclusion of that year, is really astounding when measured alongside the remarkable exhibit made by the Bureau of Census.

Two striking examples will suffice to show the tendency of big business to become a factor in the production of bituminous coal. Within the last year there has been an ominous change—this viewed from the standpoint of steam users—in the market value of coal in what might be called the western region. Three years ago the contract price on Illinois screenings, for example, was from 45 to 57½c. per ton, while the maximum price in summer was 75 to 85c., and the minimum price in winter was from 20 to 30c. The year following, contract prices rose from 57½ to 60c.; the minimum price in summer was a little higher and the minimum price in winter was not quite so low. This year the contract price on Illinois screenings ranged from 75 to 90c. per ton at the mine, and it is peculiar that the winter price is actually higher than was the summer price, the spot market being quoted all the way from 75c. to $1 per ton. There is now little difference between the price of fine coal and the price of mine run, a result traceable directly to the increasing use of various kinds of stokers in power plants.

The larger consumers of coal had previously made the unequivocal statement that when the time came that they must pay more than the cost of production for their steam coal, and especially for their small coal, they would begin to mine their own coal. The rise in market prices has warned these large companies that the time is approaching when they must pay more than the cost of production for their fuel, and this has directed attention specifically and pointedly to the need of coal-land reserves. It is peculiar and perhaps significant that this need for coal-land reserves should appear, at the psychological moment when the operating bituminous coal companies, worn out by the struggle of years to make money, discouraged and all but bankrupt, should be seeking a purchaser upon whom to unload their properties. To the outside observer it seems, that they, the coal men, lost their courage just at the moment when the long and hard fight was about won. However that may be, the operators' designs to sell, and the big corporations' desire to buy, have led to consummation of unusually large land transactions within the last year.

By way of example, J. K. Dering and R. R. Hammond brought complete deals by which control of the major part of the coal land of Montgomery county, Illinois, passed into the hands of interests allied with the Chicago & Eastern Illinois railroad. These lands were subsequently leased to F. S. Pea-

body, who embraces them in a large organization for the production and sale of coal in Chicago. Macoupin county, Illinois, is considered one of the important coal reserves of that state, and control of its coal lands was solidified and consolidated last year even beyond that which followed the entry of such live buyers as the St. Paul and Northwestern railroads. The Steel Corporations has about completed its purchases of Franklin county coal lands, and now owns in the neighborhood of 82,000 acres. Interests allied with the St. Paul railroad have purchased in that same field 16,000 acres, while the Rock Island, the Missouri Pacific, and the Illinois Central are also represented in that county. In addition to these reserves, a movement is now seriously under consideration for the consolidation of the strictly commercial mines in that district.

As this is written, negotiations are well advanced for the sale of some 36 mines in the Springfield district of Illinois to F. S. Peabody, who intends to consolidate them into one organization. A movement of similar importance and scope is under consideration for the inner group around St. Louis, but the negotiations there are not near so advanced as in the case of the Springfield district. It must be apparent that with the operators consolidating among themselves, and with large interests buying into the fields, the solidification of Illinois coal lands control is progressing rapidly. Particular point is given to this assertion by the fact that the large interests alone today hold five hundred thousand acres of Illinois coal lands.

It would be possible to show practically the same tendeney now prevalent in other fields, but a mere recital of further details would give no clearer idea of the drift than is shown by Illinois. The two important facts are, that big consumers are beginning to realize the need for coal reserves and are satisfying it, while the operators are beginning to realize the need for some kind of coal control and are beginning to bring it about. Powerful forces are at work in the bituminous coal trade, and candidly the drift is toward that consolidation that has been seen in other lines of industry, and obtains in a rather exaggerated form in the anthracite field. It seems now only a matter of time—and perhaps a very short time—until the nation will have to confront an entirely new situation as to fuel. Wise heads are anticipating this time, and are trying now to bring about a change in public sentiment which will permit this reorganization under public supervision.

This change in another way, but one equally significant, is seen in the operations of of the Consolidation Coal Co. in the East. That concern with its feet firmly planted in Maryland, in central Pennsylvania, and West Virginia, has within the last year extended its operations on a large scale to the fields of Kentucky. Concerning this latter development there has been a great deal of thoughtless discussion. It must be evident that the Consolidation Coal Co. would not spend millions of dollars in development, other millions of dollars in making railroad connections to a new mining field, and vast sums of the exploitation of a new coal if it did not have a need for that particular kind of fuel or a need for a coal nearer another market which it wanted to reach than the mines previously owned. Particular emphasis is placed upon this fact by the statement that in the Fairmont field alone one of its bases of older operations, that company has a virgin coal reserve sufficient to last it for 150 to 200 years. It has a virgin coal reserve in central Pennsylvania of almost equal proportions and its Maryland field is not by any means worked out. As a consequence, it is not going into Kentucky as a substitute for operations in other fields, but for complementary development. This calls attention to the new idea now becoming prevalent among the larger companies, which is to have coal that makes a wide appeal to the market, coals to fit into particular and peculiar uses, and especially coals virtually on the threshold of each market. The entry of the Consolidation Coal Co. into Kentucky is a definite move in all of these directions; therefore the action of the Consolidation Coal Co. is significant of trade drift and is not the mere expansion of a single company. It also points to the fact, which is the foundation of this article, that the bituminous coal industry is beginning to adopt something approaching sane merchandising methods. This might be expected to come along with the solidification of the industry.

As showing that the same tendeney is reaching into the minutae of the industry, brief attention may be made of new methods in distribution or in retailing. this only, however, to show the drift. The consolidation of retail yards in Chicago took place several years since. Within this last year, two of the largest retail concerns in New York City have consolidated, giving the new company a really commanding position and a central organization with diversified and far flung points of distribution. Within the last year, eleven companies in Philadelphia have consolidated into the Geo. B. Newton Coal Co., with a central administrative organization and widely diversified points of distribution. Thus, even the retail trade is being brought under central control. This is perhaps the older and cruder form of organization, but things of that kind may be expected to happen till the public changes its attitude.

A more significant and a newer form was that adopted by the retail dealers of Rock Island, Illinois. The identity of individual plants was maintained as also that of individual selling organizations, but the several companies united in the construction of a central coal elevator. This provides compartments, one for each of the companies interested, and these compartments are divided into separate bins for the storing and automatic loading of different grades of coal. Along with this pooling of yard space there has come, as a natural sequence, the pooling of delivery facilities, and thus the reduction in expense, and hence the vast improvement in the service which may be given the public.

As these things will indicate the bituminous coal industry is coming to be a vastly different thing from what it was five years ago, and the impression which one gains from a study of these conditions is that the transformation, rather than being complete, is just beginning.

Progress of Copper Metallurgy

By Thomas T. Read

The past year has been one of high prices for copper, compared with those immediately preceding, and therefore shows a correspondingly rapid rate of metallurgical progress since the greater profit obtained per pound of copper produced is a stimulus to secure better recovery and greater output, while from the greatly increased operating profits considerable sums may be allocated for new construction and experimental work without marked effect upon dividend disbursement. But progress has consisted largely in departures from ordinary practice rather than in improvements in accepted methods. The most significant events of the year are the adoption of the Minerals Separation Co. flotation process at the Braden mine, in Chile, and the sudden adoption of the Great Falls type of converter in a number of the large smelting works, including several of the American Smelting & Refining Co. plants. Almost equally significant is the large amount of work which is being done in leaching methods for the extraction of copper, though definite results are meagre as yet. Throughout the whole metallurgical field, however, encouraging progress has been exhibited, as will be seen from the more detailed discussion of each topic below.

Smelter Fume

There has been little of new development in regard to the smelter-fume situation during the year. The committee appointed to consider the situation at Anaconda has made no report as yet, as experimental work by the Bureau of Mines, under the direction of F. G. Cottrell, is still in progress both at Anaconda and at the laboratory of the Bureau in San Francisco. Experimental work with the Thiogen process[1] is still in progress at Campo Seco, and an account of the results attained has been given by F. L. Wilson[2]. Mechanical difficulties, some of which were not incident to the process itself, have greatly interfered with its operation on a working scale. During the year a test of the Kelly process was made at Los Angeles by officials of the Bureau of Mines, which proved it to be of no practical value as far as smelter fume is concerned. The smelters in Shasta county, California, remain closed with the exception of the Mammoth plant of the U. S. S. R. & M. Co., which continues to operate its bag-house with satisfactory results. At the end of the year tests with the Heslewood process were in progress at the electric smelter at Heroult, but no results have been disclosed.

New Construction

An unusually large amount of new construction has been started during 1912. The Granby Consolidated Mining, Smelting & Power Co., Ltd., is planning the construction of a new plant on Observatory inlet, in the northern part of British Columbia, to smelt the ore of the Hidden Creek mines, which that company took over in 1911. It is generally understood that a blast-furnace and a converter are to be constructed, and it is reported that bids for a 2000-ton plant have been called for. The ore is high in sulphur and the blast-furnaces will be able to operate with a minimum percentage of fuel on the charge. The company states that 5,000,000 tons of ore averaging 2.2% copper and about $1 in combined gold and silver has been developed. About $200,000 has been spent on the property and it is estimated that equipment will cost $1,600,000. Actual smelter construction will probably be started in the early spring. At the present plant of the company, at Grand Forks, B. C., the only change of note during the year was the construction of a second unit in the slag conveying system. This is briefly described by G. M. Lee.[3] The slag from the settlers is granulated in water and flows through launders lined with steel channels to receiving bins which dewater the slag before delivering it to two 24-in. belts which convey it up an incline of 18 degrees to a point 115 ft. above the present dump level. Two belts, one running to the left and the other to the right, are used in order that one may always be in operation in case of accident to the other. As might be expected, the sharp particles of slag give much trouble from wear in the launders and on the belt, and it would be interesting to try hard steel plates in the launders, as has been done by the Quesnelle Hydraulic G. M. Co., for lining sluices in hydraulic work, with excellent results. The smelters at Trail and Greenwood have made few changes.

At Tacoma the copper smelting plant of the American Smelters Securities Co. is undergoing complete reconstruction. This plant chiefly smelted lead ores until recently, when the growth of the lead smelting industry in Utah and the increased production of copper ores in Alaska have made such extensive changes in the work at Tacoma necessary that it was judged best to entirely rebuild the plant. Since most of the ore at this plant arrives by steamer, unloading and storage facilities are an important feature of the plant construction. New blast-furnaces, 42 by 260 inches, are under construction, and accessory apparatus as required. The electrolytic refinery at this plant, the only one in operation west of the Rocky Mountains, is being increased in size from 24,000,000 lb. per year to 36,000,000 lb. per year capacity. W. H. Howard is in charge of the work of reconstruction. No changes of note have been made at the three smelters in operation in California; the experimental work in progress at Campo Seco is mentioned elsewhere. In Nevada a new smelter, that of the Mason Valley Mines Co. has been blown in. A full account of this appeared[4] in these columns. The

[1] *Mining and Scientific Press*, Sept. 23, 1911, p. 386.
[2] *Mining and Scientific Press*, April 6, 1912, p. 497.
[3] *Met. & Chem. Eng.*, March 1912, p. 147.
[4] *Mining and Scientific Press*, August 31, 1912, p. 267.

interesting changes in practice made at the Steptoe Valley plant are elsewhere described by S. S. Sorensen.

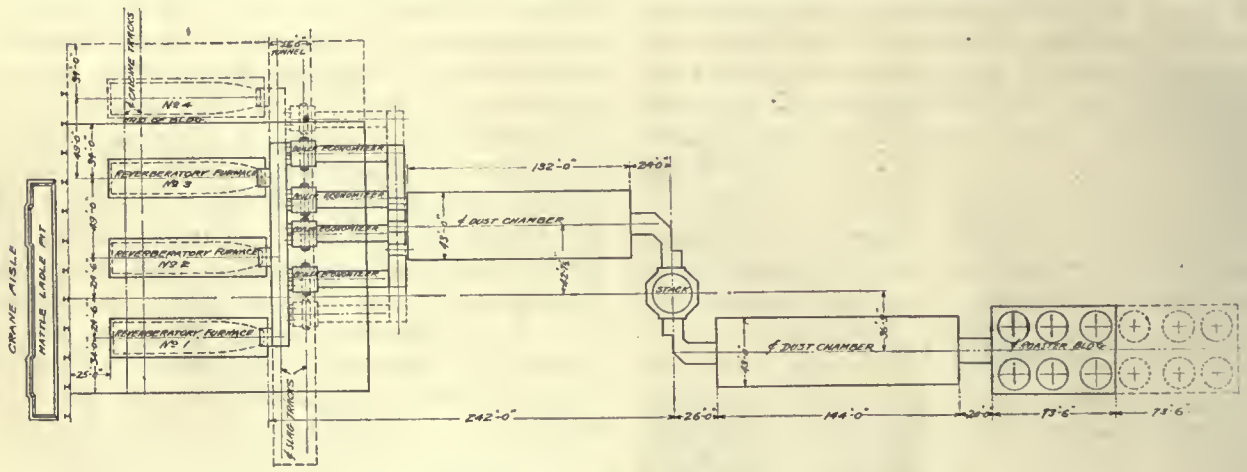
At the Great Falls plant of the Anaconda C. M. Co. in Montana, extensive re-construction is under way. The gas producers and gas-fired reverberatory furnaces now in use will be torn down and replaced by coal-fired reverberatory furnaces with a specially designed firebox, something like a gas producer. The remarkable work done at this plant with the giant basic-lined converters and the changes at the other plants in Montana are elsewhere noted.

The most important new smelter constructed during the year is the American Smelting & Refining Co. plant at Hayden, Gila county, Arizona. The preliminary work on this plant was done by the Ray Consolidated Copper Co., but it was later taken over and completed by the A. S. & R. Co. as a customs smelting plant. In keeping with the general policy of this company, no description of its construction or operation has yet appeared. The new Pioneer smelter is referred to later. The Swansea smelter[5] was blown in during the autumn.

A good deal of reconstruction work is in progress in Arizona and New Mexico. The entire plant of the Arizona Copper Co. at Clifton, is under reconstruction, under the direction of L. D. Ricketts, grading for the new site having begun in April. The new plant will follow the general plan of that at Cananea, the design including three 8-ft. converters of the Great Falls type, air-cooled roasters of the Herreshoff type, and a 300-ft. stack, 22 ft. diameter. The Calumet & Arizona has made extensive changes at its plant, including the construction of five converters of the Great Falls type. Construction work at both these plants is under the immediate supervision of Repath & McGregor. It is hoped that a full description of these will be available for publication later in the year, so no further comment is made here. Some new construction has been completed at nearly every plant, but to give details would require too much space and the data concerning the Copper Queen which follows must suffice.

The following details as to new construction at the Copper Queen smelting plant have, through the courtesy of Dr. James Douglas, been kindly furnished by Frank Rutherford, superintendent. The main changes and improvements at the Douglas Reduction Works of the Copper Queen Consolidated Mining Co. during 1912, were the finishing and starting up of the reverberatory furnace plant, the adopting of the basic lining for converters and the installation of two stands of upright converters of the Great Falls type. The reverberatory plant consists of two furnaces with 90 by 19-ft. hearths, designed to use oil as fuel, with two 520-hp. boilers placed in parallel back of each furnace. To one set of boilers, only, were added Sturtevant economizers with the idea of finding out, by practical operation, whether there was any advantage in their use. To date, on account of reasons beyond control, it has not been possible to run the two furnaces sufficiently long to give conclusive results as to economizers, but it is hoped soon to be able to do so.

Contrary to general practice, a large dust-chamber of 1200 cu. ft. cross-section and 132 ft. long, was built to catch any dust from the reverberatory furnaces that might pass the boilers.



PLAN OF REVERBERATORY AND ROASTING PLANT, COPPER QUEEN.

That dust does pass through the boilers is evident, but the plant has not been running long enough to definitely state whether the amount and metal content is sufficient to warrant the building of a dust-chamber. In the dust-chamber are suspended some 30,000 wires. The roaster plant consists of six 18-ft., 6-hearth McDougall furnaces of the usual type, to which the concentrate is delivered by means of conveyor-belts and a cup elevator. Nothing unusual, or different from general practice, was used in this department. A large dust-chamber was also built to catch the dust from the roasters, similar in design, but slightly larger than the one for the reverberatory furnaces. The gases from both departments go to a common stack 300 ft. high by 22 ft. internal diameter, built of hollow radial tile.

The new converters are of the Great Falls type, 12 ft. in diameter by 12 ft. 3 in. high, and have the top made so that the flame shoots straight up, and not back at an angle, as is the usual practice. The shells are lined with magnesite brick, and work so satisfactorily that four more units are being installed as quickly as possible to take the place of the old barrel type. During the year the management gradually worked out of the acid and into the basic lining for

[5] *Mining and Scientific Press*, December 21, 1912, p. 799.

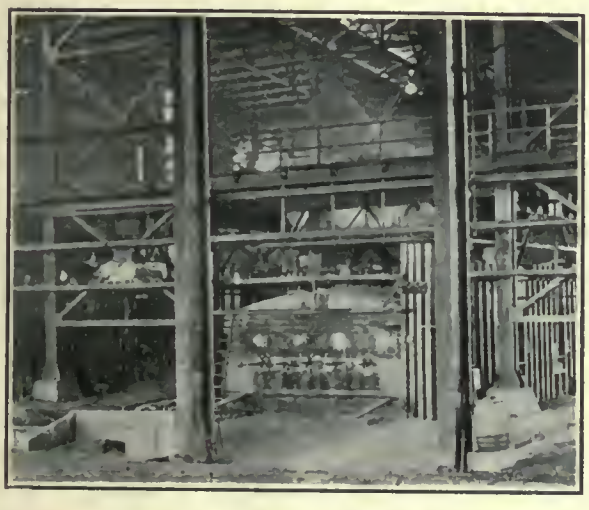
the converters, the Douglas plant now running entirely on the latter.

Reverberatory Practice

In reverberatory practice the change of most interest is the intimation that the use of gas-producers will probably be abandoned in the new construction of the Great Falls plant of the Anaconda Copper Mining Co. The coal used in the producers at this plant is from Belt, Montana, containing 25% ash. The reverberatory furnaces are small, with hearths 15 by 42 ft. and are fitted with checker-work regenerators of the usual Siemens type. Even with great care in dropping charges it was impossible to prevent the entrance of dust into the checker-work, necessitating delay and expense for cleaning at intervals. In the new construction a specially-designed firebox will be used, and waste-heat boilers substituted for checker-work as a means toward heat economy. As this is the only copper smelter in America, to my knowledge, at which regenerative furnaces have been tried, the decision to abandon them is significant. At Kyshtim, in Russia, producer gas made from wood is used for firing 15 by 35-ft. reverberatory furnaces, and in the most important paper on reverberatory smelting practice which appeared during the year, E. P. Mathewson[6] presented before the eighth International Congress of Applied Chemistry a statement of the low cost of smelting there attained by this means. In a run of about six months 10,690 tons of charge was smelted with a consumption of 3417 cords of wood, costing $1.05 per cord at the producer, corresponding to a fuel cost of 33.6c. per ton of charge smelted. The tabular summary of present reverberatory practice in America given by Mr. Mathewson[6] covers the subject thoroughly. D. H. Browne has described[7] the new reverberatory furnaces constructed at Copper Cliff. These are 19 by 112-ft. hearth area and are designed to burn pulverized coal, following the experiments made at the Highland Boy by S. S. Sorensen and at Cananea by Charles Shelby. For full details reference should be made to the original paper. The character of the coal used is not stated, but it is crushed to ¼ in., dried, and pulverized by Raymond impact pulverizers so that most of it will pass a 200-mesh screen. The powder is sucked by fans to a separator at the top of the building, whence screw conveyors take it to the storage bins at the ends of the furnaces. Five 4-in. variable-speed screw conveyors drop the coal in front of air-jets in the burners. The system works well and no difficulty is experienced from the ash, which gave trouble both at the Highland Boy and at Cananea. No attempt is made to save the waste heat in the escaping gases. The new reverberatories at Douglas have already been mentioned.

Handling Flue-Dust and Fine Ore

Interesting progress in handling of flue-dust has been made at the East Butte and Mason Valley smelters. At the East Butte the flue-dust is caught in a dust-chamber constructed from slag by pouring in molds. The chamber is 48 by 70 by 250 ft. in size, with walls 10 ft. thick at the bottom and 6 ft. thick at the top, and is provided with three tunnels beneath for drawing off the dust, the roof being suspended from trusses. The whole was constructed at a cost of $25,000, which must be a record minimum, under the direction of Oscar Rohn, the superintendent. The coarser dust from the end of the chamber nearest the furnaces contains enough coke-dust so that when fed to an ordinary Dwight-Lloyd sintering machine and ignited in the ordinary way a good grade of sinter is obtained. The finer dust, amounting to about one-fourth of the total, requires the admixture of a little ground coke to furnish heat enough to produce a firm sinter. Similar practice at the Mason Valley smelter has already been described[8] at some length in these columns. In a very interesting paper,[8] M. J. Elsing has described the methods of handling furnace charges of concentrate at Cananea. H. Foster Bain has described[9] the machine developed by K. Nakamura at the Shisaka smelter, in Japan, for nodulizing fine ore and also an interesting modification of the Huntington-Heberlein pot for sintering fine ore. The work at this plant is of unusual interest, since peculiar conditions have to be met.



REVERBERATORY FURNACES, COPPER QUEEN.

12-FT. GREAT FALLS CONVERTER, COPPER QUEEN.

[6] *Mining and Scientific Press*, November 9, 1912, pp. 592 and 593.

[7] *Jour.* Canadian Mining Institute, Vol. XV, 1912.

[8] *Mining and Scientific Press*, May 4, 1912, p. 619.

[9] *Ibid.* Sept. 21, 1912, p. 363.

Converter Practice

The most marked changes are to be observed in converter practice. The use of acid lining for converters is now generally discontinued, except in a few plants where, owing to special conditions, no economy would result from the change. As a natural, though not generally foreseen, result the horizontal cylinder type of converter is now being discarded and the vertical cylinder substituted. As will at once be seen, the vertical cylinder is a much stronger shape mechanically than a horizontal one, since in the one case the open end serves for the addition of matte and the escape of gases, while openings must be made in the side of the horizontal cylinder, thus greatly reducing the strength of the lining. In the case of the acid lining, which required frequent replacement, this facilitated the removal of the old lining without markedly further decreasing the short life of a new one. But when, as at Great Falls, a single basic lining suffices for over two years' continuous operation (in several cases a single lining having lasted through the production of over 12,000 tons of blister), it is essential to make the lining as strong mechanically as possible, since failure results from mechanical strains, and not through chemical corrosion. This factor is of so much importance that this type of converter is now being employed in the plants of the American Smelting & Refining Co., which owns the patents on the Pierce-Smith converter. The central opening also greatly facilitates distribution of material added. The converters at the Copper Queen have already been referred to, and, in addition, the Great Falls type is being used at Cananea, Hayden, and El Paso, for the new construction at the Calumet & Arizona and the Arizona Copper Co., are already in use at Kyshtim, and will probably be employed in the new Granby plant and at Tacoma. At Great Falls it is found that the first essential in use is to secure a proper coating on the basic lining by careful blowing of the first charge, after which manipulation is easy. The success of the 12-ft. converters led the Great Falls management to undertake the construction of a larger size, and a 20-ft. converter was built and blown in during the summer, with remarkably good results. Through the courtesy of C. W. Goodale, A. E. Wheeler, and M. W. Krejci, I am enabled to give the following summary of a run with this converter:

Diameter of converter, inside shell, ft.	20
Diameter of converter, inside lining, ft.	15½
Magnesite brick lining, 2½ ft. on tuyere side, 2 ft. on front tuyeres: 62 of 1¾-in. diam.	
Air, cubic feet per minute	25,000
Air pressure, pounds	6 to 12
Initial charge of matte, tons	65

	Hr.	Min.
Total elapsed time	7	23
Blow on slag	3	35
Blow on finish	1	44
Actual blowing time	5	19
Copper cast, tons		52.3
Tons per 24 hr., based on elapsed time		170
Tons per 24 hr., based on actual blowing		236

In the paper already mentioned, D. H. Browne has given some details of the results attained with the use of basic lining for converting nickel-copper matte. The Pierce-Smith converters are 37 ft. long and 10 ft. diam., taking an initial charge of about 60 tons of matte. Addition of siliceous material, blowing, skimming of slag, and addition of matte proceeds until at the end of 30 to 50 hours blowing time the converter contains 70 to 80 tons of finished product derived from 300 to 400 tons of matte. A single lining lasts for 3000 or 4000 tons of finished product; an 80% copper-nickel matte. An interesting modification of the ordinary construction is that oil is used in the hydraulic equipment for operating the converter in place of water, to obviate trouble from freezing in the cold climate of Sudbury.

Blast-Furnace Practice

The event of most interest in blast-furnace practice during the year is the construction of a 42 by 106-in. oil-fired Colorado Iron Works Co. blast-furnace by the Pioneer Smelting Co. at Corwin, Pima county, Arizona. This was to have been blown in during May, but no account of the results obtained in practice has been published. An interesting account of the unusual practice at El Boleo[10] appeared during the year. The average slag there contains 52% SiO_2, and no forehearth is employed on account of the rapid chilling of so acid a slag. The slag flows continuously through 4-in. ports, and carries only about ½% copper, as the high manganese content gives it a considerable degree of fluidity.

Hydrometallurgy of Copper

The problem of recovering the copper from the tailing of ore-dressing plants has greatly stimulated research on the hydrometallurgy of copper, but the results of experimental work are usually unavailable for publication. It is generally known, however, that work with the Laist process, which involves leaching with H_2SO_4 and precipitating with H_2S generated from matte, thus regenerating the acid, is progressing favorably. The Shannon Copper Co. has done much experimental work on leaching tailing, but is unwilling to disclose the results. As J. W. Bennie, the superintendent, has recently patented a method of heap-roasting and leaching in which the heaps during roasting are sprinkled with solutions containing $FeSO_4$ or NaCl, or both, to aid in converting the copper into sulphites and sulphates as completely as possible, followed by leaching and subsequent precipitation, presumably this is the procedure followed.

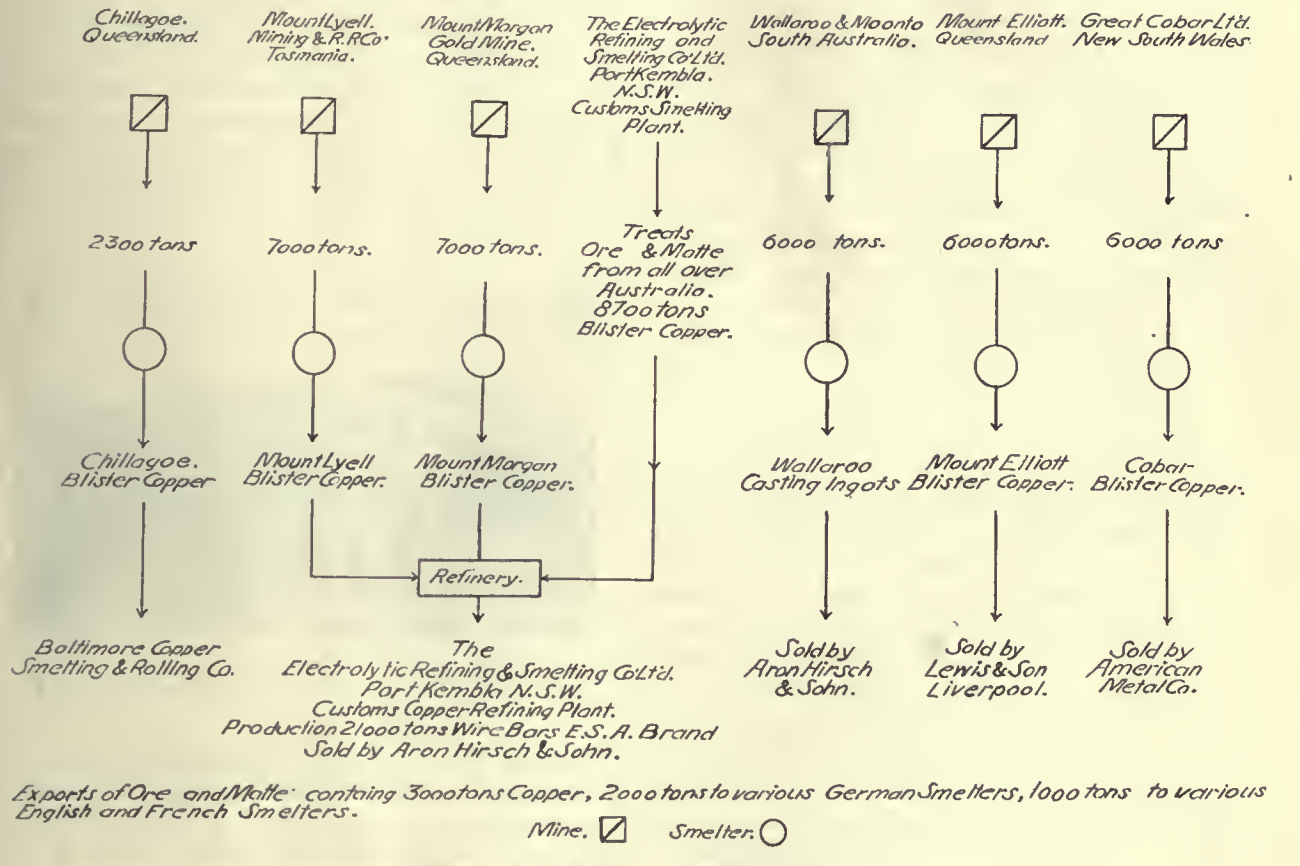
A leaching plant for oxidized ores is in process of construction at the Bullwhacker, at Butte. The Bradley plant, at Anaconda, of which large things were predicted last year, has been shut down nearly all the year, having treated only a few tons, and it is at least doubtful if the process can ever be put upon a profitable working basis. Leaching experiments have been made at the Braden, but no results have been published. An interesting and valuable book upon this topic[11] appeared during the year, and

[10] *Mining and Scientific Press*, May 18, 1912, p. 700.
[11] 'Hydrometallurgy of Copper,' by W. E. Greenawalt.

reference should be made to it for fuller details regarding hydrometallurgy.

Flotation Processes

The use of flotation for the recovery of copper from its ores, though perhaps strictly a branch of ore dressing, which is covered in another article, is so significant that reference must be made to it. The development in practice of flotation processes, as well as the settlement of the great mass of litigation concerning rival patent claims, has until recently been largely confined to Australia, though some small plants are at work in Europe. Last year the principal controversies were settled by compromise, and the Minerals Separation, Ltd., at once proceeded to introduce its process in North and South America. The largest plant built as yet is that at the Braden mine, in Chile, where a 600-ton unit has been completed, two more are under construction, and it is planned to finally increase the capacity to 3500 tons per day. During November the first unit made 81.6% recovery as compared with 61% in the new 2000-ton wet concentration mill recently completed. Test runs by flotation gave recoveries as high as 95%, and when the process gets into normal working order a recovery of 85% is expected to be maintained in practice. At Butte an extensive series of tests have been in progress during the year to determine the best type of plant to construct for re-treating the accumulated tailing of the old Butte Reduction Works, about 1,500,000 tons containing 10% copper. The Minerals Separation process and the McQuisten tubes are used in competition to determine which will give the maximum saving at the minimum cost. Final announcement has not yet been made. McQuisten tubes have so far only been used in the concentration of zinc ores, and their application to copper metallurgy is of great interest. It is most unfortunate that the advent of the Minerals Separation process in this country should be signalized by litigation such as has been the bane of American industrial development. The Butte & Superior Copper Co. has been sued by the Minerals Separation, Ltd., for infringement in the use of the so-called Hyde process, but it is to be hoped that metallurgical progress will not be hampered by further litigation. A number of companies have been carrying on careful experiments with flotation, but no announcement of plans has been made as yet.


Chillagoe. Queensland.
Mount Lyell. Mining & R. Co. Tasmania.
Mount Morgan Gold Mine. Queensland.
The Electrolytic Refining and Smelting Co Ltd. Port Kembla. N.S.W. Customs Smelting Plant.
Wallaroo & Moonta South Australia.
Mount Elliott. Queensland
Great Cobar Ltd. New South Wales.
2300 tons
7000 tons.
7000 tons.
Treats Ore & Matte from all over Australia. 8700 tons Blister Copper.
6000 tons.
6000 tons.
6000 tons
Chillagoe. Blister Copper
Mount Lyell Blister Copper.
Mount Morgan Blister Copper.
Wallaroo Casting Ingots
Mount Elliott Blister Copper.
Cobar Blister Copper.
Refinery.
Baltimore Copper Smelting & Rolling Co.
The Electrolytic Refining & Smelting Co Ltd. Port Kembla N.S.W. Customs Copper Refining Plant. Production 21000 tons Wire Bars E.S.A. Brand Sold by Aron Hirsch & Sohn.
Sold by Aron Hirsch & Sohn.
Sold by Lewis & Son Liverpool.
Sold by American Metal Co.
Exports of Ore and Matte containing 3000 tons Copper, 2000 tons to various German Smelters, 1000 tons to various English and French Smelters.
Mine.
Smelter.

AUSTRALIAN SMELTING AND REFINING PLANTS.

Refining and Marketing of Copper

Refining and marketing are no less important stages in the production of copper from its ores than roasting and smelting. In two admirable articles W. R. Ingalls[12] has discussed the selling of copper in all its somewhat complex phases. In this connection I have prepared charts showing the relations between the various mines, smelters, refineries, and metal-selling companies. For the accompanying chart showing these relations in Australia, I am indebted to the courtesy of Benjamin Magnus, manager of the Port Kembla refinery. Charts showing similar relations in America have been prepared, but considerations of space make it necessary to defer their publication. T. Hasegawa[13] has briefly described the new electrolytic refinery constructed by the Furukawa Mining Co. at Nikko, Japan. The Walker arrangement of electrodes is used.

[12] *Eng. & Min. Jour.*, May 4 and 11, 1912, pp. 887, 939.
[13] *Mining and Scientific Press*, Oct. 12, 1912, p. 465.

Progress in Ore Dressing

By Henry S. Munroe

Hand Sorting

Much has been written[1] on the advantages of hand sorting of ore before treatment by mechanical means; for the removal of waste rock, for the saving of rich ore, and for the separation of minerals of nearly the same specific gravity. This preliminary treatment of the ore is becoming increasingly common, resulting in increased output for the mills, diminished losses, and larger net profit. In one case[2] annual loss has been changed to profit largely through sorting. Attention should be drawn to a fourth application of hand sorting deserving of more frequent use. In some cases a portion of the ore contains valuable mineral in microscopic particles too fine to be released by crushing or saved by mechanical means. Sometimes such ore is rich enough for metallurgical treatment or can be used with profit as a flux with incidental saving of the valuable metal. In such cases it may pay to sort it out by hand before it is crushed. Otherwise such material will go almost wholly into the tailing and be lost.

The cost of hand sorting bears close relation to the amount of material picked out, so that the cost per ton of material treated will be low when a small quantity only of rich ore, or poor rock, or other material is to be removed. In comparing the cost of hand sorting with mechanical treatment, account should be taken of maintenance and amortization costs, which will be small for hand sorting on account of the simplicity of the apparatus required.

The most important improvement[3] in the mechanical appliances for hand sorting consists in the general use in South Africa of two-deck sorting tables in which the lower deck is used for the hand-picked material, while the bulk of the ore remains upon the upper deck. The material on each deck is scraped by plows into appropriate bins or chutes at the end of the revolution of the table. The same result is secured by the use of two conveying-belts, one above the other, as at the El Tigre mine.[4]

Preliminary Washing

A simple and efficient method[5] of washing ore for the removal of tough clay is by the use of a small jet of water under considerable pressure. At the Totok Gold Mine, Celebes, Dutch East Indies, F. A. Killik uses a small giant with a 7/8-in. nozzle, with a head of 125 ft., using 15 to 20 cu. ft. of water per minute to wash 200 tons per day. The washing is done in a large chute or bin with converging sides and a steeply inclined bottom, the lower end of which is partly closed by two board partitions, one at the top and the other somewhat in advance at the bottom. This form of opening doubtless contributes much to the success of the plan. There is provided also a small platform on which the washing may be completed before the washed ore is finally swept off by the force of the nozzle. In the discussion of Mr. Killik's paper, A. G. Charleton describes the use of the same method in a tin mine in the East. At this mine the washed ore was further treated in a revolving trommel with inside blades. R. H. Richards[6] describes the use of a jet washer with a 1½-in. nozzle using 50 lb. pressure, the work being done in an iron cylinder 2 ft. in diameter by 6 ft. long with a large feed-opening above. This arrangement proved much more efficient than a log-washer used at the same plant. According to Killik, the cost of washing by this method is low, and the simplicity and cheapness of the plant warrants the consideration of this method where work of this kind is to be done. The amount of water used with a 7/8-in. nozzle is probably no more than that required by other methods of washing, and even if the water be pumped, the power required will be small in comparison with that consumed by log washers or wash drums.

STEEL ORE-BINS ON CONCRETE FOUNDATION, CHINO MILL.

Storage and Feeding of Ore

At many of the large mills recently constructed, cylindrical steel bins have been built, and in some instances these have been provided with concrete bottoms. The next step is likely to be the construction of cylindrical bins of reinforced concrete. This construction would have the advantage over steel bins of greater durability and, with proper arrangements for handling the material and for the construction of the forms, should be built at moderate cost. Flat-bottomed ore-bins filled with waste rock, so as to form a sloping bottom, have been adopted in rock-houses built for the Copper Range Mining Company.[7]

[1] Huntoon, L. D., *Eng. & Min. Jour.*, Vol. 93, p. 52, Jan. 6, 1912. Shepard, F. E., *ibid*, Vol. 93, p. 543, March 16, 1912. Thomas, J. E., in 'Rand Metallurgical Practice,' Vol. 1, p. 22.

[2] Editorial *Eng. & Min. Jour.*, Vol. 93, p. 152, Jan. 20, 1912.

[3] 'Rand Metallurgical Practice,' Vol. 1, pp. 27-30.

[4] Malcolmson, J. W., and Budrow, L. R., *Mining and Scientific Press*, Vol. 104, pp. 398-400, March 16, 1912.

[5] *Trans.* Inst. Min. & Met., Vol. 31, p. 230-6, Dec. 1911. *Ibid, Bull.* 88, pp. 11-12, Jan. 1912, reprinted in *Eng. & Min. Jour.*, Vol. 93, pp. 304, 738, Feb. 10, April 13, 1912. *Min. & Eng. World*, Vol. 36, p. 61, Jan. 13, 1912. *Min. Sci.*, Vol. 45, p. 47, Jan. 18, 1912. *Mines & Methods*, Vol. 3, p. 419, Feb. 1912. *Erzbergbau*, March 15, 1912, p. 82.

[6] Richards, 'Ore Dressing,' Vol. 1, p. 334.

[7] *Trans.* Lake Superior Min. Inst., Vol. 17, Aug. 1912. *Met. & Chem. Eng.*, Vol. 10, p. 679, Oct. 1912.

H. P. Stowe[8] advocates the construction of flat-bottomed bins and filling the additional space with ore, thus obtaining additional storage for use in emergencies. He also instances a case in which it was possible to rebuild such a bin without interrupting the operations of the mill. This work was made possible by the space available under and around the temporary chute constructed in the bin to carry the ore from the dump-cars to the crushers. If the extra cost of handling the ore at the bottom of such bins, and the interest charge on the working capital locked up in such ore be considered, it may prove that the additional storage is secured at considerable cost.

F. E. Shepard[9] emphasizes the importance of delivering the fine ore from the grizzly and the coarser ore from the crusher at the same point in the mill-bins in order to secure a uniform distribution of ore in the bin and a uniform feed to the mill. Mr. Shepard further suggests the preliminary bedding of the ore, as is now done in smelting plants, to secure still greater uniformity in the mill feed. The tendency in recent years, however, has been rather to overcome irregularities in mill feed by the adoption of concentrating machines providing a storage of mineral under treatment sufficient to overcome minor variations in richness or quantity of feed. It is this that has led to the extended use of vanners and riffle tables instead of the more sensitive film tables, such as the round table, Rittinger table, and cross-flow belt table. It may well be that further advance in ore-dressing practice may be secured by the use of the more sensitive type of machine and the adoption of the above suggestion. Mr. Shepard's attention doubtless has been called to this point from his experience with the Richards pulsator jig, which has small storage capacity and is exceedingly sensitive to variations in the richness of the material treated.

Crushing

It is much cheaper to crush rock and ore by mechanical means than by blasting or sledging. This fact is illustrated by the erection of mammoth crushers of different types capable of handling large masses and thus saving the expense of breaking by powder or by hand. Notable examples of this are found in the Lake Superior copper region,[10] where mammoth jaw-crushers 24 by 36 in. and 24 by 48 in., of the Blake type, have been in use for many years. The Traylor Engineering Co.[11] recently built for the contractors at the Kensico dam, at New York, a plant for the production of crushed stone containing one 60 by 84-in. Blake crusher and one 30 by 72 in., followed by a pair of 30 by 60-in. rolls, the total capacity of the plant being 500 cu. yd. per hour. At a limestone quarry at Martinsburg, West Virginia,[12] a pair of Edison giant toothed rolls, 6 ft. in diameter by 7 ft. face, are used as the only crushing machine for reducing this rock to 7 or 8-in. pieces. These rolls readily crush blocks as large as can be handled by a 100-ton steam-shovel, pieces 15 tons or more in weight, and it is said could deal with cubes 7 ft. in size which would weigh 28 tons. The capacity of these rolls is 1000 tons per hour. Additional rolls are to be added to produce smaller sizes. Giant rolls are in use at the Edison portland cement works, where they have given satisfactory service with low cost for repairs and replacements. Similar rolls were installed at Franklin Furnace, New Jersey, for the crushing of zinc ore, but these have been long since abandoned.

Gyratory crushers are taking the place of the Blake swinging-jaw type in most of the mills recently built. The great advantage in the use of this form of crusher is not only its large capacity, but the great saving in power effected, amounting to 40 to 60%. This offsets the more complicated design, which tends to increase repair and maintenance costs and loss of time in the mill. Gyratory crushers require somewhat greater height between the feed and discharge-level than the Blake type of crusher. This advantage, however, has been lessened by the introduction of the pillar type, in which the gyratory motion is about a fixed vertical axis instead of the pendulum movement of the earlier type.

The Symons disc crusher[13] has attracted much attention and constitutes a new type of crushing machine likely to prove of importance. In this the ore is crushed between two saucer-shaped discs revolving at high speed in the same direction, one of the discs being given a gyratory movement. The ore is fed at the centre and escapes by centrifugal force at the circumference of the discs, thus securing a maximum length of discharge opening where the crushed material can escape. In this it differs from all other types of crushing machines, where the length of the discharge opening is either equal to the feed opening, as in rolls and in jaw-crushers, or is of less length than the feed opening, as in the gyratory type. The screen analysis of crushed material shows a remarkably small proportion of slime and, if this be confirmed by other tests, shows that this crusher is likely to do even better work than rolls. As designed at present, these machines crush to ¼ or ⅛ in. only, but it is quite possible that their field can be extended to the production of finer material. At the Federal mill No. 3, at Flat River, Missouri,[14] the crushing plant has been remodeled during the present year by replacing jaw crushers and coarse rolls in each section by two No. 7½ Symons gyratory crushers and four 48-in. Symons disc crushers. The effect has been a reduction of about 80 hp. in operating load and an approximate increase of 1000 tons in the crushing capacity of the mill. The saving in power, however, is mainly due to the use of gyratory crushers instead of the swinging-jaw type.

At other plants in which the Symons disc crusher has been chosen, the usual difficulties attending the

[8]Stowe, H. P., *Mining and Scientific Press*, Vol. 104, p. 601, April 27, 1912.

[9]*Eng. & Min. Jour.*, Vol. 93, p. 543, March 16, 1912. *Met. & Chem. Eng.*, Vol. 10, p. 215, April 1912.

[10]Rice, C. T., *Eng. & Min. Jour.*, Vol. 93, p. 159, Jan. 20, 1912.

[11]*Mining and Scientific Press*, Vol. 104, p. 310, Feb. 24, 1912. *Eng. & Min. Jour.*, Vol. 93, p. 450, March 2, 1912.

[12]Springer, J. F., *Mining and Scientific Press*, Vol. 105, p. 276, Aug. 31, 1912.

[13]*Eng. & Min. Jour.*, Vol. 91, p. 157. *Min. Sci.*, Vol. 63, p. 164. *Mining Methods*, Vol. 2, p. 138. 'Mineral Industry,' Vol. 20, p. 809, 1911.

[14]Guess, H. A., private communication.

introduction of a new type of machine have been experieneed in the breakage of shafts and of erushing parts. These accidents are due to the presenee of bolts or of drill-steel and similar material to the feed. The only safety devices in the machine are the 15 or 16 spider bolts whieh hold the fixed erushing disc to the revolving axis. The breaking of these bolts brings excessive strain on the moving parts. At the Federal mill and other places this difficulty is overeome first by the use of eleetro-magnets to remove iron and steel from the feed and also by loose belts on the pulley giving the gyratory movement to the axis. I am informed[15] that the 1913 design of disc crusher will be of mueh heavier eonstruction and will embody minor improvements which will add materially to the ease of replaeement of worn parts.

At the Round Mountain mine,[16] Nevada, two crushing and sereening plants have been built underground. Each plant includes a 12 by 20 crusher, an 18-in. belt-conveyor, and a 10-ft. by 40-in. screen over a loading pocket. The fine material is sent to the mill and the coarse waste roek, amounting to 66%, to the dump. Before these plants were built the waste was 54%, and contained valuable ore now saved.

High-speed crushing rolls of large size are being used in most of the recent mills. Among these may be mentioned the 20 by 72-in. rolls in the coarse-erushing plant of the Chino mill,[17] weighing 175,000 lb. and having a capacity of 450 tons per hour, crushing from 2½ to ½ in. and, at Miami, the two 24 by 54-in. rolls used for erushing from 2 to ½ inch in the coarse-crushing plant. For fine crushing, 16 by 42-in. rolls are used in many of the large mills, while few of the recently built mills eontain rolls less than 15 by 36 inches in size. At the Steptoe Valley concentrator in some of the sections an elaborate system of stage-crushing has been adopted; crushing from 1½ inehes to 2 mm. in four or five stages, the reduction in eaeh case being about 50%. In most mills the crushing by rolls is in two stages only, the reduction being usually four to one.

At the Buffalo mill at Cobalt the erushing is in three stages, from 1½ to $^3/_{16}$, or 50% at each stage. At the Utah, Chino, and Ray Consolidated the fine crushing is in a single stage, the rolls being operated in closed circuit with a fine screen having $^1/_{10}$-in. openings at Chino and $^1/_{16}$-in. at the other mills. One of the seetions of the Steptoe Valley eoncentrator has been equipped on the Utah plan. It will be interesting to have data from this mill as to the eharacter of the crushing by this, as compared with the four-stage plan in other sections. When rolls are operated in closed eireuit with a fine sereen, coarse material tends to accumulate. I have known instances where tests have shown two and three times the amount of actual feed in the eireuit. Under such conditions a certain degree of choke feeding becomes inevitable, and a large proportion of colloidal material will be produced.

The Traylor Engineering Co.[18] has built a large number of heavy crushing rolls with an automatic lateral adjustment device attaehed to one roll by whieh the roll shaft is slowly moved back and forth endwise ½ in. during 120 revolutions. This is effeeted by a worm wheel and spur gearing operating an eccentric shaft in the bottom of the thrust box. This device is in use at the mill of the Miami Copper Co., the Butte & Snperior Copper Co., and elsewhere. The effeet of this lateral movement is to prevent the corrugation or channeling of the rolls and to lessen the end-thrust whieh is one of its effeets. The same result may be secured by the use of flanged rolls[19] with a feed-chute having an angle-iron lip turned upward, this angle iron being eut in the form of a convex eurve and thus feeding more ore toward the ends of the rolls than in the middle. Flanged rolls are in common use in the Joplin lead region of Missouri and have proved satisfactory at the North River garnet mill in Warren county, New York.

One of the most interesting of recent changes in mill practice has been the instant and wide acceptance of the Hardinge conical tube-mill. Tests have been made for a period of seven months by the Miami Copper Co., and tests of shorter duration have been made by David Cole at the coneentrator of the Arizona Copper Co., at Morenci, and it has been pretty well demonstrated that the new mill fills a very important place for the fine grinding of ores in which the mineral is finely disseminated. Within the past two years a large number of these mills have been placed in the Lake Superior concentrators for the re-grinding of middle produets and tailing, and a new re-grinding plant for the Calumet & Hecla M. Co. is now building which will call for 64 of these mills. Reeently I had the opportunity of examining screen analyses of the product of these mills from many sourees, and, while the results leave mueh to be desired from the standpoint of sliming, it is quite clear that the results so far obtained show less eolloidal material than is produced by the high-speed Chilean mill, and no more than from the Huntington mill, whieh heretofore have been the aceepted maehines for very fine grinding for concentration purposes. The Hardinge mill is evidently destined to take the same place in concentration that the long tube-mill occupies in cyanide practice. It is more than probable that equally good results, so far as the uniformity of the product is concerned, would have been seenred by the use of short tube-mills; that is, mills less than 15 ft. in length; but certain advantages are claimed for the conical over the cylindrical form which may prove to have good foundation. It is probable that further experiments with the Hardinge mill may show that the amount of colloidal material can be redneed by changes in some one or more of the adjustments. Up to the present time those using the new mill have followed closely the lines whieh have been developed for the tube-mill in cyanide practiee where, however, the production of slime is an object to be attained rather than avoided. In two respects practice with the Hardinge

[15]Symons, J. E., private communication.
[16]*Mining and Scientific Press*, Vol. 104, p. 224, Feb. 3, 1912. *Eng. & Min. Jour.*, Vol. 93, p. 1265, June 29, 1912.
[17]Sully, J. M., *Mining and Scientific Press*, Vol. 104, p. 464, March 30, 1912.
[18]Roberts, W. J., vice-pres., private communication.
[19]Payne, C. Q., *Bull.* 577, Amer. Inst. Min. Eng., June 1912. *Eng. & Min. Jour.*, Vol. 93, p. 370, Feb. 17, 1912.

mill seems to be developing along new lines, namely, in the amount of water in the pulp and in speed. The water used is rarely less than 60 to 70%, and sometimes reaches 80% or more. The mills are usually driven at higher speed than would be considered good practice with a cylindrical mill of the same diameter. It has been attempted to use the Hardinge ball-mill to replace rolls, but in this field the new mill has not proved entirely successful. It will undoubtedly serve well as a substitute for stamps where the production of a certain amount of fine material is not objectionable.

In considering the production of a finely pulverized material for concentrating purposes, the fineness of crushing must be proportioned to the fineness of the valuable mineral in the ore, and in some cases, at least the crushing of all the material to go through 100-mesh, may be necessary. It does not follow, however, that it is desirable to crush all or any large part of the material so as to go through 200-mesh, and it is quite certain that the production of colloidal material is to be avoided. In the final pulp crushed to 100-mesh it is not unlikely that fully half of the material below 200-mesh will be produced in the preliminary crushing by jaw crushers and rolls, and it is quite as important to see that the preliminary crushing is conducted on proper lines as well as the final crushing in the tube-mill.

Crushing by stamps finds a limited application in concentrating mills, their use being confined chiefly to the stamp-milling of native copper ores at Lake Superior and of gold ores where concentration is an adjunct to amalgamation and to the cyanide process. Nevertheless, the crushed material produced by stamps, under favorable conditions and with proper design and operation of the crushing-plant, is but little inferior to the pulp often produced by rolls and fine-crushing machines that are operated without regard for the conditions which tend to increase the amount of sliming. I have in my possession samples of crushed material from mills using rolls only, which contain much more slime than would be produced by stamps properly run. At the Edison cement plant choke-feeding of rolls gives a product nearly all below 200-mesh.

Sizing

The most interesting and important improvements in sizing in recent years are the Rowand-Edison system for dry screening and the Callow belt-screen for wet sizing.[20] In the former system the screens, inclined 45°, are placed in steps, with baffles between, in an inclined screening chute so arranged that the material passes over 10 or more screens of the same mesh, each screen being quite short, not more than 9 in., and the fall of the ore being interrupted each time so that the velocity of the falling material remains uniform and is not accelerated. This screen proves to have a large capacity and does excellent work, the proportion of undersize being much less than with ordinary shaking and revolving screens. The best results are secured when the ore is dried, in which case the wear on the screen surfaces is negligible. The wear on the screen plates is increased when the ore contains even 1% of moisture. Screens of this type, modified in design by Mr. Rowand, are in use on a large scale at the mill of the New Jersey Zinc Co. at Franklin Furnace.

For the screening of wet ore the well known Callow screen, in which the material is washed through a moving endless-belt of wire cloth, has made it possible to extend the field of screening to very fine material which formerly could not be sized on account of the high cost of such work. These screens have large capacity and make a clean product. A new form of screen, styled a revolving grizzly,[21] consists of a series of hard steel rings of V cross-section assembled with distance pieces between to form a cylindrical screen. A screen of this type with 30-mesh aperture is said to handle large tonnage of coarse material with little wear.

Classifiers

The Richards-Janney and the Richards hindered-settling classifiers have found extended application in many of the largest concentrating mills. The pulsator classifier does not seem to have had as much success. A new form of the pulsator classifier[22] in which the adjustments have been greatly simplified has been introduced, also a single-cell pulsator classifier[23] designed to be attached to mill launders.

Conical settlers or Callow cones have replaced the rectangular spitzkasten in almost all of the modern mills. The credit for the first use of these cones, however, should be given to C. B. Parson, of Bonne Terre, Missouri, who built a series of settlers of this type in the first Doe Run mill twenty-five years ago. The advantage of the conical type of settler is that the great length of discharge edge produces a very slow surface current and consequently greatly facilitates the deposition of fine material. The conical tank with radial flow will have several times the capacity of a rectangular tank where the discharge is over one edge only. R. H. Richards has shown that the surface current of box classifiers produces an overturning current, descending on one side of the box and ascending on the other, which affects the whole mass of pulp. This overturning vortex current carries down much fine material which would otherwise be carried over by the horizontal current. This accounts for the poor work done in the classification of fine slime in the old spitzkasten. In a conical tank the vortex current induced by surface flow takes the form on an annular ring like the smoke-ring made by a locomotive. This vortex ring has the same effect as the overturning current in the box form of classifier, so that the slime is no better classified in the cone than in the old box type.

Some years ago, in the laboratory of the School of Mines, Columbia University, I introduced the use of inclined baffle-plates for box classifiers and conical baffle-plates for cone settlers, so arranged as to prevent the formation of these overturning currents. These baffle-plates have been successfully used in

[20] Richards, R. H., 'Text-Book of Ore Dressing,' pp. 203, 218, and 'Ore Dressing,' Vol. III, pp. 1345, 1358.

[21] Ruthenberg, Marcus, *Met. & Chem. Eng.*, Vol. X, p. 412, July 1912.

[22] *Eng. & Min. Jour.*, Vol. 93, p. 896, May 4, 1912.

[23] Shepard, F. E., *ibid*, Vol. 93, p. 546, March 16, 1912.

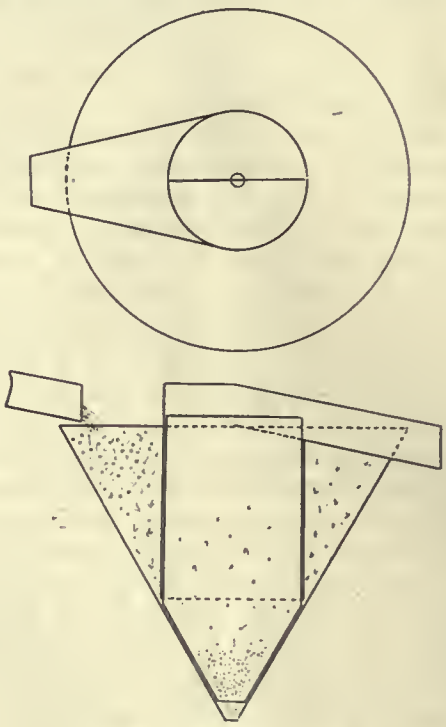
practice and have been found to increase the capacity of the settling-tanks, both rectangular and conical, as well as to produce a more uniform product. Similar baffle-plates have recently been used at the Sons of Gwalia mine in Australia[24] and at the Kyloe copper mines, New South Wales.[25] In these instances a very large number of baffle plates are used, many more than are needed for the purpose. Inclined baffle-plates not only prevent the formation of overturning currents, but also promote the settling of the material. The particles as they fall tend to leave the swifter moving current and fall into the slower-moving portion, which is retarded by friction on the surface of the baffle-plates. The settled material slides down the plates in this slow-moving current until it reaches the discharge openings at the bottom. In the use of the conical baffle-plates that I designed, the descending current is gradually throttled by diminishing the openings in the conical baffles, and the overflow current at the top is maintained of uniform velocity by gradually enlarging the space between the upper edge of the conical baffles and the surface of the water.

Separation of Sand from Slime

The separation of sand from slime is a problem arising frequently in concentrating mills for the separation of material for re-crushing, for facilitating the work of sand classifiers, and to divide at once material going to slime treatment from that to be treated on jigs or sand tables. It is also necessary when conditions make the separate handling of sand and slime tailing desirable.

The separation of sand and slime can be effected by the use of screens, classifiers, jigs, and tables, and by mechanical appliances and de-watering devices designed for the purpose. Small settling-cones are frequently used for the preliminary separation of sand from slime-settlers and slime treatment. The addition of baffle plates to such cones makes this separation more perfect and prevents the entangled slime finding its way to the sand-classifiers and sand-concentrators. The Caldecott cone is used in South Africa to separate sand from slime, the sand going to tube-mills and the slime to cyanide treatment. An improved cone[26] designed by W. G. Mosher has been generally adopted in the Butters plants. This consists of a cone with a large inner cylinder prolonged as a cone to near the bottom, the annular space between the two cones being ½ to ⅝ in. The feed enters the outer cone and the overflow is discharged by a spout from the inner cylinder passing through the wall of the outer cone. A longitudinal vertical partition is placed in the cylinder to prevent eddy currents, which may be produced by the spigot discharge. The rising current in the cylinder is of low velocity and free from bubbles. It is stated that by the introduction of this cylinder the capacity of the cone has been doubled in spite of the small discharge exit from the inner cylinder.

Mechanical sand and slime separators are for the most part modifications of the well known Dorr sand-classifier and are designed to elevate the sand from a large settling-tank by mechanical means. In the Dorr classifier this is done by a reciprocating



IMPROVED MOSHER CONE.

mechanism carrying a number of scrapers. In the Akins classifier[27] this is replaced by a revolving frame carrying a continuous helical scraper blade. In the Esperanza-Federal machine[28] the scraping blades are attached to an endless chain. The Argall classifier[29] contains two helical screw conveyors of long pitch and moderate diameter which raise the sand from the bottom of a conical settler with overflow at the circumference. Finally, there are several different types of shovel de-waterers in which the sand is raised from a tank by a vertical or inclined wheel carrying scoops or shoveling blades.[30] In the Federal mill at Flat River, Missouri, Mr. Guess has adapted the principle of the Esperanza drag to the delivery of tailing even from the jigs. This permits cleaner table and vanner work and economizes water.

[Jigging, magnetic separation, electrostatic separation, decrepitation, and flotation will be discussed in the continuation of this review to be printed January 11.—Editor.]

Chrome iron is actively mined in Russia, that country being one of the largest chrome-iron producers in the world. The reserves are principally in the Urals.

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[24]Gardner, B. L., *Monthly Jour.* Chamber of Mines of Western Australia, May 31, 1911, p. 120. *Jour.* Chem., Met., & Min. Soc. of South Africa, Vol. 12, p. 73, 1911. *Mines & Methods*, Vol. 2, p. 295, Aug. 1911. *Eng. & Min. Jour.*, Vol. 92, p. 438, 1911. *The Mining Magazine*, Vol. 5, p. 149, Aug. 1911. *Trans.* Amer. Met. Soc., Vol. 1, p. 62, 1911. *Met. & Chem. Eng.*, Vol. 9, p. 467.

[25]*Bull.* Inst. Min. & Met., Vol. 97, p. 11, Oct. 10, 1912.

[26]Waterman, D., *Mining and Scientific Press*, Vol. 104, p. 567, April 20, 1912.

[27]*Eng. & Min. Jour.*, Vol. 90, p. 720, Oct. 8, 1910. *Min. Sci.*, Vol. 62, p. 208, Sept. 1, 1910.

[28]*Eng. & Min. Jour.*, Vol. 94, p. 591, Sept. 28, 1912. *The Mining Magazine*, Vol. 7, p. 378, Nov. 1912 (Reprint).

[29]*Eng. & Min. Jour.*, Vol. 93, pp. 311, 547, Feb. 10, March 16, 1912

[30]*Ibid*, Vol. 94, p. 737, Oct. 19; p. 1028, Nov. 30, 1912.

Quicksilver Production and Prices

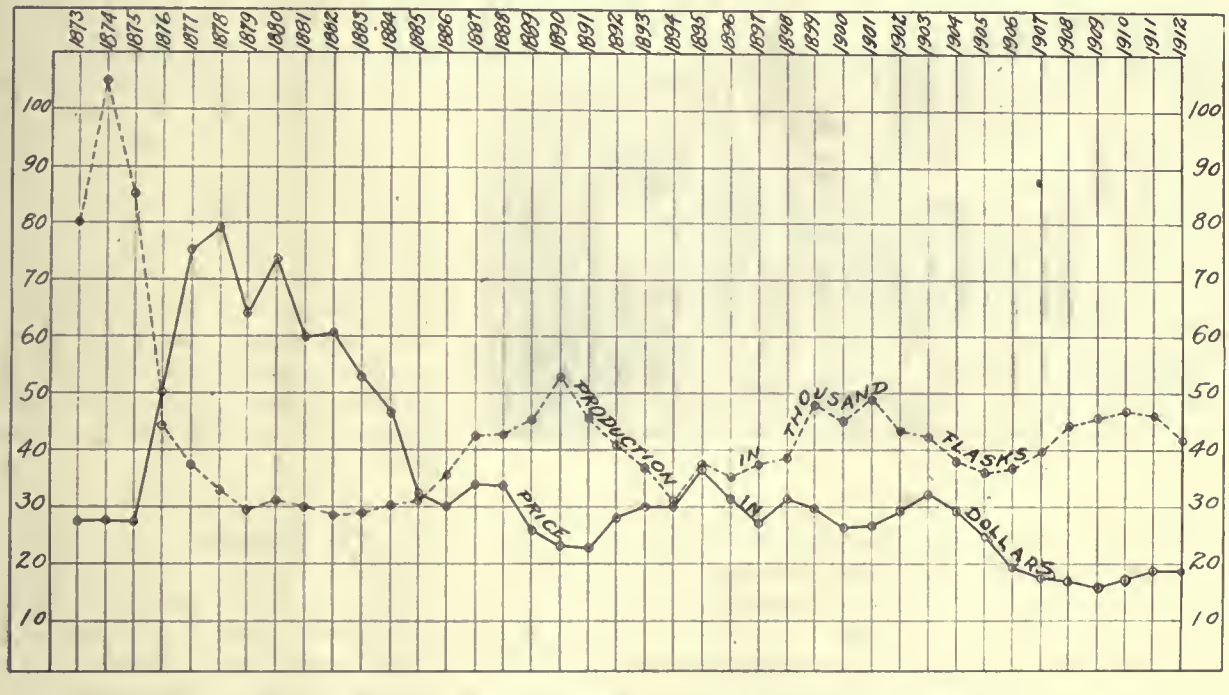
By Clifford G. Dennis

The quicksilver industry for the year 1912 has been quietly prosperous. The total production has been approximately the same as that of 1911, when it amounted to 21,256 flasks of 75 lb. each. Production in 1912 may be estimated at 23,650 flasks, of which California produced 18,150; Texas, 2500; and Nevada, 3000.

The powder and cap manufacturers continue to be the largest consumers, although considerable metal was used by the makers of electrical appliances. The usual amount was sold for medicinal purposes and use in the arts. The consumption in metallurgy decreased. No new uses have been found, but the fact that electrical appliance manufacturers are taking more each year is encouraging. The diagram published herewith, showing the California quicksilver production for the past forty years, with the price per flask during that period, indicates that the production is in no way regulated by the price, but that each company produces to its limit as long as there is ore that can be mined and reduced with profit at the prices set by the London market. A rise in price results in a slight increase in production due to the small producers, but as this increase is immediately met by the necessity to export, the average price is immediately reduced. This terminates the activities of the small producers who must meet high working costs.

California remains the chief producer, San Benito and Santa Clara counties yielding the bulk of California's production with the balance scattered over seven counties. In Texas, Brewster county alone yields quicksilver. Nye county yielded the bulk of Nevada's quicksilver, with a small production from three other counties. Oregon contains a few small mines, the Black Butte mine being best known. At the New Idria mine in San Benito county, California, active development has been carried on during the past year and this property is probably in better shape as to ore reserves than at any time for several years. The Guadelupe mine in Santa Clara county, California, had a remarkable production record for several months and will, no doubt, be able to resume this production when development work, now under way, is completed.

The Chisos mine, in the Terlingua district, Brewster county, Texas, is the principal producer of that state. The Chisos is situated in a formation geologically above any of the old producers of the Texas mines, and beyond a major fault that occurs between it and the older producers. The deepest workings at 400 or 500 ft. have not, as yet, penetrated the underlying formation that was so productive in the old mines, so that a long uninterrupted period of production may be looked for from this property. It will be interesting to learn what will happen when the Chisos workings penetrate the Lower Cretaceous formations. The older miners, who did all their mining in this lower formation found practically no metal in or above a thin overlying shale stratum but extraordinarily rich ore immediately below it. In fact, it is safe to assume that 70% of the mercury produced from the Terlingua fields was taken from a zone within 50 ft. below this stratum of shale. The interesting point now is what conditions will be met with as the Chisos workings enter the Vola limestone and Del Rio shales that overlie the zone that was so productive in the eroded area. Will ore occur in the shales and below it, or will the shales mark the termination of all ore downward? If ore occurs below the shale in this area, as it did in the eroded area, the Chisos mine is but in the infancy of its productive period and no doubt, owners of other properties that have only fair prospects on the surface will be encouraged to sink to the zone below the shales in the hope of finding bonanza ore.



CALIFORNIA PRODUCTION OF QUICKSILVER AND PRICES, 1873 TO 1912, INCLUSIVE.

The Mercury Mining Company's property at Ione, Nevada, was the principal producer in that state. This property was equipped with a 25-ton furnace of the Scott type and seven brick double condensers, in 1911. The reduction of ore began in January, 1912, and has been continuous. The ore occurs along and adjacent to a main fault that courses through the entire district. This fault has itself been subsequently faulted, and crushed areas of rhyolite, granite, chert, and limestone, highly altered, occur along the faulted zone. The metal occurs in the breccia of these subsequent faults and is distributed through the crushed areas in irregular bodies. The main fault bears the relation to the ore deposits that

FURNACE OF THE MERCURY MINING CO., IONE, NEVADA.

a trunk railway does to its branches. It has been the means of transport, but carries little commercial ore. The future production of the district depends on the number of these subsequent faults and crushed areas found along the main fault and the methods pursued in tracing the ore that undoubtedly occurs in and along them.

It is reported that a 10-ton furnace of Scott type, with condensers, is to be erected in the Fluorine district, which is situated about five miles easterly from Beatty, Nye county, Nevada. This furnace is to be in operation by January 15, 1913. The mine is reported to have a large quantity of high-grade ore available for treatment.

Arizona did not produce any quicksilver in 1912, but the Cinnabar Development Co., which is developing the old Colonial mine situated near Ehrenberg, reports good ore in the lower workings. The ore in this mine occurs in shoots along a well defined fissure. In the upper levels the ore showed undisputable signs of leaching. Bunches of very rich ore were found within the shoots but careful study revealed that these bunches had been protected from leaching by clay gouges along fault planes due to pressure. It is likely that development in depth has reached a point below the zone affected by leaching and that the metal is distributed through the ore more uniformly. Discoveries of cinnabar have been reported from near Roosevelt, Arizona, but no reports of any production from this locality have been noted.

QUICKSILVER PRICES, 1912

Month.	London.	New York.	Logical Import.
January	$40.75	$41.50	$46.44
February	40.14	42.00	45.83
March	40.75	44.00	46.44
April	41.97	41.00	47.66
May	40.14	41.00	45.83
June	39.53	41.00	45.22
July	38.92	42.50	44.61
August	38.32	42.50	44.01
September	41.36	41.50	47.05
October	37.71	41.00	43.40
November	37.09	41.00	42.78
December	36.49	40.00	42.18
Averages	39.43	41.58	45.12

The price received from quicksilver in 1912 has been considerably lower than in 1911. In that year the average price was $47.58—in 1912, $41.58. The table above shows the London price, the New York price as actually received for quicksilver, and the logical New York price based on the London price plus duty and freight. It permits interesting comparisons.

There have been practically no exports during the year, so that it is evident that the several sellers of quicksilver have traded the price down to get the business, and that American buyers have received for their metal less than was consistent with the world's prices.

Oil Exports

Mineral oil exports from the United States in 1912 will show a larger total, both as to quantity and value, than in any earlier year. The quantity exported will, according to the latest figures of the division of Statistics of the Department of Commerce and Labor, approximate 1800 million gallons, or an average of 5,000,000 gal. per day, and the value $120,000,000, or an average of about one-third of a million dollars per day. The history of the export trade in mineral oils touches the half-century line with the year 1912, the first statistical record of the exportation of mineral oils being that of the year 1862, when the value of the exports, including both crude and refined, was about $1,500,000. By 1872 the exportation had risen to 34 million dollars: in 1882, 51 million; in 1892, 45 million; in 1902, 72 million, and in the fiscal year 1912, 112 million: while in the calendar year 1912 the total will approximate 120 million dollars. The total value of the mineral oils exported in the half century since the export movement began is almost three billion dollars, and the total during the past decade nearly one billion dollars.

The distribution of the mineral oil exports extends over a wider area than perhaps any other single article. Europe is by far the largest customer, taking a little more than one-half of the lubricating oil and over one-half of the gasoline and naphthas exported.

Iron Ore, Pig Iron, and Steel During the Year

By G. H. Cushing

Iron Ore Shipments

Shipments of iron ore from the Lake Superior region by the Great Lakes for the season of 1912 were unprecedentedly heavy, running to 47,435,777 gross tons. Owing to the fact that shipments were light both in April and November, the six months from May to October, inclusive, showed a record movement of 7,000,000 tons per month. Iron-ore shipments for 1911 were 32,130,411 tons. This makes the increase for 1912 over the shipments for the preceding year 15,305,366. Shipments for 1912 were almost 5,000,000 tons in excess of the largest record previously made.

The shipments of iron ore by ports for November and for the lake season of 1912, as compiled by the *Marine Review*, were as follows:

Port.	Nov. 1911.	Nov. 1912.
Escanaba	513,790	560,328
Marquette	244,135	214,431
Ashland	168,909	414,224
Superior	800,531	1,140,767
Duluth	476,563	1,080,066
Two Harbors	514,325	662,858
Totals	2,523,253	4,072,674
1912 Increase		1,549,421

Port.	Dec. 1911.	Dec. 1912.
Escanaba	.....	10,428
Two Harbors	.....	4,151
Total	.....	14,579

Port.	Season 1911.	Season 1912.
Escanaba	4,278,445	5,234,655
Marquette	2,200,380	3,296,761
Ashland	2,429,290	4,797,101
Superior	9,920,490	14,240,714
Duluth	6,934,269	10,495,577
Two Harbors	6,367,537	9,370,969
Totals	32,130,411	47,435,777
1912 Increase		15,305,366

While the volume of business was big, prices were reduced 65 to 75c. per ton under those prevailing in 1911. This was clearly an effort to induce a return of activity in the iron and steel trades, and was so understood by all concerned. The activity in the iron and steel business came, but not exactly in response to this reduction in price. The cut in ore prices was made early in the year, but the upturn in the steel business did not appear until September. This suggests clearly that the improvement was traceable to crop and general business conditions rather than to the change in the basing prices of ore. Because general business is now upon such a firm footing, iron ore prices have been advanced again on sales already made and in prospect for 1913 delivery. Those prices are 55 to 65c. per ton higher than the prices charged for 1912, and therefore still 10c. per ton below the prices charged in 1911. On sales already made for next year, the guarantee of iron content has not changed, being 51.5% for non-bessemer and 55% for bessemer ores.

Stock Piles

While shipments of iron ore from the Lake Superior region were heavy enough to have afforded foundation for the large expansion of the iron and steel trade, which came with the last four months of the year, it must be definitely understood that neither the quantity nor the analysis of ore shipments determine either the quality of pig iron made or the amount of that pig iron. Production of ore from the Lake Superior region has been remarkably heavy for the past five years. Not all of the ore has been going into immediate consumption, and consequently considerable quantities have been placed in storage on the lake docks and in the furnace stock piles. The Northern iron business, or that which is dependent upon the Lake Superior region, has had rather hard sledding for the past five years. This was true because general business of a character to demand steel has been slight, because Southern iron has sold extensively in Northern markets, and because the Eastern steel trade has been drawing a large and increasing amount of ore from mines in the northern part of Cuba and from Sweden. On these various accounts Northern ironmakers have not used the ore that has been moved from the Lake Superior region. Furnaces in the Chicago district; along the south shore of Lake Erie; in the 'Valleys'; and in the Pittsburgh district have been steadily accumulating ore in storage which acted as a reserve upon which to draw when business became brisk along in the fall. Thus the iron ore which was the foundation for the business in the last four months of 1912 was a mixture of held-over ore and that newly shipped, so that quality and analysis of the year's shipments do not define either the amount or quality of pig iron produced.

Steel Mills and Foundries

At the time this review is written, the steel trade from one end of the country to the other is enjoying an astounding period of prosperity. Furnaces that have not been in blast for months, and in some cases not for several years, are now running, and in a good many cases are 60 to 90 days behind urgent orders. One criticism that has been made of the fall period of activity is that it was merely a movement to exchange merchandise for the farmer's cash, and would likely subside the instant the crops were moved and the farmer's harvest of dollars had been garnered into other people's pockets. Without attempting to make any prophecy, it might be said that if such were the case railroad and other improvement programs would not now be so extensive as to take up the iron and steel output for the next 60 to 90 days to such degree as to cause furnace interests to buy their ore supply four months ahead of the time which is customary when the business outlook is not sure. In fact, considering the amount of ore that had accumulated on lake docks and furnace stock piles, and considering that 1912 shipments were almost 5,000,000 tons in excess of any previous record, the fact that buying for

1913 delivery is already on and is heavy, indicates that steel interests are proceeding on fundamental assurances.

Pig Iron Prices

The one check which has been put upon the iron industry in the last four months has been the difficulty of getting coke. Cokemakers had had such a hard time for the preceding five years that no oven company was in the mood to spend large sums of money for building new plants. The companies went into this fall unprepared for the urgent orders which came upon them from every quarter. More particularly, they were seriously embarrassed by a shortage of labor due to the return to Europe of coke-oven workers who went home to participate in the Balkan war. Also, they were hampered by the same thing that has hampered every other business—the shortage of cars. This has brought about a rising cost in production of pig iron which has prevented any great profits for the past year, when the range of prices is taken into consideration. It was not, in fact, until September, that the average price on bessemer iron at the furnace rose above $14.50, and that basic iron rose above $15. Within the year bessemer iron had been 50c. cheaper, and basic iron had been $1.75 cheaper, the latter being, of course, down close to the cost of production. After, however, the period of greater activity set in, prices rose rapidly, and for September bessemer was worth on the average $16, in October $17, and in November close to $17.25. Basic iron in September rose to over $15, and in October to over $16, which price it held through November with another rise declared December 1. The range of prices on bessemer and basic pig iron, by months, for the past two years, has been as follows:

	Bessemer.		Basic.	
	1911.	1912.	1911.	1912.
January	$15.00	$14.078	$13.291	$14.372
February	15.00	14.000	13.603	12.250
March	15.00	14.053	13.750	12.760
April	15.00	14.250	13.750	12.981
May	15.00	14.234	13.400	13.000
June	15.00	14.250	13.060	13.209
July	15.00	14.250	13.000	13.480
August	15.00	14.530	13.000	14.000
September	15.00	15.960	12.667	15.134
October	14.64	17.000	12.515	16.184
November	14.02	17.172	12.278	16.192
December	14.19	.....	12.442	.....
Averages	$14.82	.....	$13.063	.....

Transportation and Docks

In the transportation of iron ore, a number of new influences have made themselves felt. One of them has been the increased speed of unloading cargoes at Lake Erie ports. One vessel there, late in the fall, accomplished the task of unloading a cargo in about 2½ hours. This was even better than the record made by the steamer *Widener*, which, on August 8, unloaded 10,636 gross tons in 2 hr. and 50 min. The latest record is about 30 min. less time on a cargo of approximately the same size, the latter record being all the more remarkable in view of the fact that the ore was transferred to cars instead of to storage piles.

Another influence of importance was the increased size and efficiency of the ships. Not as many vessels have been built in the past few years as had been built prior to the period of depression that started in 1907. Nevertheless, the tonnage of lake vessels has been steadily increasing even with a smaller number in service. Thus in 1905 the gross tonnage of lake bulk freighters was 1,919,285, in 1907 it was 2,442,754, while in 1912 it was 3,135,953 gross tons.

Cuban Ore

Another important influence on the Eastern ore trade has been the rapid development of the ore from Cuba. Just how big an influence this is going to have upon the steel business will depend upon the developments in the next few years. Already those engaged in the Atlantic coastwise business are beginning to get a proper viewpoint on what the Panama canal is going to mean. They are beginning to appreciate that, for coarse commodities, it is not going to mean so much in the way of business through the canal as it will in the expansion of trade to and in the canal. For example, it is beginning to be appreciated that the coal business can hardly expand much beyond that zone, but that trade expansion in the way of bunkering coal in the canal may be considerable. The peculiar advantage of this will be—and Eastern interests are beginning to take account of it—that there will develop on the coast practically a duplication of that condition which brought about the real development of the Great Lakes. That is, there will be a south-bound movement of coal and, with a short run in ballast, a north-bound movement of iron ore. This will cheapen transportation on both iron ore and coal, and consequently bring about an expansion of the trade in both commodities. With any such expansion taking place it may be expected that Cuban ore will be even a larger factor in the East than it is now, regardless of the fact that it has already practically monopolized the business in Baltimore and Philadelphia. In 1912 Baltimore received 1,125,000 tons of this Cuban ore, which was about three times the volume of the heaviest previous shipment. This ore will analyze in iron content a little better than the non-bessemer or Mesaba ores of the Lake Superior region. However, in its other particulars it analyzes close to the bessemer ores.

The influence which this Cuban ore will have upon the Northern markets is offset in a measure by the changed plans and the new attitude adopted by the Southern iron interests. These have their eyes now fixed not quite so much on the highly competitive Northern market as heretofore, but are devoting their attention more to home developments and to the trade to the south. This is likely to take some Southern iron out of the Northern markets, and will leave the Lake Superior region a tremendous uncontested territory, one which is expanding at an enormous rate. In fact, the indications are that the business toward the end of 1912 was in excess of any record that has ever been made in this country, not even excepting the very busy season of the middle of 1907. Even at that, programs of railroad improvement and of expansion of other lines of business indicate a mere start on an era of big things, and the steel trade may be expected to grow in proportion.

REVIEWS BY STATES AND DISTRICTS

CALIFORNIA

By W. H. Storms

The total mineral production of California for the year 1912 is likely to exceed $91,500,000; a gain over the output of 1911 of about $4,000,000. This estimate is based upon inquiry and unofficial returns, though calculated upon what is considered fairly reliable information, and a knowledge of the general condition of the industry throughout the state. As usual, petroleum is the largest factor, the production of oil reaching 87,000,000 bbl., valued at $41,000,000. This value is $500,000 lower than that of 1911, notwithstanding the fact that the volume of production was greater by about 2,500,000 bbl. This is due to the fact that a generally lower price was received for oil during 1912 than in 1911. The increased production is the direct result of extensive new drilling, in both old and new territory. Several 'gushers' were brought in during the year, particularly in the west-side field of the upper San Joaquin valley. The Lost Hills field has been extended largely during the year, as has also that of Belridge, and further extensions of these fields are anticipated. From late information it seems not improbable that Monterey county may became an important factor in production. Test wells were drilled there some time since. These were capped, the derricks and machinery removed, and it was supposed that it had been proved that the field was unpromising. Early in December, several tons of drilling machinery was shipped into this field, and it looks as though Monterey county may become an important producer of petroleum, possibly within the coming year.

The output of gold in 1912 has probably been about the same as in 1911, when it was $20,000,000. There have been some new important developments in quartz mining in several counties during the year, however, and the outlook for increased production in 1913 is encouraging. Mr. Janin discusses separately the gold-dredging industry. Although the copper production of 1912 is little, if any, greater than in 1911, yet no branch of the mineral industry in California shows greater signs of largely increased output, as soon as the smelter fume trouble can be solved in a satisfactory manner. Extensive copper development has been under way for the past two years, particularly in Siskiyou and other northern counties, and large deposits are being systematically developed.

The value of cement produced in 1912 will approximate $10,000,000, being about a million dollars more than in 1911, two and a half millions more than in 1910. This indicates clearly the constantly increasing importance of the cement industry in California, and it is highly probable that the demand for cement will continue and increase in the coming years, together with the expansion of other industries in the state and with increase in population. Structural materials constitute a large part of the mineral output of California. These include bricks, terra-cotta, lime and limestone, marble, sandstone, granite, and other building stones. The development of the state constantly demands an increasingly larger amount of these natural productions, which finds a corresponding increase in the total value of the mineral production.

Thus far, all materials for structural steel and steel rails are brought from outside the state. It is true that a large amount of structural steel is rolled in California mills, but it is all from imported iron or from old metal. It is hoped that before long California may produce all the iron used locally and may also export. There are known to be large and valuable deposits of iron ore in several counties, and the recent success attending the operations at the Heroult electric furnace in Shasta county gives hope that the difficulties have been so far overcome as to permit the manufacture of iron direct from ore in the electric furnace. Detailed estimates of production for the year 1912 were published in the *Mining and Scientific Press*, December 21.

Gold Dredging in California

By Charles Janin

The production from gold dredging in California for the year 1911 was $7,666,461, being $116,000 in excess of the production of 1910. This was somewhat lower than expected, and was caused by the loss of the two large dredges by fire, as mentioned in the review for 1911.* Fig. 1 shows the production of gold won from dredging operations in the principal counties in the state since the beginning of 1898. Yuba county led during 1911, with a production of $2,964,737; Butte was second with $2,251,764; Sacramento came third with $1,805,071. Sacramento county will probably exceed or tie Butte county for second place in 1912. It is a question if the production from dredging in the state has not reached its highest point. Much of the best ground has

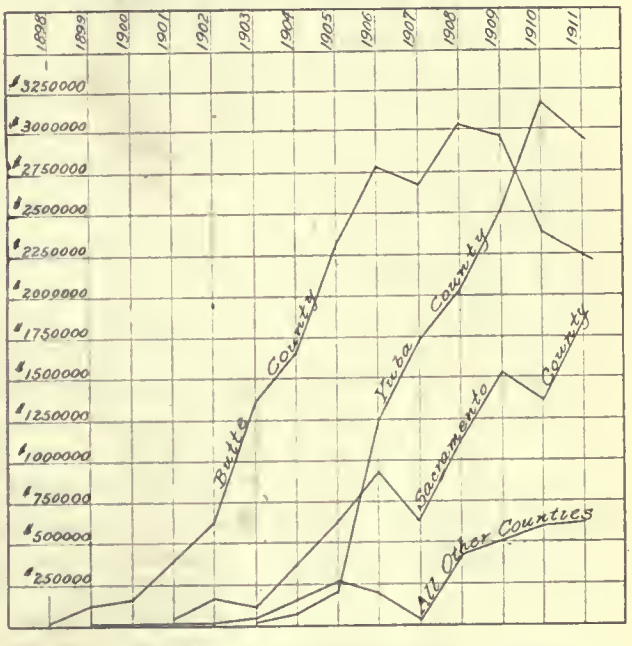


Fig. 1. Growth of gold dredging in California.

been exhausted, and while the larger companies, notably the Natomas and the Yuba Consolidated Gold Fields, may increase the yardage handled, taking into account the lower value of the ground and the exhaustion of the richer areas in Oroville and other districts, the results from operations cannot be expected to increase the total. The production from dredging in Butte county reached its maximum in 1908 with $3,043,051. The production of 1911 shows a decrease of approximately $800,000 below that, and $137,000 below the production of 1910; that for Yuba county also showed a decrease in 1911 as compared to 1910. Figures for 1912 are not yet available. Sacramento county, on account of the increasing yardage being handled, is still increasing its gold production. The combined output from all other counties, while the average value per cubic yard dredged is less than in 1910, shows a slight though steady increase, which will be maintained in 1912 and in 1913 by the addition of proposed new dredges.

There were 64 dredges operating part of the time in 1912 with a total yardage for all dredges of approximately 68,000,000. The average value recovered will be about 11c. per cu. yd. as compared to about 12c. for 1911. The world's record for yardage handled by any dredge is held by Natomas No. 4, a 13-ft. dredge. During 1911, working in unusually favorable ground, this dredge handled 4,056,422 cu. yd. from an average depth of about 19 ft. at a cost of 2.4c. per cu. yd. This will be more appreciated when it is realized that it almost equals the entire yardage handled for the year by the five dredges of Oroville, Ltd. It is not in-

*Mining and Scientific Press, January 6, 1912.

OPERATIONS OF GOLD DREDGES IN CALIFORNIA IN 1912.

County, district, and name of company.	Name of dredge.	Cap. of buckets.	Manager or superintendent.
BUTTE COUNTY—27 dredges operating; approximate total yardage for 1912, 18,500,000.			
Oroville District:			
Oroville Dredging, Ltd.....	Boston 4	7	W. P. Hammon, general manager,
	California 2	5	Alaska-Commercial Bdg., San Francisco.
	Exploration 1	3	
	Exploration 2	5	
	Exploration 3	7	
Natomas Consolidated,	Feather 1	8	S. L. G. Knox, general manager,
Feather River division.....	Feather 2	8	Alaska-Commercial Bdg., San Francisco.
	Feather 3	15	
Pacific Gold Dredging Co.....	Pacific 1	7	O. C. Perry, manager, Oroville.
	Pacific 2[1]	4	
	Pacific 3[1]	5	
	Pacific 4	7	
Oro Water, Light & Power Co.	Lava Bed 2	5	C. G. Leeson, manager,
	Empire	5	
	Victor	5	
	Hunter	5	
Indiana Gold Dredging Co....	Indiana 3	4	O. C. Perry, manager, Oroville.
El Oro Gold Dredging Co.....	El Oro 1	5	W. S. Noyes, president,
	El Oro 2	5	Mills Bdg., San Francisco.
Ophir Gold Dredging Co.....	Ophir	5	F. S. Mayhew, manager,
			Clunie Bdg., San Francisco.
Pennsylvania Gold Dredging Co.	Pennsylvania	6	Sam Cheyney, manager,
			237 First St., San Francisco.
Vil Oro Syndicate.....	Vil Oro	7	W. James, Superintendent, Oroville.
Gardella	Oro Vista	5	L. Gardella, manager, Oroville.
Wyman's Ravine District:			
Leggett G. M. Co.[2].....	Leggett 4	5	O. C. Perry, manager, Oroville.
Butte Creek District:			
Butte Creek Con. D. Co.....	Butte Creek	11	H. D. Gallihan, superintendent, Chico.
Drexler Dredging Co.....	Wade	4	John Ross Wade, superintendent, Chico.
Horncut District:			
Kentucky Ranch G. D. Co.....	Kentucky	5	L. Gardella, manager, Oroville.
Gardella	Horncut	5	L. Gardella, manager, Oroville.
YUBA COUNTY—12 dredges operating; 1 under construction; approximate total yardage for 1912, 20,000,000.			
Yuba Con. Gold Fields.....	9 dredges	7½	Hammon Engineering Co., San Francisco.
	Yuba 13	15	
	Yuba 14[3]	15½	
Marysville Dredging Co.....	Marysville 3 and 4.....	8	Bulkeley Wells, general manager, Marysville.
SACRAMENTO COUNTY—11 dredges operating; 1 under construction; approximate annual yardage for 1912, 25,000,000.			
Natomas Consolidated	Natomas 1	13½	S. L. G. Knox, general manager,
	Natomas 2 and 3.....	8	Alaska-Commercial Bdg., San Francisco.
	Natomas 4	13	
	Natomas 5, 6, and 7[4].....	9	
	Natomas 8,[3] 9, and 10.....	15	
Ashburton Mining Co.....	Ashburton	7	Bulkeley Wells, general manager, Marysville.
Union Dredging Co.....	Union 1	9	A. Turner, superintendent, Folsom.
CALAVERAS COUNTY—3 dredges operating; 1 under construction; approximate total yardage for 1912, 1,500,000.			
Calaveras Gold Dredging Co...	Calaveras	5	S. A. Moss, manager,
			Alaska-Commercial Bdg., San Francisco.
Isabel Gold Dredging Co.....	Isabel	5	F. L. Estep, superintendent, Jenny Lind.
Oro Water, Light & Power Co.	Mokelumne[3]	6	C. G. Lessen, manager,
			First National Bank Bdg., San Francisco.
Butte Dredging Co.....	Butte	3	L. N. Parks, superintendent, Jenny Lind.
SHASTA COUNTY—2 dredges operating.[5]			
Shasta Dredging Co.....	Shasta	5	R. F. Lewis, secretary,
			Mills Bdg., San Francisco.
U. S. Gold Dredging Co[6].....	Redding	3	C. A. Westenberg, manager, Berkeley.
PLACER COUNTY—3 dredges operating; 1 under construction.[5]			
Gaylord Mining Co.....	Gaylord	6	E. C. Gaylord, manager, Auburn.
El Dorado Placer G. M. Co.....	Cache Rock	..	A. W. Copps, superintendent.
Beaver Gold Dredging Co.....	Beaver	4	N. J. Martin, superintendent, Loomis.
El Dorado & Placer Co. G. D. & M. Co.[3]		3½	A. Tredidgo, manager,
			Foxcroft Bdg., San Francisco.
TRINITY COUNTY—2 dredges operating.[5]			
Alta Bert Dredging Co.....	Alta Bert	7½	M. Ashley, superintendent, Trinity Center.
Trinity River Dredging Co....	Trinity	9	Baker, superintendent, Minersville.
SISKIYOU COUNTY—1 dredge operating.[5]			
Siskiyou Dredging Co.....	Siskiyou	5½	George C. Carr, president, Hammonton.
MERCED COUNTY—1 dredge operating.[5]			
Yosemite D. & M. Co.....	Yosemite	3½	James H. White, manager, Snelling.
Total—64 dredges operating; 4 under construction; approximate yardage for 1912, 68,000,000.			

[1]Dismantled or out of commission.
[2]Company taken over by O. C. Perry and others.
[3]Under construction.
[4]Being reconstructed with new steel hull.
[5]Total approximate yardage, Shasta, Placer, Trinity, Siskiyou, and Merced counties, 3,000,000.
[6]Formerly suction dredge; reconstructed with Risdon bucket line; sank in November 1912.

tended to use these figures to disparage the latter company, as yardage records and operating costs are in a great measure a result of the physical conditions encountered. A case in point is that of the Hunter dredge, a 5-ft. boat of the Oro Light & Power Co. in Oroville. For a period of three years this dredge successfully handled an average of about 200 cu. yd. per hour. It was moved to a different part of the same property and for some time handled only about 50 cu. yd. per hour, and for a number of months the average has not exceeded 80 cu. yd. per hour. This is similar to the experience of other Oroville dredging companies. Operating costs of dredging at Oroville range from 4 to over 10c. per cu. yd., varying according to the size of the dredge and the character of the ground handled. It is obvious that comparisons of dredging costs cannot properly be made unless operating conditions are similar, and it would be unjust to compare the high operating cost of an Oroville dredge under difficult conditions with that of a dredge in another locality operating under more favorable conditions. Following is a summary of dredging operations for the last three years of the largest dredging companies operating in California:

NATOMAS CONSOLIDATED OF CALIFORNIA

	Year ended December 31—		
	1910.	1911.	1912.
Cubic yards handled...	15,988,362	22,270,586	24,000,000*
Recovery per yd., cents	9.64	9.21	
Cost per yd., cents.....	4.52	3.91	

YUBA CONSOLIDATED GOLD FIELDS.

	Year ended February 28—		
	1910.	1911.	1912.
Cubic yards handled...	13,970,728	15,757,264	15,000,000*
Recovery per yd., cents	20.88	16.86	
Cost per yd., cents.....	5.67	4.67	

OROVILLE DREDGING, LTD.

	Year ended July 31.		Nine months.
	1910.	1911.	1912.
Cubic yards handled...	5,661,612	4,433,262	3,512,842
Recovery per yd., cents	9.91	10.42	10.29
Cost per yd., cents.....	5.05	4.52	5.03

*Approximated.

Yuba County.—There are two dredging companies operating in Yuba county. The Yuba Consolidated Gold Fields, during the year ending February 29, 1912, operated 11 dredges continually and 13 part of the time. No. 2 dredge was dismantled in May, 1911, and No. 1 during 1912. Dredge No. 13 was put in commission in August, 1912, and represented the highest type of dredge construction at the time of building. It has 15-cu. ft. buckets and is the largest dredge in the world to dig 65 ft. below water level. In spite of minor defects and loss of time incident to adjusting new machinery, the dredge averaged nearly 8300 cu. yd. per day at an average operating cost of 3.11c. per cu. yd. The total yardage for all dredges for the year was 15,757,264; the average value was 16.86c. per yard. The dredges turned over 157.46 acres of an average depth of 62.1 ft. The operating cost, exclusive of some special work done by No. 12 for the United States Government was 4.67c. per cu. yd. During 1912 the company shut down dredge No. 1 and contracted with the Yuba Construction Co. for a new 15-ft. dredge, which will be put in commission early in 1913. Yuba No. 10, which was destroyed by fire November 10, 1911, will not be rebuilt; such of the machinery as was saved will be used for repairs on the other dredges. The approximate yardage handled by all dredges of the Yuba Con. Gold Fields for 1912 will be close to 15,000,000.

The Marysville Gold Dredging Co. at Marigold operated two 8½-ft. dredges, which have been described by R. E. Cranston in a previous issue of the *Mining and Scientific Press.* The results of operation are not made public. The total capacity of both dredges is approximately 3,000,000 cu. yd. per year. The plant of the Tarr Mining Co. at Smartsville, which was described in the *Mining and Scientific Press*, October 26, 1911, still remains untried, no work being done during 1912. This plant, which is somewhat allied to dredging, has some interesting features, and its operation is anticipated with interest by engineers who rather doubt whether the management will realize the expected results. A plant of a somewhat similar nature, much less ambitious, is in successful operation at Beauce, Canada. This will be described in a later article.

Butte County.—In Butte county 28 dredges operated part of the time. The total yardage handled would closely approximate 18,500,000. The five dredges of Oroville Dredging, Ltd., handled, for the nine months ended April 30, 1912, 3,512,842 yards of an average value of 10.29c. and an operating cost of 5.03c. This company is also preparing to operate dredges in Colombia. The dredge of the Pennsylvania Dredging Co. finished the company's holdings on the west side of the county road, and is now working on the small piece left on the east side of the road, where it will have about six months' life.

The dredging ground remaining on the east side of the river is fast approaching an end; in about three years more most of the dredges now operating will be out of commission and several companies will finish their ground in less time. Some dredges will doubtless before long be moved to other fields; a number of investigations have been made and options secured on outlying properties. It is generally conceded that any attempts to re-dredge the tailing will be a failure, unless a very low operating cost can be obtained. In general, wherever any of the present dredges have found it necessary to cut through tailing piles in moving, the gold recovered did not pay expenses. With larger dredges, however, where a low operating cost would obtain in land of this character, and in connection with re-soiling arrangements for reclaiming the dredged land, the proposal would seem more attractive and will undoubtedly be tried on some of the areas near Oroville.

The black sand man has again been in evidence in the Oroville district. This summer several attempts were made to treat the black sand or arrange with the dredging companies for that privilege, but, so far as I know, nothing definite was accomplished. The general procedure of those interested in black sand is to express a willingness to experiment with the black sand if the dredging companies will save it for them, and this most of the companies have not found profitable. The efforts of J. H. Leggett, in reclaiming dredged land, have been quite successful. An interesting account of his experiments appears in the *Mining and Scientific Press* of October 26, 1912.

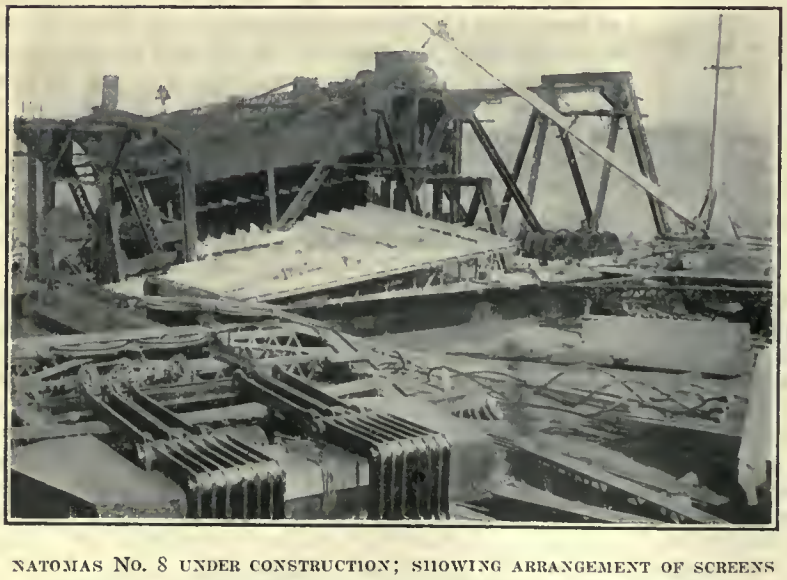
Sacramento County.—There are three dredging companies operating in Sacramento county; two companies each operating one dredge, and the Natomas Consolidated, whose present gold-dredging equipment consists of three dredges in the Oroville field, and nine dredges operating in the Natomas division near Folsom. Three dredges of the latter division are equipped with 12½-ft. buckets, one with 15-ft. buckets, the other dredges have 8 or 9-ft. buckets. Three new dredges were under construction in 1912; No. 10 being put in commission in October. All of these new dredges are of steel construction. No. 10 is equipped with 15-ft. buckets, and, during the first eight days of operation, averaged 15 hours working time, and 3000 yd. per day, or about 200 yd. per hour, while dredging to an average depth of 30 ft. in hard ground containing a number of large boulders. It is said that the dredge has since been digging in excess of 5000 yd. per day. Dredge No. 8, a duplicate of No. 10, replaces the former No. 8, which was destroyed by fire in October, 1911, and will be put in commission in January, 1913. It was originally planned to dismantle No. 4 during 1911, but, on account of the loss of No. 8, this dredge has been kept in commission. No. 7, which will be in operation in April or May, 1913, is equipped with 9-ft. buckets to dig to a depth of 70 ft. It replaces old No. 7, which has worked out all available ground, and uses most of the machinery of the old boat. New No. 7 will be built at Blue Ravine about 7 miles northeast of Natoma on a gravel channel which was worked by drift mining some years ago.

During 1911, the nine old dredges of the Natomas Consolidated averaged 82.4% mining time, as against 77.8% for 1910, and handled 809,310 cu. yd. more material than the same dredges did in 1910. The total yardage handled

for all dredges in 1912 will approximate 24,000,000. In addition to dredging, the Natomas company operates three rock-crushing plants, two at Natomas and one at Oroville, and is also reclaiming a large area of river bottom land north of Sacramento. The rock-crushing plants crushed 538,644 tons of rock, and operated at a profit of $47,459.34 for the year of 1911. Information of the reclamation project, while of interest to holders of Natomas securities, has nothing to do with the review of gold dredging and need not be detailed here.

In addition to Natomas, the Union Dredging Co. on the Fassler ranch at Blue Ravine about 2 miles from Folsom is operating a 9-ft. Bucyrus boat designed to dig 55 ft. below water level. The company owns about 250 acres, some of which is of rather low grade. This dredge was put in commission in March, 1912, and has been working satisfactorily, handling a large yardage. Results of recovery are not available. The Ashburton Mining Co. is operating a 7-ft. dredge which was put in commission in May 1908. The ground averages in depth about 30 ft. and the dredge handles a little under 1,000,000 yd. per year.

UNION No. 1, NEAR FOLSOM; 9-FT. BUCKETS DIGGING 55 FT. BELOW WATER; BUILT BY THE BUCYRUS COMPANY.



NATOMAS No. 8 UNDER CONSTRUCTION; SHOWING ARRANGEMENT OF SCREENS AND GOLD-SAVING TABLES; BUILT BY YUBA CONSTRUCTION COMPANY.

Other Counties.—Of the outside counties, Trinity has attracted most interest during 1912. The Alta Bert dredge, rebuilt by the Union Construction Co., has had a successful season in spite of several weeks' delay on account of bucket-line renewals and repairs, about 30 new buckets replacing some that went to pieces against the hard bedrock. Some of the ground handled averaged 90c. per yard and the clean-up for the year will be in excess of $170,000. The new dredge now obtains power from the Trinity G. M. & R. Co. The Trinity River Dredging Co. started its 9-ft. dredge late in September, but, on account of delays and changes, did not handle much yardage before the end of the year. Details of operations are not available at this writing. The success of the Alta Bert company stimulated prospecting in Trinity county, and a number of areas were drilled during 1912. It is stated that a dredge will be built during 1913 on ground above that of the Trinity River Dredging Company.

In Calaveras county, the Butte dredge operated steadily and successfully during the year. The buckets on this dredge, instead of being of 4-cu. ft. capacity, as ordered by the company, hold only 2.6 cu. ft. by sand measurement, which made considerable difference in yardage and in operating cost. The bucket line will be changed in 1913. In this connection it is interesting to note the difference sometimes existing between rated and actual capacity of dredge buckets; one dredge having so-called 9-ft. buckets was found by measurement to hold 7 cu. ft. of sand. The large dredges with so-called 13 to 16-ft. buckets may hold from 12 cu. ft. upward. In reference to this, the following is pertinent. Last year I asked one of the dredge men at Natomas, the actual size of the buckets on one of the boats. He said: "We always called them 13 cu. ft., but when them mining engineers visited here, they said they were 15-ft. buckets, and we have called them 15 ft. ever since." The Jenny Lind dredge has been operating as usual, and the Calaveras since being re-commissioned.

Dredge Construction.—Pacific No. 1, which sank in December 1911, was repaired and recommissioned in 1912, after being idle about one month. The sinking of the dredge was caused by a leak back of the well-hole, due to the timbers being worn through by gravel dropping from the spill-over at the main dump chute.

El Oro No. 1, which turned over in the dredging pond, was thoroughly overhauled and started digging on March 20. By increasing the deck width 6 ft. on either side, beginning from the curve at the bow and extending to the stern of the boats, the freeboard was increased to 27 inches as compared to about 8 before the accident. The accident was probably caused by the weight of the steel spud, which had been raised preparatory to stepping the dredge ahead, tipping the hull on that side just as the winchman was swinging the boat from the headline from the opposite side. The strain doubtless caused some of the planks to part, and the weight of the water rushing in added to that of the spud, caused the boat to capsize. The hull had just been examined and found to be in fair condition. In fact, a man was emerging from the hatchway when the dredge began to tip, but fortunately he had time to get to a safe position before the dredge sank.

Calaveras 1, which sank in 1911, was also raised, overhauled, and re-commissioned in 1912, and has been doing good work. The Beaver dredge sank on February 21, 1912, but was soon raised and again in operation. It is reported that a good recovery is being made; the ground averages about 14 ft. deep. Leggett No. 4 was taken over by O. C. Perry and R. S. Kettrick and is again in operation. The Yuba Consolidated Gold Fields shut down Yuba No. 1. The Pacific Gold Dredging Co. shut down Pacific No. 2 and 3. The dredge of the United States Gold Dredging Co. on the Sacramento river, above Redding, sank on November 29. This was formerly a suction dredge, which had been converted to a bucket-ladder dredge some years ago by adding a Risdon bucket line. It operated a little during 1912. The total operations of the company have not been great.

Natoma No. 10 commenced operations in October 1912. This is the first dredge of steel construction to be built in

California and represents the highest type of dredge construction in the California fields. The construction of Mokelumne No. 1 was continued during the year, and it will be put in commission in January 1913. This company has been taken over by James H. Goodwin. The dredge is to be equipped with 6-ft. instead of 9-ft. buckets, as contemplated by the old company. The Lawrence Gardella dredge commenced operations in January, on the Downing tract in the Oroville district. This is a 5-ft. boat built by the Union Iron Works and designed to dig 35 ft. below water-level. It is said to be handling about 80,000 yd. per month. The Union dredge near Folsom commenced operations in March 1912. This is a 9-ft. dredge, built by the Bucyrus Co. The Gaylord Mining Co.'s 6-ft. dredge, on Rattlesnake bar, eight miles south of Auburn, was put in commission in April. This dredge was re-designed and rebuilt by the Union Iron Works, partly from the machinery of El Dorado No. 1. The Trinity River Dredging Co. started in September. This is a 9-ft. dredge built by Ed. L. Smith. Some work was done on the hull for the proposed 3½-ft. Treadidgo dredge near Loomis in Placer county, and it is expected that the dredge will be built during 1913. In addition to these dredges, Natomas No. 7 and No. 8 are under construction and will be put in commission early in 1913. No. 8 in January, and No. 7 in April or May.

There are several other dredges proposed for 1913, including one for Trinity county above the Trinity dredge, one for Mammoth bar near Auburn, Placer county, and one for the Merced river north of Snelling, Merced county. The latter is to be a 15-ft. dredge. In addition to this, there are several examinations being made or contemplated of property supposed to be suitable for dredging. This, with the contemplated moving of some Oroville dredges to other areas, indicates that there is still a live interest in gold dredging in the state.

NEVADA

By L. F. Adamson

In the *Mining and Scientific Press* of January 6, 1912, I gave a comparative statement, by quarters, showing the production of precious metals of Nevada for the years 1909-1910 and first six months of 1911. Below are given corresponding figures for the whole of 1911 and first six months of 1912:

	Tons.	Value.
1911.		
First quarter	1,075,139	$ 8,455,543.30
Second quarter	1,073,762	7,917,203.33
Third quarter	1,070,634	7,789,941.07
Fourth quarter	1,001,925	8,264,886.85
Totals	4,221,460	$32,427,574.55
1912.		
First quarter	1,137,460	8,377,502.86
Second quarter	1,280,384	8,994,116.20
Totals	2,417,844	$17,371,619.06

It is hardly expected that the last half of 1912 will show quite as favorably as the first half given above. The reason for this is due largely to two causes. (1) The Goldfield Consolidated Mines Co. is now working on a grade of ore of much less value than through the past two years; (2) the Nevada Consolidated Copper Co. suffered the handicap of a serious labor strike during the month of October, which materially curtailed its production. Despite these conditions, the state as a whole for the year 1912 will show a satisfactory increase in both tonnage and value.

Churchill County.—During quarter ended Sept. 30, 1911, this county produced 4582 tons of ore of a value of $76,555; quarter ended December 31, 14,733 tons, $290,185; quarter ended March 31, 1912, 2461 tons, $66,544, and quarter ended June 30, 15,832 tons, $364,946. The Fairview and Wonder districts particularly, are now in full swing, and the outlook is for a continued heavy production. The falling off during the first quarter of 1912 was due largely to unfavorable weather conditions and temporary shortage of water.

Clark County.—This county produced during last quarter of 1911, 4887 tons, valued at $86,636; first quarter of 1912, 5118 tons, $86,020, and second quarter, 5830 tons, $135,955. An immediate further increase is anticipated. The Yellow Pine Mining Co., of Goodsprings, is largely responsible for this healthy development. Another favorable indication is the recent resumption of operations on the property of the Quartette Mining Co., of Searchlight.

Esmeralda County.—There was produced in this county during first quarter of 1911, 134,503 tons of ore valued at $2,904,827; during the second, 145,831 tons, $2,017,383; third, 149,985 tons, $2,499,034; fourth, 140,184 tons, $2,403,566; during the first quarter of 1912, 133,295 tons, $2,219,538; second quarter, 128,463 tons, $1,783,871. As already intimated, Esmeralda county may reasonably be expected to show a considerable further decrease during last half of 1912, owing particularly to the lower grade of ore worked by the Goldfield Consolidated Mines Co. This company has been a wonderful producer during its short existence, and has paid approximately $24,000,000 in dividends to date. Its mill is still running full capacity but on the lower grade of ore.

Eureka County.—This county produced the fourth quarter of 1911, 21,802 tons, valued at $98,590; during first quarter of 1912, 24,213 tons, $91,097; second quarter, 21,458 tons, $64,280. Eureka county is gradually increasing its tonnage and the values of its ore prospects are bright.

Humboldt County.—Production in Humboldt county during the fourth quarter of 1911 was 1724 tons, value, $306,344; during the first quarter of 1912, 1240 tons, $28,790; and second quarter, 5753 tons, $289,403. This county shows a general average of the highest grade ore produced in the state. It also boasts the greatest number of producers scattered over the broadest field. Perhaps the most interesting district in the county is that in which the National mine is situated. Hard-fought litigation over apex rights was determined this year in favor of the National Mines Co. The mine has yielded over $3,000,000 since 1907.

Lander County.—This county produced during last quarter of 1911, 13,141 tons, value, $48,370; during first quarter of 1912, 57 tons, $7266; second quarter, none. Just at present Lander county's production is somewhat erratic, but development is being quietly pressed and will doubtless lead to a considerable future expansion.

Lincoln County.—During last quarter of 1911, Lincoln county produced 13,391 tons, of a value of $60,568; during the first quarter of 1912, 25,672 tons, worth $226,327; and the second quarter, 14,231 tons, worth $164,190. Lincoln county's outlook is exceptionally bright. The Prince Consolidated Mining Co., and the Day-Bristol Consolidated Mining Co., have both re-entered the list of heavy producers, and the output for the last half of 1912 is confidently expected to show a substantial increase.

Lyon County.—During last quarter of 1911, Lyon county showed a production of 4630 tons, worth $19,927; during the first quarter of 1912, 47,980 tons, $404,890, and the second 72,208 tons, $661,540. The completion of the Wabuska smelter has brought Lyon county to the front in record time, and her copper production is increasing rapidly. The Mason Valley Mines Co. and the Nevada-Douglas Copper Co. will make the output for the last half of 1912 far in advance of that shown for the first half.

Mineral County.—This county showed no production during first three quarters of 1911; during last quarter production showed 1102 tons, of a value of $15,024; no production during first two quarters of 1912. There are many flattering prospects in Mineral county and considerable development work is under way.

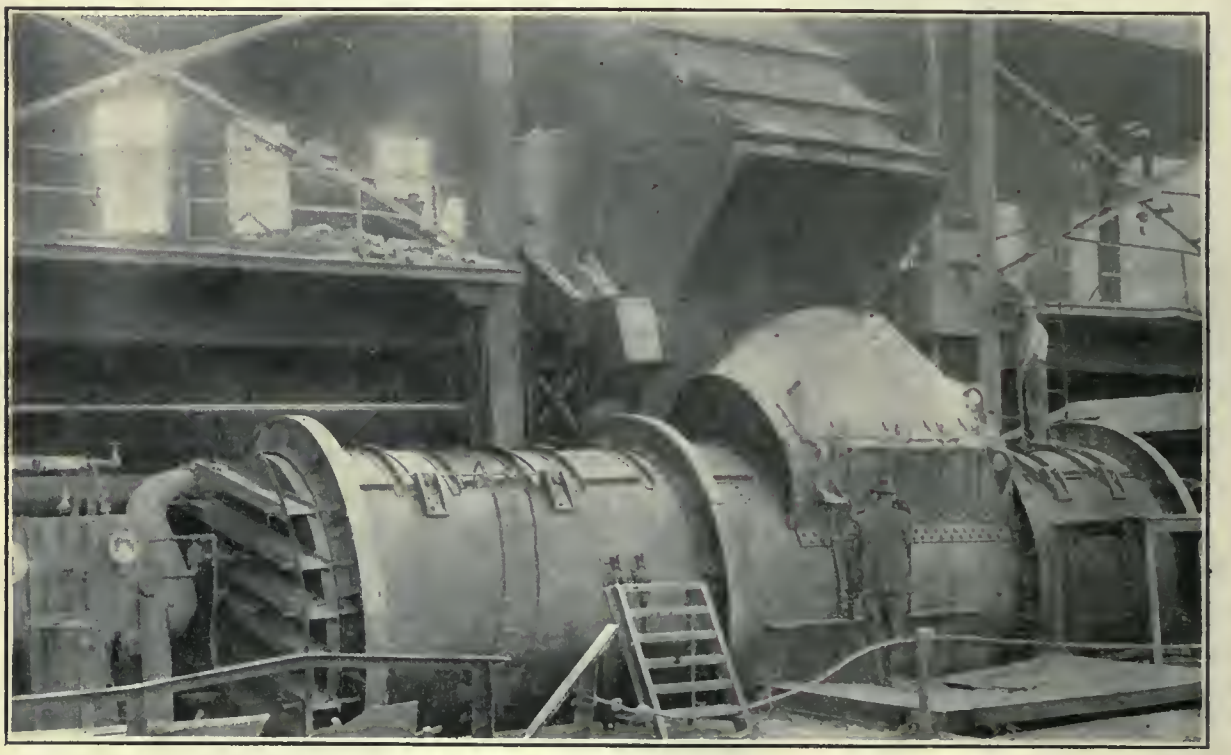
Nye County.—The production in Nye county during first quarter of 1911, shows 247,464 tons valued at $2,527,788; during second quarter, 115,867 tons, $2,324,611; third quarter, 122,204 tons, $2,193,650; fourth quarter, 128,730 tons, $2,310,510; during first quarter of 1912, 124,219 tons, $2,315,530; and second quarter, 127,643 tons, $2,240,884. Nye county is the premier silver-producer of the state, and the gross value of the output is only occasionally exceeded, and by a

very small margin, by the great copper county of White Pine. Nye has a greater number of large tonnage producers than any other county and the outlook was never so bright as at present.

Storey County.—This county produced during first quarter of 1911, 21,230 tons of ore of a value of $175,696; during second quarter, 22,285 tons, $126,195; third quarter, 37,440 tons, $567,594; fourth quarter, 32,419 tons, $443,892; during first quarter of 1912, 27,579 tons, $242,589, and the second, 38,135 tons, $327,183. The old Comstock lode is dependable and may be expected to maintain its present rate of production for some time to come, with a by no means remote possibility of a heavy increase.

Washoe County.—This county produced during the first quarter of 1911, 441 tons of ore valued at $5964; during the second, 182 tons, worth $14,105; during first quarter of 1912, 35 tons, $3350, and second quarter, none. Mining operations in Washoe county have been negligible. Her prospects are the reverse, and when systematic development is begun, the county will doubtless prove a source of considerable production.

White Pine County.—This county produced during first quarter of 1911, 655,178 tons of ore of a value of $2,306,894; during the second, 775,473 tons, $2,019,635; third, 729,157 tons, $2,112,986; fourth quarter, 620,465 tons, $2,150,708; during the first quarter of 1912, 744,470 tons, worth $2,422,705; second quarter, 849,681 tons, $2,959,682. The third quarter of 1912 is expected to show a material increase over preceding quarter. The Giroux Consolidated has now entered the list of heavy producers and every indication points toward increased prosperity in White Pine's already enormous copper industry. Changes at the Nevada Consolidated are discussed separately by Mr. Sorensen.



PIERCE-SMITH CONVERTERS, SHOWING SPECIAL CHARGING DEVICE.

Changes at the Nevada Consolidated

By S. S. Sorensen

Changes in plant and equipment made within 1912 may be summarized as follows:

In the mill 10 Wilfley concentrators, modified as roughing tables, have been placed in No. 1 section together with 4 five-compartment Steptoe classifiers. In sections five and six 4 sets of 36 by 15-in. rolls have been put in for regrinding to do the work done by the Chilean and Huntington mills in the other sections. On the vanner floor 32 Wilfley tables substituted for some of the corrugated belt vanners, and 8 Craven three-decker slimers have been put in. These are treating material which formerly went to tailing. In the line of water recovery 4 Dorr thickeners 17 ft. in diameter by 9 ft. deep have been placed in sections 7 and 8 and similar thickeners are being placed in the other sections.

The pumping equipment has been increased by the addition of a 4-sec.ft. motor-driven, volute pump, which has been installed as an auxiliary to the steam-pumping engine.

The slime-settling plant has been increased by the addition of a string of five ponds excavated along the contour of the hill below the mill, giving a total surface area of nearly two acres. The slime water is taken from the overflow of the existing Steptoe settling tanks and others and is distributed at frequent equal spaces along one side of whatever ponds are in use. The ponds are so arranged that the settled slime can be drawn out and run to a central slime-treatment plant or to a pumping plant to raise it for treatment in the mill. The clean water is pumped back into the mill service by the compound steam pumping engine.

At the smelter pressure-blast air cooling has been extended to all the roasting furnaces by the installation of belt driven fan of 25,000 cu. ft. capacity at a pressure of 3½ in. of water, and the tonnage has been raised to about 90 tons per furnace day with a sulphur elimination of over 60%. No radical change has been made in the construction or working of the reverberatories. The three now running are smelting 440 tons of total charge each per furnace day, with an oil consumption of 0.86 bbl. per ton of charge. One has been rebuilt with an increase in size and a change in the design of binding. The latter has been concentrated into beams set at 5-ft. spaces, centre to centre, instead of the old method of close-set 8 to 12-in. I-beams. This furnace is ready to go into commission whenever required.

At the converters the greatest improvement has been the remodeling of the No. 1 Pierce-Smith basic converter. This converter, which is 30 ft. long inside, and has 46 tuyeres, is making 78 tons of blister per day from 38% matte. Charging is not done through the outlet as hitherto, but through a special charge hole from a fixed launder. A new copper casting machine has been built with oil-fired receiver which holds 50 tons of blister and is tilted by means of gearing from the old disused converters by an electric motor.

UTAH

By Our Special Correspondent

Defeat of the Western Federation of Miners in an important and far-reaching battle; increase in production of staple metals and coal; the development of rare metals, especially uranium and vanadium; these were the leading features of the year 1912 in Utah. The struggle between the mine operators and the Western Federation was perhaps most important. Bingham was the principal battleground, although the conflict waged in other districts. The victory at Bingham settled the question. The operators granted an increase in wages, but fought the recognition of the union. The strike was declared at Bingham September 18, and nearly 5000 men at Bingham, Garfield, and Tooele quit work, affecting the mills and smelters as well as the mines. The principal fight was against the Utah Copper Co. The great weakness of the men lay in the fact that such a large proportion of those employed by the big producers is unskilled. Most of the men who follow the steam-shovel are common laborers, and their places were easily filled. The fight on behalf of the operators was directed by men experienced in breaking strikes. Work was resumed at the mines October 10, under the protection of a large force of deputies, and in a short time there followed a general resumption of operations with nearly a full force of men. There is still a labor shortage, partly due to the fact that so many Greeks and Servians left to fight in the Balkan war. The forces are being steadily recruited, and are now almost up to normal. As a result of this campaign the Western Federation of Miners has lost whatever grip it had at Bingham, while the moral effect at Tintic, Park City, and elsewhere in Utah has been of first importance.

Returns of production for the eleven months, with estimates for December, indicate marked increases. The smelter figures and average values for 1912, compared with the United States Geological Survey statistics for 1911, are as follows:

1912.	Value.
Gold, 230,785 oz., at $20.67	$ 4,770,326
Silver, 14,774,413 oz., at 60.66c	9,759,956
Copper, 145,445,785 lb., at 16.35c	23,780,386
Lead, 155,566,138 lb., at 4.51c	7,016,033
Zinc, 20,303,706 lb., at 6.72c	1,364,409
Total	$46,691,110

1911.	Value.
Gold, 227,217.28 oz.	$ 4,696,998
Silver, 13,473,787 oz.	6,611,107
Copper, 146,960,827 lb.	18,370,103
Lead, 136,496,750 lb.	6,142,354
Zinc, 17,840,261 lb.	1,016,895
Total	$36,837,457

The production of copper would have been still greater had it not been for the Bingham strike. Park City did not come up to the expected mark on zinc, but Tintic more than made up for this deficiency. The high price of spelter, together with the favorable smelting and railway rates, greatly stimulated production. The production of uranium and vanadium began in commercial quantities from the San Rafael swell in the vicinity of Green river in eastern Utah. Two properties have been shipping with comparative regularity while there are a number of prospects. The discovery and initial development of the deposit of alunite near Marysvale was another important event.

At Bingham the Utah Copper Co. attained a record for production, and the decks were cleared for a higher record for 1913. In August the output reached 11,841,162 lb. of copper. The strike came in September, bringing the total for that month down to 6,965,144 lb.; in October it was 2,128,792. The estimated production for November is 4,500,000 lb., and for December, 8,000,000. When working at a maximum capacity, the company has handled as high as 50,000 tons of ore and waste in a day, which is 75% of the amount of material being handled on the Panama canal. During the year 13 sections of the Arthur mill were completed. The mills now have a capacity for concentration of 20,000 tons of ore per day. Officers of the company expect to reach a production of 150,000,000 lb. of copper during 1913. Significant of the closer relations between large producers and consumers of copper was the consolidation of nearly all leading hydro-electric power-plants in Utah. These are now controlled by the Utah Power & Light Co., a $40,000,000 corporation, financed by interests connected with the Utah Copper Co. and the General Electric Co. D. C. Jackling is president. The Utah Consolidated improved during the year, and neighboring properties show increased production. The long tunnel of the Utah Metals Mining Co., extending underneath the Oquirrh range from one side to the other, connecting Bingham with the smelter at Tooele, was not finished as anticipated, but is expected to be completed in the spring of 1913.

Park City has not been the scene of any sensational performances, but the old mines have done well. The Silver King Coalition Mines Co., after accumulating a fund to

MAP OF UTAH.

take care of the heavy judgment obtained against it by the Silver King Consolidated Co., resumed payment of dividends in December. This company and the Daly-Judge have both completed thorough electrical equipment of their properties. The Daly-Judge also resumed dividends and paid $225,000 in 1912. The Daly-Judge has developed enough water-power from the Snake Creek tunnel, in which it is a heavy owner, to meet all of its power requirements. The old Ontario has been the scene of some interesting work on the metallurgy of its silver-gold-lead ores. The Mines Operating Co. has a lease on the property, including the dump. After exhaustive experiments, it was announced that the low-grade ores left in the old stopes and on the dump of the Ontario could be treated to advantage. Concentration and cyanidation were the processes employed at first by the lessees. Further experience demonstrated that the loss of silver through cyanidation of certain classes of the ores was too great. As a result of further experimentation, the company is now treating the ore with a combination of the old chlorination process, concentration, and cyanidation. It is said that a profit is being made on ore averaging $8.67 per ton.

Tintic has had a year of prosperity. Records of shipments show an increase of nearly 20% over 1911, which in turn was the record year for the camp. The Centennial-Eureka still continued in the lead in quantity of ore shipped, with the Iron Blossom second. One of the new properties,

which was brought into the dividend-earning class during the year, was the Chief Consolidated. Such properties as the Yankee, May Day, and others profited by the improved conditions for zinc producers. It is estimated that the zinc production from the Tintic district was close to 8,000,000 lb. in 1912, and that this will be largely increased during 1913 if the spelter market remains strong.

Alta, scene of one of the first mining excitements in Utah, shows signs of revival. The trend during the year has been toward consolidation of properties with a view to economy in operations and to deep drainage. The most important consolidation was that which now operates under the name of the Michigan-Utah Mining Co. This company now owns about 1200 acres of land which it intends to develop at depth. It has solved the transportation problem by means of an overhead tram, with which a projected spur of the Denver & Rio Grande railroad will connect.

Coal development in Utah has had a great impetus through the entry of the United States Smelting, Refining & Mining Co. into the field. This corporation, with an initial investment of approximately $10,000,000, consolidated a number of coal mining companies, and began an extensive campaign of mine development and railroad building. The results will be apparent in 1913.

ARIZONA

BY OUR REGULAR CORRESPONDENT

Copper Mining.—Arizona, already the leading copper producer, is responding to the stimulus of 'high-price' copper in a manner that makes that metal the most interesting factor in the new state's history. The so-called 'disseminated porphyries,' because of their enormous tonnage and the immense concentrating plants required to handle their millions of tons of ore, just now are attracting most attention; and among these the Inspiration Consolidated Copper Co., because of its program of construction, including a 7000-ton mill, is with its neighbors making Miami the present centre of interest. During the past year the Inspiration Copper Co. and the Live Oak Development Co. merged their

MINING GROUPS AT MIAMI.

interests under the name of Inspiration Consolidated Copper Co. From the viewpoint of economy this coalition was deemed necessary. The Miami Copper Co. production for 1912 was about 33,000,000 lb. Its former estimate of 18,000,000 tons of developmed 2.58% ore has been materially increased by recent drillings.

The Ray Consolidated Copper Co. produced about 35,000,000 lb. of copper during 1912 and expects to increase its production to a 70,000,000 lb. basis by 1914. Its 85,000,000 tons of developed 2.2% ore includes the former Ray Central and Hercules, absorbed by the Ray Consolidated last year. The Ray orebody has the distinction of being the third largest, being surpassed only by those of Utah Copper and Chino. Among the low-grade Arizona copper properties now undergoing development, the most promising are the Bagdad Copper Mining Co.'s ground in Yavapai county, the Southwestern Miami in the Miami district, and the claims formerly comprised in the Copper King's holdings at Bisbee. Among the older copper properties the Copper Queen, Calumet & Arizona, Arizona Copper, Old Dominion, Detroit, Shannon, and the United Verde are the great producers, and they have been turning out copper at a steadily increasing rate during the past twelve months and are enlarging their reduction plants. The Copper Queen at Bisbee produced about 82,000,000 lb. last year; the Calumet & Arizona, also in the Warren district, came second with an output of 58,000,000 lb.; the Arizona Copper company's eight mines at Morenci, Metcalf, Longfellow, Garfield, and Coronado turned out more than 36,000,000; the Old Dominion at Globe yielded 27,000,000; the Detroit Copper at Morenci shipped 24,000,000, and the Shannon's contribution from that district was 15,000,000. The gross earnings of the United Verde at Jerome during the past year approximated $5,000,000, although the 1912 dividends were but $6 per share, as compared with $8.25 for 1911. This decrease was due to the increased expense of building a railroad to the site of the 6000-ton smelter now in course of construction, the driving of the Verde adit to tap the ore at the depth of the smelter site in the Verde Valley, and accompanying expenses. The Calumet & Arizona company also is enlarging its smelting plant at Douglas and will handle Shattuck-Arizona ore under a five-year contract. The latter company has about 1,000,000 tons of high-grade ore blocked and when the C. & A. smelter has been completed in July the present daily shipments of 250 tons from that mine will be doubled. Important improvements were made at a number of smelters and all over the state companies operating smaller mines have been building reduction plants.

Gold Mining.—Arizona gold mines have been active during 1912, both as to production and preparatory work. The Commonwealth mine at Pearce is building a $300,000 mill. It will contain thirty 1500-lb. stamps. This mine, in many respects the most remarkable gold and silver producer in the Southwest, has $1,783,000 of low-grade ore blocked. Its rich surface ores have been extracted. The Tom Reed, in Mojave county, during the last months of 1912 produced 120,000 dollars. Its dividends for December amounted to 7% and the board of directors decided that the company could disburse $75,000 in dividends monthly and still maintain the sinking fund. A new orebody has been opened. The cyanidation plant is being perfected and when finished will be one of the best in the United States. The extension of the railroad to the Tennessee mine at Chloride was completed during the past year and shippers from that point will begin this year. Mining activity in the Bradshaw range and adjacent mountains around Prescott has kept pace during the past year with the marked advance in the other parts of the state. The contemplated resumption of work at the Crown Point and Crown King mines is of great interest. The Crown King management last year arranged for the erection of a plant to concentrate ore in old dumps. The mill will be designed to save the zinc as well as the gold. Another interesting utilization of supposedly worthless material is involved in the contract of the United Verde to handle 850,000 tons of Congress tailing. The contract calls for a payment of $1 per ton, but the silicious character of the tailing makes it valuable at the smelter, where the material will be used for converter lining. The gold contents of $1.40 per ton in that way will be recovered. East of Congress the Octavo has been preparing to resume. In Mariposa county the famous Vulture mine, with a record of $16,000,000 production and an estimated additional extraction of $1,000,000 by 'high graders,' is being worked again with a modern mill. The equally historic Harqua Hala gold mine southwest of the Vulture has made preparations to resume work.

Miscellaneous.—During the last three months of 1912 evidence of the presence of oil was discovered in the Verde valley below Jerome. The activity manifested by the Phelps-Dodge, C. & A., Guggenheim Exploration Co., Lewisohns, W. A. Clark, and others in acquiring control of mining prospects throughout Arizona is significant of the development that should mark the present year. Attracted by the wonderfully rich ore in the Superior and Silver King districts the C. & A. and Guggenheim Exploration Co. are engaged

there in active development. The Copper Queen and C. & A. are resuming work at Courtland where the Leadville property was sold for $600,000 in December. The Copper Queen company has also bonded properties in the Patagonia and Big Hat districts. The Magma copper company, producer of the richest copper ore in the state, and the Gibson, which for many years has been the shipper of the world's richest sulphide, maintained a steady output during 1912 and are planning an increase of production for the present year.

NEW MEXICO

During the past year mining in this state was active, especially in Grant and Socorro counties. In the former, the Chino Copper Co. had, at the beginning of the year, two units of its new mill in operation; each treating 1000 tons per day with 70% extraction; three units were added in April and five in September, when 3,549,860 lb. of copper was produced, this being the first time everything worked full time. To the end of November, the output was 25,174,000 lb., that month yielding 4,117,000 lb. of copper, at a cost of about 8c. per pound. Five steam-shovels are working

MAP OF NEW MEXICO.

in the pits of the Hearst and Chino sections of the mine. It is expected that an initial dividend will be paid before long, and production increased.

The Colorado Fuel & Iron Co. is shipping iron ore from its mines at Fierro; while the Phelps-Dodge company erected an electric plant at the Emma copper mine at this place. The Apache Box Canyon shipped a little high-grade ore to the Clear Lake mill, and came in for some comment during the year. Additions were made to the zinc plant of the Chloride Flat company, at Silver City, and ore was shipped to El Paso. At a depth of 30 ft. the Lanamex Mining Co., near Hachita, cut 36 in. of silver-lead ore; the National opened a 4-ft. vein; the Mineral Mountain company started work; and the El Oro has mined good ore. At Pinos Altos, the Utter mine made a shipment of 500 tons of zinc concentrate to Bartlesville, Oklahoma. Shipments of ore were made from the Pacific No. 2 mine, of the Savanna Copper Co. to the smelter at El Paso. The Twin Peaks company is erecting a mill. In Socorro county the Ernestine mine has been operating full time, and now has 30 stamps at work, the mill having been reconstructed, and a power-plant using oil fuel having been completed in the year. In fact, in this district, oil engines of the De La Vergne type, are largely used, and with great satisfaction. Returns from this mine are given in 10-day periods, but the mill has been treating about 3200 tons per month, while the bullion output has been 34,920 oz. and 18 tons of concentrate. The Socorro mines have produced over 5000 tons of ore per month, yielding up to 45,000 oz. of bullion. An extraction of 93% is maintained by concentration and cyanidation. At the mine development is under way on the 600 and 700-ft. levels. The mill is now treating considerable custom ore. The 500-ft. level of the Deadwood mines is opening well, and the mill treats 250 tons per week. During the year the shaft-house and head-frame were burned, and the oil-engine crank-shaft broke. At Kelly the Ozark company is erecting a 200-ton plant, at a cost of $250,000, to treat the lead and zinc ores. The mines have produced largely in the past and seem good for some years yet. The Oaks Co. is developing the Pacific mine, and shipping ore; and the Mogollon company let a lease on the Little Charlie mine to Los Angeles people, the adit yielding high-grade ore. In Lincoln county, the old White Oaks district, 150 miles from El Paso, is having a revival. Coal and water are available near the mines. At the Cat mine a mill is being erected. A suit of interest, involving title to iron mines near Capitan, between the California Industrial Co. of Los Angeles, and the New Mexico M. & M. Co., was decidedly in favor of the former. During the year the Treasure company, in Socorro county, was treating up to 60 tons of ore per day. The ore-bins were burned, but caused little delay. The San Pedro Gold & Copper Co. employs 200 men, and started its smelter in Santa Fe county. It has a 100-ton capacity, and matte is sent to El Paso. At the close of the year low-grade gold deposits supposed to be of unusual size and situated near the border between New Mexico and Colorado were being examined in the interest of Eastern men experienced in mining, and possibly New Mexico will soon become the scene of extensive low-grade gold as well as copper mining.

Reese H. Beddow was appointed State Mine Inspector, this being the first appointment to the position, and new mining regulations have been arranged.

COLORADO

Progress in Colorado during the past year, as perhaps might be expected, has been chiefly along metallurgical lines and is typified by the opening of the state testing plant at the School of Mines at Golden. Largely through the initiative of the president, Victor C. Alderson, an appropriation for the purpose was secured from the state legislature and the plant constructed. The advisory consulting board consists of Philip Argall, D. W. Brunton, Thomas B. Crowe, J. T. Millikin, and W. G. Swart. The plant, which is equipped with full-sized machines and provided with research laboratories, is intended to serve as a testing plant where engineers may treat large lots of ore at minimum expense, as a research laboratory where new methods of treatment for Colorado ores may be sought, and as a working laboratory for the instruction of students. It was discussed at some length in the *Mining and Scientific Press* of December 14 and has aroused great interest throughout the state. The Bureau of Mines has also opened an office and laboratory at Denver, but will probably not construct any large testing works, in order not to conflict with the work of the state plant. It has been urged, and with some reason, that it would be better to have the headquarters of the Bureau of Mines at Golden, but the officials evidently prefer a small laboratory under their own charge for routine work, leaving them free to use the Golden mill in special cases. Early in the year a bill was introduced in Congress providing for establishment of a Bureau of Mines testing plant at Silverton. This did not secure passage. The Silverton people thereupon proceeded to help themselves. Following the successful work of the electrostatic plant of the American Zinc Ore Separating Co. in the Sunnyside mill, which started in March, the construction of a public plant to serve for general customs work and to aid in the metallurgical study of the district was arranged. In the meantime the Iowa-Tiger, Silver Lake, and various other famous mines in this district have produced as usual. At Telluride the Smuggler-Union and Tomboy mills were remodeled during the year under the direction of Gelasio Caetani. The Tomboy mill was de-

scribed in some detail in the *Mining and Scientific Press* of December 28. An essential feature at this mill is the necessity for conserving the water, of which the supply is limited. An attempt was made to increase the rate of settlement in the Dorr thickeners by adding lime. This raised the rate of clear overflow from 70 to 120 gal. per minute, but it was found that the lime interfered so much with amalgamation that its use was discontinued. Pipes take the place of the usual launders in this middling plant, thus eliminating slopping throughout the mill. At the Smuggler-Union the increased zinc content of the ore from the lower levels of the mine made it desirable to remodel the mill in such a way that both zinc ores and those from the upper levels can be treated. The Gilpin county bump tables formerly in use have been replaced by two sets of Wilfley tables, the feed being first classified. The tailing from the tables is re-ground in Hardinge mills and treated on the Triumph vanners previously in use. The tailing goes to the cyanide plant, rebuilt by Walter Read, where the sand tailing separated by Akins classifiers is leached.

MINERAL DISTRICTS OF COLORADO.

The slime is thickened and dewatered on Portland filters, mixed with cyanide solution, agitated in Pachuca tanks, thickened in Dorr thickeners, and filtered. The plant is doing excellent work. At the Liberty Bell mill no changes of note have been made. Deister tables are now in use and are giving satisfactory results. The Suffolk mill of the Ophir company has been rebuilt and minor changes made at other plants. The Camp Bird, which has been near the point of exhaustion for some time, was again revived by a find of ore during the year. In June the resources of the mine were estimated at about $350,000, but since then an additional orebody has been found between the third and fourth levels east below the main adit. This ore averages $25 and is expected to add materially to the value of the property, though even the Camp Bird cannot be expected to last forever. There will be general regret when the old mine 'cashes in.'

At Aspen the Free Silver shaft has been unwatered and through efforts of the Smuggler Leasing Co. and the Hope M. M. & L. Co., the old district is being given a new lease of life. At Leadville the higher prices for the metals reacted favorably on the mines and a gross production of about 60,000 tons per month has been maintained. A new schedule for low-grade zinc ores has been put into effect and carbonate ores containing 22% zinc are now in demand. On the other hand, freight rates to the Kansas smelters have been raised, though not to the extent of interfering with shipments. One of the projects of the year was the formation of a Leadville Mines Pumping Co. to unwater the main downtown district by central pumping. Some such voluntary organization must ultimately be effected unless the state provide, as has been proposed, for the organization of drainage districts in the mining regions.

At Cripple Creek the drainage problem has been temporarily solved by the success of the Roosevelt tunnel. In June 12,000 gal. per minute was being discharged through it and lower ground was rapidly being recovered through the western part of the district. It is estimated that the drainage effected would have cost $3,500,000 in excess of the cost of the work if done by pumping. Plans for connecting with the Vindicator, Golden Cycle, and other mines to the east, are still discussed but nothing definite has yet resulted. Production at Cripple Creek has increased and inroads are being made on the accumulations of low-grade ore in the dumps and stopes. A number of small cyanidation plants are working steadily on oxidized ores. At Stratton's Independence, Philip Argall is treating lump ore at a cost below his estimates, while at the Portland Messrs. Taylor and Crowe continue their good work with the 'Portland process.' An interesting feature of operations at this property is the filling of stopes with sand from the mill. This is not flushed into place but is dewatered and then placed dry by dumping from above. It is expected that the material will pack tight enough to permit work through and next old stopes when, as has often happened in the past, new discoveries make this necessary. In the meantime this use of the tailing minimizes danger from damage suits, already threatening, from the farmers in the valley below. At the Ajax, the new mill is still undergoing adjustment and is being rebuilt so that the announcement of final success must be deferred. Among the big mills at Colorado City the notable event of the year was the final closing of the last chlorination plant, the Standard. The U. S. R. & R. Co. continues to operate its mines at Cripple Creek and is cyaniding accumulated tailing at the mill. The Golden Cycle plant has been operated at capacity as before. An additional Edwards furnace has been placed and numerous ingenious minor improvements have been made. The Portland mill is being rebuilt so as to operate entirely with cyanide, the second unit having been started in May. Merrill presses have been adopted with zinc-dust precipitation. The old cyanide plant originally built to work on tailing has been operating on fresh ore from the mines, but eventually all this is to go through the new presses.

In Clear Creek and Gilpin counties mining matters have gone along with the steady sweep that characterizes the industry in these old standbys. Through the deeper shafts in Gilpin and the Argo or 'Newhouse' tunnel a steady stream of ore has been brought to the surface. The Argo company has progressed to the point of beginning construction of the first unit of the long expected mill at the mouth of the tunnel. This was designed by Arthur Roller and is to be built along the lines of the Hudson mill, including amalgamation, concentration, and cyanidation. A custom mill to treat the ores of the district must necessarily be complex and it has long been proved that no panacea was to be found. In the upper end of the district the Tonopah Mining Co. has a force of men at work examining the Alice mine. This has long been known as a large low-grade deposit. Just how large and whether of present profitable grade will doubtless soon be determined. Rise in price of silver and zinc has helped the mines at Georgetown and Silver Plume and all have been busy.

Legislation regarding the mining industry was not especially important in 1912, though the foundation for far-reaching changes was laid. Influenced by the popular feeling against the 'smelter trust' an amendment to the constitution was adopted declaring reduction plants public utilities. Just what changes this will bring will depend upon future legislation, but the wording of the amendment is so broad as seemingly to include all ore-buyers and custom reduction plants. A much more commendable move was the formation late in the year of a special committee of mining men to recommend to the new Governor and the Legislature changes needed in the mining law. Among others suggested is the enactment of some provision for condemning rights-of-way for power-lines, ditches, and other adjuncts of mining.

WYOMING

By C. E. Jameson

The year 1912 was probably the most prosperous in the history of the mining industry of Wyoming. Increases in the productions of gold and copper were made, while the production of coal and of oil was greater than ever before. Much attention was given the various oilfields during the year, the Salt Creek field, Natrona county, having become important. The production of iron ore, which comes from the Sunrise mine of the C. F. & I. Co., remained the same as in 1911.

The mineral production of the state in 1912 may be estimated as follows:

	Quantity.	Value.
Coal, tons	7,600,000	$13,680,000
Oil, bbl.	2,200,000	1,540,000
Iron ore, tons	1,000,000	1,500,000
Gold, oz.	6,500	130,000
Copper, lb.	150,000	25,500
Silver, oz.	5,400	3,240
Other minerals		2,700,000
Total		$19,578,740

Wide-spread attention was attracted to the Salt Creek oilfield which became a steady producer early in the year. The oil is high in grade while the yield of the wells ranges from 20 to 1200 bbl. per day. Two refineries were erected at Casper in January, having a combined capacity of 6000 bbl., pipe-lines having been laid to the field, 45 miles north, in the preceding year. The refineries have already been doubled and preparations are now being made to again increase their capacity. Fifty-seven wells were drilled during the year, the total number of wells in the field now being 123, of which 102 are productive, 12 have been abandoned, and 9 are drilling. In January one section of land, owned by the state, was leased to the Midwest Oil Co., the royalty rate being 5c. per bbl. Eight wells have been drilled, the first production being made in February, since which time 409,165 bbl. of oil have been produced from this section, while the state has received $20,457 as royalties.* At no time has the entire production been taken, as the refineries are not capable of handling the output of the field. In March the output of one well was handled separately in order to gauge it. The yield of this one well for the month was 29,357 bbl., or an average of 947 per day. The production of which the field is capable is more than 12,000 bbl., though not more than 7500 per day is produced at present. Production of petroleum from the Lander district was somewhat less than in the preceding year. The Wyopo Oil Co., the principal producer, went into the hands of a receiver early in the year, and although some work was carried on in the reservation fields, it was of a desultory character. Production from the Spring Valley and Byron fields remained about stationary. Oil is reported to have been obtained in a well drilled near Cody, but no production has yet been made. Near Moorcroft 7 wells have been drilled and oil, chiefly valuable for lubricating purposes, was obtained. This field will probably be a producer in the spring. Several wells have been drilled near Sundance and, although oil was obtained, the results were not altogether satisfactory. No production was made from the Douglas field. One well was drilled near Glenrock and oil with an asphaltum base, 11.6° Beaume, was obtained. The production of the state for the year is estimated to be 2,200,000 bbl., valued at $1,540,000, an increase of $1,155,000 in value and 1,925,000 bbl. in quantity over the preceding year.

Mining was active in the South Pass gold district and a find of high-grade ore was made near Lewiston. Fifteen tons of ore shipped to Denver netted $700 per ton. The Beck company kept its stamp-mill in operation throughout the year and erected a 50-ton cyanidation plant. The XL Dredging Co. commenced hydraulicking in the spring but, on account of the shortage of water, operated only one monitor. Stamp-mills are now being erected by the Hidden Hand and the Mary Ellen companies. In the Medicine Bow district the Victoria company carried on development during the summer and has opened a rather large body of ore reported to contain $9 per ton in gold. A stamp-mill was erected in the Bear Lodge district, Crook county, but no ore has been milled.

The affairs of the Penn-Wyoming Copper Co. continued to be in litigation, and the smelter owned by the company was idle. But little work was done in the Encampment district. Shipments of copper ore were made from the Esterbrook and Hartville districts. A number of cars of ore shipped from Hartville gave net returns of $20 per ton. No production of asbestos was made from the Casper Mountain district, though the International Asbestos Co. reports a large tonnage of ore ready for fiberizing. The Colorado Fuel & Iron Co. operated its iron mines at Sunrise throughout the year, mining about 3000 tons of ore per day.

*Figures for December are not included.

IDAHO

The estimated operating profits of some of the principal mines of Idaho for 1912, as compared with the preceding year, are as follows:

	1912.	1911.
Bunker Hill	$752,100	$866,550
Federal	720,000	840,000
Hercules	600,000	400,000
Hecla	300,000	240,000
Success	180,000	60,000
Snowstorm	75,000	.....

Results at the Snowstorm are only based on a comparatively few months of work, as the first unit of the 200-ton mill was started about the middle of the year and the second unit during the autumn. The leaching plant is no longer in use. This is a copper mine, the only one of importance in Idaho, as the Lost Packer did not operate during the year. The operating profit at the Hercules is only estimated, as it is not a stock company. The mill has a capacity of 400 tons per day and is unusual in that it consists of two adjacent buildings, the pulp from the Hancock and Harz jig tailing being crushed in Huntington mills and pumped to the top of the other building, where it is dewatered, classified, and treated on Franz tables and Frue vanners. The Federal company operated its three mills, the success of the McQuisten tube plant for treating the tailing from the Wilfley tables being the matter of most interest. The first unit of this plant did such good work that a second was added, starting in July and making 248 tubes in all. The capacity is now 200 tons per day. The feed to the plant contains about 10% Zn, and about one-half of it is separated as a concentrate containing 48% Zn, at a total cost for operation and maintenance of not over 50c. per ton, yielding a good profit on the operation. During the year the Federal company bought the Wilson-Mackay property and is now negotiating for the control of the Star, adjoining the Morning at Mullan.

Early in the spring the Bunker Hill & Sullivan started the second unit of its new mill, constructed by R. S. Handy following the general design of the first unit constructed by Gelasio Caetani two years ago, but embodying important improvements worked out in practice in the interval. The old mill is now being remodeled to form a third unit. The Bunker Hill, Federal, and other companies engaged in milling, combined in the purchase of lands along the Coeur d'Alene river where damage from tailing was alleged and suits were threatened. The Gold Hunter mill has been increased to 400 tons per day and the 50-ton mill of the Black Horse was started during the year. The Success, which has a 250-ton mill in Nine-Mile canyon is shipping a 42% Zn concentrate and an 80% extraction is reported. The operating profit was considerably increased during the year. Work in the Carter district has been stimulated by the introduction of electric power, brought in from Thompsons Falls by the Iron Mountain company. The 150-ton mill of the Wilbert Mines Co., 25 miles north of Arco, was started during the spring and has been shipping silver-lead concen-

trate, making an 80% extraction. The dredging work in the Boise basin was described in some detail by J. H. Miles in the *Mining and Scientific Press* of September 14, page 330. The Boston Idaho G. D. Co., operating a 5-ft. Union-Risdon boat in November, handled 99,560 cu. yd. and had a running time of 82.6%, an unusually good record. There is little of interest to add regarding placer and gold-quartz milling. Serious efforts are being made to establish a state geological survey, and hopes of success are entertained. The year in the Coeur d'Alene was marred by much litigation, some of which has been settled, but much of which is still in progress, so that the year closes somewhat under a cloud.

OKLAHOMA

In common with other Middle Western states the mineral industry of Oklahoma enjoyed a prosperous year. The zinc mines near Miami in the northeast benefited from the high prices prevailing, and the smelters at Bartlesville, which still enjoy the benefits of natural gas fuel, have been growing as those in Kansas were dismantled. The coal

OKLAHOMA MINERAL DISTRICTS.

mines have had an eager market to meet and the demand for petroleum has been such that stocks have decreased despite a slight increase in production. Figures showing runs and stocks in the mid-continental field, including Kansas and Oklahoma, as compiled monthly by *The Oil and Gas Journal*, are presented below:

1911.	Runs, bbl.	Stocks, bbl.
December	4,087,224	50,260,203
1912.		
January	3,857,448	49,876,465
February	3,719,798	49,607,961
March	3,826.496	49,371,119
April	3,671,572	49,022,689
May	4,171,483	49,022,614
June	4,162,648	48,752,055
July	4,468,873	48,865,091
August	4,703,036	48,751,731
September	4,482,978	48,301,432
October	4,896,647	48,093,614
November	4,790,734	47,794,788

TEXAS

While no startling changes occurred in the year, the Texas mineral industry is in healthy condition. At the Shafter silver mine production has continued as usual, but improvements in practice have been introduced. The most important was the substitution of a De La Vergne gas-engine for the steam-engine that has long served so well. In the *Mining and Scientific Press* of December 14, W. S. Noyes gave figures showing that with Texas crude oil for fuel, only 0.425 lb. per brake-horse-power was now used, as against 2.882 with the Corliss engine. Property adjacent to the Shafter has been bonded by the Lewisohns and is being tested under direction of Louis A. Wright. If this venture results in discovery of as good a mine as that owned by the Presidio M. Co., the newcomers will be fortunate. The tin mines near El Paso made no shipment in 1912, development being inadequate to support the plant erected. Conditions in the quicksilver district are discussed on another page by Mr. Dennis. Iron mining in northeastern Texas is developing, and despite the low grade of the ore seems destined to become important. One feature of the year was the commencing of production from the sulphur deposits near Freeport on the coast. The work is undertaken by the 'Swenson Syndicate,' which includes such well known men as James Stillman, J. H. Hammond, and A. C. Beatty. Attention to the sulphur possibilities of this section was attracted a few years ago when several wells that were bored in search of oil upon Bryan Heights, a natural mound situated nearby and about three miles from the Gulf of Mexico, penetrated, at a depth of 700 to 900 ft., a deposit of sulphur. The Swenson Syndicate acquired the land and began systematic testing of the extent of the bed. A number of wells were bored, thoroughly exploring all parts of the mound. The mound is 15 to 20 ft. higher than the surrounding plain and embraces about 1000 acres. No estimates of the amount of sulphur available have been published. It is understood that mining will be attempted by a process similar to that used by the Union Sulphur Co., in Louisiana, and the probable contest with that concern attracts much quiet interest. The Swenson Syndicate is reputed to own oil lands near Tampico, Mexico, and to contemplate importing its fuel from that source. The petroleum industry of Texas and Louisiana has been characterized for the year by extensive wild-catting, but no striking discoveries were made. Production amounts to about 18,000 to 19,000 bbl. per day in Texas and 6000 to 8000 for Louisiana.

ILLINOIS

The mineral industry in Illinois was generally prosperous in 1912. The coal mines were active, and for the first time in several years operators made money. Important changes in the industry are discussed elsewhere. In the oilfields the important feature of the year was the decrease in production. The runs and stocks for the first ten months of the year and for 1911, as recorded by the Ohio Oil Co., are given below. To get total production, approximately 100,000 bbl. per month must be added to the runs to cover oil handled by the Tidewater Oil Company.

1911.	Runs, bbl.	Stocks, bbl.
January	2,160,878.48	26,243,014.70
February	1,994,231.42	25,635,245.01
March	2,589,635.00	23,997,496.00
April	2,173,939.00	24,005,009.96
May	2,209,881.16	24,129,387.96
June	2,208,358.29	23,195,749.12
July	2,292,926.66	22,714,182.54
August	2,340,877.21	22,265,927.92
September	2,179,591.49	21,904,718.65
October	2,195,407.56	21,359,482.42
1912.		
January	1,879,413.30	18,393,303.04
February	1,872,169.87	17,706,834.72
March	1,970,421.14	17,278,537.27
April	1,935,015.12	17,001,287.72
May	2,104,689.43	16,636,328.76
June	2,099,719.88	16,235,352.83
July	2,241,787.12	15,689,993.67
August	2,013,419.46	14,682,822.79
September	1,885,225.99	13,949,064.15
October	1,915,926.31	13,039,507.24

Test wells sunk to the Trenton horizon offer some encouragement, and plans are being perfected for serious exploration of the lower sands. A few small fields have been found in the southern and western part of the state, but as yet nothing comparable to the Clarke-Laurence county fields has been found. The fluorspar mines in the south, and the lead-zinc mines in the north increased production. The output of the zinc mines at Galena amounts now to about 1000 tons per month, mainly of low-grade ore. Important additions were made to various zinc smelters, as described elsewhere by Mr. Hall.

MICHIGAN COPPER MINES

By Robert H. Maurer

As nearly as can be calculated at this time, the output of the Lake Superior copper mines for the year 1912 approximates 219,703,000 lb. of fine copper, as compared with 218,185,235 in 1911. This output, representing a gross value of nearly $40,000,000, was made at a cost of about $22,000,000, or at approximately 10c. per pound for all companies. Approximately 8,000,000 lb. of copper, about 4% of the total, was produced at a loss, this production being the output of companies that are still in the development stage. Omitting this production and considering only the output of the profitable producers, the average cost was about 9.5c. per pound.

Twenty companies contributed to the output for 1912, as compared with 22 in the preceding year, and there are now 19 companies yielding a regular production with a combined output not far from 22,000,000 lb. fine copper annually. There is little likelihood that the present rate of production will materially increase in the next year or two, though a 5% increase is easily possible. New sources of production in the present year, 1913, are seemingly limited to the Hancock mine, the Ojibway, and the La Salle, and will show no marked effect on the annual rate for a year at least. These companies, producing in a small way, yielded a combined output of 1,049,622 lb. in the years 1911 and 1912. Any material increase must come from one or several of the present producers. There is no undue restriction on output, though production would be materially greater were labor conditions more favorable. A number of companies, notably Calumet & Hecla and Osceola, are capable of far greater production. A number of others are gradually increasing their outputs, and all are producing well up to capacity. Where production has materially declined, the cause may be found in the physical conditions of the mine.

A table showing the estimated production in pounds of fine copper of the several Lake Superior companies for the year 1912, and also figures of production for the preceding year, is appended herewith. Official figures will not be available in some instances for several months to come.

Company.	1912.	1911.
Calumet & Hecla	69,197,646	74,130,977
Quincy	20,972,000	22,252,943
Osceola	18,092,925	18,388,193
Champion	16,495,200	15,639,426
Ahmeek	16,368,955	15,196,127
Baltic	13,572,800	15,370,449
Mohawk	12,058,000	12,091,056
Wolverine	9,160,000	9,408,960
Isle Royale	8,096,291	7,090,120
Tamarack	7,670,704	7,494,070
Trimountain	7,288,800	6,120,417
Allouez	5,474,780	4,780,494
Superior	3,881,709	3,326,233
Winona	2,500,000	1,275,675
Mass	2,350,000	1,326,898
Franklin	1,970,755	820,203
Centennial	1,640,435	1,493,834
Lake	1,500,000	318,050
Victoria	1,452,000	1,303,331
Miscellaneous	20,000	1,049,622
Total	219,703,000	218,877,078

The product in 1912 commanded unusually high prices, the average being around 16½c. per lb. This has been exceeded only twice in the past decade, the average price in 1906 being 19.6c., and 20c. in 1907. The average for the decade was 15.12c. The market price, which in the preceding year held steadily around 12½c., advanced sharply just before the close, and in the beginning of 1912 stood at 14.33c. It reached its highest at 17.69c. in September and was holding firm at 17.5c. at the close of the year. The average, which is figured at 16.55c., compares with an average price of 12.63c. recorded in the preceding year. Dividends for the year amounted to $9,069,257, making a grand total to date of $200,030,418. Calumet & Hecla led for the year with $4,200,000, as it does in the totals with $119,100,000. The second heaviest dividend-payer in 1912 was Osceola, which disbursed $1,201,875, making a total of $11,266,250.

MINNESOTA

The year was a prosperous one on the iron ranges. General conditions in the iron trade are discussed on another page, but below are given the latest figures from the various railroad docks, covering iron-ore shipments by lake. Though

STEAM-SHOVEL STRIPPING A MINNESOTA IRON MINE.

these may be changed by a few thousand tons, they are substantially accurate as a final total:

	1912. Gross tons.
Duluth, Missabe & Northern (Duluth)	10,505,577
Duluth & Iron Range (Two Harbors)	9,370,970
Great Northern (Superior)	13,936,899
Soo Line (Superior)	305,000
Lake Superior & Ishpeming (Marquette)	2,224,217
Duluth, South Shore & Atlantic (Marquette)	1,054,085
Chicago & Northwestern (Ashland)	3,776,500
Soo Line (Ashland)	1,018,788
Chicago & Northwestern (Escanaba)	4,050,190
Chicago, Milwaukee & St. Paul (Escanaba)	1,202,600
Total	47,444,826

To this must be added whatever all-rail shipments are made direct to furnaces, which may be heavier than usual. Docks are left unusually clean of ore; the lake season ceased during good weather and did not drag on in freezing cold, as is sometimes the case. The fall has been especially favorable for traffic, which continued in great volume to the very last.

WISCONSIN ZINC MINES

By W. F. Boericke

The year 1912 has been a prosperous one for the Wisconsin zinc district. The fact contributing most largely thereto has been the highly satisfactory price of zinc ore, and the steady and uniform demand for all grades, especially during the past six months. This has enabled the larger companies to mine their low-grade ores at a profit, has increased the ore reserves to a marked extent, and has rendered profitable thousands of tons of material. New companies have come into the field, attracted by the high prices and many of the old mines have been re-opened. The business of mining has been conducted generally on a solid foundation, with no press agent work, and almost entirely by private companies or individuals.

Speaking generally, the year has seen a steady growth of the larger companies in the holdings and scale of operations. There are still a considerable number of mines worked in a small way by lesees, but the number is decreasing. Much of the desirable zinc land is now held by the large operators, who have no intention of leasing. The crude methods of mining formerly in vogue are disappearing, and there is no question but that average costs

for the year in the majority of cases have been substantially reduced. The most serious handicap with which the district has had to contend has been a shortage of labor. Shovelers and drillmen are in demand at nearly every mine, and the winter supply usually confidently counted on has not been forthcoming. Electric power has replaced steam in many of the mines, the Interstate Light & Power Co. of Galena supplying the Hazel Green, Benton, and Platteville fields, while the Mineral Point Power Co. has just completed a power line to Mifflin and Livingston.

Highland.—This field produces by far the largest amount of zinc carbonate locally known as 'drybone' in the district and has had a good year. A large proportion of the 'bone' is mined by lessees, working above the water-level. The best of the ore at this horizon has been mined, but the field is a large one and no doubt further prospecting will show other easily won deposits. The Franklin has shipped largely to the oxide works at Mineral Point. The Kennedy and Wallace have also shipped. The Red Jacket mine has been bought by the Mineral Point Zinc Co., which is heavily interested in the Highland field, and will probably be operated next year. There has been considerable prospection for blende in the formation below the carbonate, with generally encouraging results.

WISCONSIN ZINC MINES IN RELATION TO SMELTERS AND FUEL.

Linden.—The production at this place has been about the same as last year, and there has not been much prospecting. The shipping mines include the Glanville, Optimo, Hinkle, Ross, and the Morrison. The Rajah mine was closed.

Mifflin.—The Peacock mine, for some time conducted at a loss, is now showing a handsome profit. The Squirrel and the Dodger, on the same range presumably, have made a considerable tonnage of high-grade concentrates. The Slack mine has been closed.

Livingston.—The Coker has increased its production largely, and ranks among the big mines of the district. Over 10,000 tons per month is mined. A new double-compartment shaft is being equipped for two cages, an innovation in the district. At present hoisting is being done from three shafts. It is probable that a new mill will be built on another part of the property. The Ellsworth, controlled by the Vinegar Hill Zinc Co., is mining on the Sunrise land.

Platteville.—The Empire, one of the largest mines of the district, is now controlled by the Wisconsin Zinc Co. The mine is in excellent shape, and producing heavily. All the Platteville mines are working full shifts, and the new discoveries on the East End and Klar-Piquette have given an impetus to this field. The East End is reported to have made one of the best discoveries of the year. The Grant County mine has been reopened by the Vinegar Hill Zinc Company.

Cuba City.—The Wilkinson, controlled by the Vinegar Hill Zinc Co., is successfully working some of the lowest-grade ore in the district. The Board of Trade, formerly a heavy lead producer, has been closed. The Baxter has been reopened by the Frontier Mining Co. There is considerable drilling going on in the field, and it is likely to be active in 1913.

Benton and New Diggings.—The Frontier, another of the big mines, besides maintaining its heavy production, has opened a shaft on the Hird fraction. The old Jack of Clubs is now being worked by the Lafayette Mining Co., with a new equipment. The Fields mine at New Diggings is probably the premier of the district, having made a monthly production of 1000 tons of 58% concentrate. The Fox mine, owned by the Mineral Point Zinc Co., has worked steadily throughout the year, on a north and south run, now proved for over half a mile.

Hazel Green.—The Unity has been closed down. The Vinegar Hill, Kennedy, Northwestern, Illinois, Roliy, and Cleveland have all worked steadily and made a heavy production. The Kennedy mine looks especially well. This mine includes the old Winnebago, or Hoskins. The Cleveland Mining Co. lately acquired the Scrabble Creek and will build a mill. The Badger is building a mill on the Big Dad ground. The Mills mine has been closed during the winter. This part of the district has been particularly hard hit by lack of men.

Galena.—The Mineral Point Zinc Co. has had a small force of men prospecting the old Ryan farm, which was a heavy lead producer in early days. The results of the work will be of interest to all in proving this part of the field, which has never been thoroughly tested, and may result in enlarging the present lines materially. The same company has brought the old Black Jack mine south of Galena, and will immediately equip it for a heavy production. The Vinegar Hill mine, north of Galena and near the state border, is still actively worked by the company which, beginning at this property, has expanded its operations throughout the district.

MISSOURI

High prices and unusual activity were characteristic of the year among the mines of Missouri. Lead mining, the pioneer industry of the state, was especially prosperous. While final figures are not at hand, it is probable that the production in 1912 exceeded that of the record year 1910, when it amounted to 161,016 tons of pig lead. Missouri now produces nearly two-thirds of the crude ore, and but little less than half of the total of the pig lead of the United States. The bulk of the production comes from the disseminated lead region of the southeast. The output is now mainly from St. Francois country; the famous old Mine La Motte, the Catherine, and the North American mines in Madison county being all involved in financial difficulties and temporarily out of the running. The territory to the west in Washington county, where disseminated ore is thought to exist at depth, still awaits serious prospecting. The expense of deep drilling through the overlying cherty limestone has so far prevented thorough exploration. In St. Francois county there are five principal companies. The Federal Lead Co., a Guggenheim concern; the St. Joseph Lead Co., and the Doe Run Lead Co., two sister concerns controlled by the Jones, Parsons, and Camp families; the St. Louis Smelting & Refining Co., controlled by the National Lead Co.; the Desloge Lead Co., controlled by the Desloge family. Each of the first three named mine approximately a million tons of ore per year, while the last two together produce another million tons. Some notion of the scale of operations may be gained from the fact that the new Federal mill handles 4500 tons per day and the Doe Run No. 3, now crushing 65,000 tons per month, is being doubled in capacity. Ore containing an average of but 2% lead is being treated by one company and it is to be remembered that lead is practically the only metal of value in the ore. While the concentrates contain an average of one ounce of silver per ton, the metal is only de-silverized at one plant. At the Federal, H. A. Guess, the capable manager, saves a small amount of zincy iron-copper concentrate. This has been re-treated in a magnetic separation plant and small shipments of copper ore have been made for some time. Temporarily the zinc product has been stored but ultimately it, too, will be made to swell the profits. The cost of mining and milling, because of the simple character of the ore, the large scale of operations, freedom from timber expense, and low cost of fuel, has been brought down to low figures. Roughly, the mining costs 80c. per ton and milling 20 to 30c. With legitimate overhead and selling expense ore can be handled in this district at a total cost of $1.25 per ton and as a matter of fact, all the companies are making excellent profits.

Dissatisfaction among minority stockholders in the St. Joseph and Doe Run companies was voiced at the annual meeting by Robert Holmes of St. Louis and has led to action in the New York courts since. No criticism of the technical work has been made, though the policy of continuing to operate the old Doe Run mill, finally closed last fall, was questioned. O. M. Bilharz, who has charge as engineer of the mines and mills of the companies, is credited with having done excellent work. D. A. Jones, president of the companies, points out to stockholders that the Doe Run, since its organization in 1866, has increased its holdings from 100 to 7057 acres. In the past year 932,220 tons of ore has been hoisted, yielding 53,080 tons of concentrate and 33,729 of metallic lead, worth $2,267,155. All expenses, including operation and interest, amounted to $1,687,167. The approximate net profit was $576,988. A 3% dividend was paid in place of the usual 6. It is estimated that next year, due to economies and enlargement of No. 3 mill, the net income will be doubled. Because of an active campaign of land buying it became necessary a year ago to issue $2,000,000 worth of bonds. As representing the bond-holders, Philip N. Moore was made a director and consulting engineer for the Doe Run company last year. A part of the bonds have already been retired and no one doubts the soundness of the two companies though probably some economies in the New York office may be effected. The National and Desloge companies have had a prosperous year and are doing excellent work.

Zinc, in the production of which Missouri also leads, enjoyed unusually high prices in 1912 and as one result a record production was made. On p. 31 of this issue will be found a detailed statement of shipments and prices. The year has been marked by the re-opening of many old mines at Joplin and many improvements in practice. Entry of the large companies, notably the American Smelters Securities, into the field will undoubtedly result in material changes in methods. The average zinc content of Missouri ores is given by C. E. Siebenthal of the U. S. Geological Survey, as 1.5%, which means a value in the ground of $1.80 to $2.10 per ton. Allowing for the inevitable metallurgical losses, it will be seen that Missouri zinc mining must needs be conducted with great care to assure any profit.

In 1911 the state produced silver to the value of $26,430 and copper worth $80,051. Both these items will show an increase in 1912, since both are in part related to lead production. In addition copper is mined separately at a number of points in periods of high prices. At the close of the year the St. Genevieve and the Sullivan copper mines, in particular, were being reopened. Iron mining continues, but is not extensive. Within the year the state Bureau of Geology and Mines distributed an excellent report upon the iron deposits. Coal mining and the quarry industries enjoyed their share of the industrial prosperity now dawning in the Middle West.

SOUTH DAKOTA

By Jesse Simmons

Gold production from South Dakota in 1912 broke the record. The best previous year was 1911, when $7,636,555 was turned out. Over 90% of the gold production of South Dakota comes from Lawrence county, where are the Homestake, Wasp No. 2, Trojan, Golden Reward, Mogul, and other large mines. Mining is confined to the Black Hills. The remainder of the state is farming country; many counties lacking even deposits of stone suitable for foundation rock. The Black Hills has been a producer of gold for 37 years, commencing with $1,200,000 in 1876 and gradually increasing nearly every year, until the present. The total production of gold in the district according to the United States Geological Survey, was $162,940,149 up to and including 1911. It is safe to say that the next period of 37 years will show a far greater output than the past.

The Homestake, at Lead, is the world's greatest gold mine. This is said advisedly. It has paid the greatest number of consecutive dividends, has the greatest quantity of ore blocked out, and on the immense scale of operations makes the best recovery at the lowest cost. It has paid dividends since 1877, with only two interruptions, once when a fire in the mine and another time when labor difficulties caused a suspension. The mine today contains an ore supply sufficient for the present scale of operations for 20 years. The six mills with 1000 stamps handle a little more than 4175 tons per day. The average yield is a little better than $4 per ton, and only slightly in excess of 5% of the gross value is lost in the tailing, the treatment of amalgamation, sand leaching, and slime treatment in Merrill presses, yielding nearly 95% of the gold. The year 1912 was the most prosperous in the experience of the Homestake, and in recognition of the loyalty of the workmen, the company in November announced that it would pay to each employee who was with the company during the year and employed in December, a check equal to 7% of his earnings for the year. This is a bonus, and the success of future operations will determine whether it shall be annually distributed. Another gratuity to the employees is the construction of Recreation Hall, equipped with reading rooms, baths, billiard rooms, bowling alleys, and an opera house seating 1000. This will be completed at an estimated cost of $200,000. Its privileges will be free to employees of the company. A meeting of stockholders will be held in San Francisco in February when a proposal to increase the capital stock will be voted upon. It is planned to declare a stock dividend of 15%. The payment of such a dividend will require the issuance of 32,760 shares of stock, making the total 251,160 shares. To pay the usual

monthly dividend of 50c. per share $125,580 will be required, an increase of $16,380, or $196,560 per year—practically the same amount as will be called for by the payment of the 7% bonus to the employees. The most important improvement of the year was the completion of the Spearfish hydro-electric plant. This plant has been in operation since summer, and all of the stamps and rock crushers are now driven by the electric power generated here and at the Englewood plant. Further applications of electric power are to be made, and within a few months the entire 5450 available horse-power will be in use. The introduction of this power saves at least $40 per horse-power per year over the cost of operating steam-engines in the various mills.

The Wasp No. 2 had a prosperous year—the best in its history. The mine paid $85,000 in dividends, making a total of $381,965 to date. The property was operated steadily throughout the year at the maximum capacity of the mill, 15,000 tons per month, excepting 40 days in January and February when bad weather interfered. Only the ordinary improvements and repairs were made during the year. The steam-shovel was used to advantage for the first full season, and made a decided reduction in stripping costs. This is the banner low-grade mine of the world, the total cost of mining and milling running $1.25 per ton. The net bullion recovery is under $2 per ton.

The Golden Reward is just putting the finishing touches on a roasting plant of 75 tons daily capacity, built to give the ores of the Astoria mine a preliminary roast before they are sent to Deadwood for treatment in the company's cyanide mill. The plant will also be used for experimentation on the so-called 'blue ores' of the Bald Mountain district as it is believed that roasting will make them amenable to cyanidation. The plant is constructed on the unit plan, and at little expense it can be doubled in size should its operation prove successful. The Wedge furnace is used and Wyoming oil will be the fuel. The plant was erected at the Astoria mine, where late developments have exposed a body of ore containing over 200,000 tons, with the limits not yet defined. This ore roasts easily and then makes an almost perfect cyanidation material. The mill at Deadwood was operated steadily.

The Trojan company operated steadily, handling about 200 tons per day in the cyanide mill. A number of improvements were made, the most important of which was the opening and equipment of the Portland mine with air-compressor and electric hoist, the building of several thousand feet of tramway, and the erection of a complete machine shop. Plans for the present year include the doubling of the mill capacity. This can be done by adding tanks and slime treatment, the crushing and grinding departments being ample for the increased tonnage.

In March the mill of the Mogul company, at Pluma, was destroyed by fire, and was not rebuilt. The balance of the year a small daily tonnage, largely from the Lucile mine, was shipped to the Lundberg, Dorr & Wilson mill, at Terry. The insurance on the burned plant is in the hands of trustees, and this fund, with what machinery can be utilized from the old mill, will be sufficient to provide the company with a good plant. This, it is stated, will likely be erected near the mine, perhaps at or near the Snowstorm property, in Nevada gulch. Lundberg, Dorr & Wilson confined the operation of their plant at Terry largely to the treatment of custom ores, although some rock from the Buxton and Big Bonanza mines, belonging to them, was treated. The mill operated steadily through the year.

The Victoria, in the Spearfish canyon district, and the Black Hills Standard, at Ragged Top, made small productions, but each promises to yield more the present year. The New Reliance mill was equipped with four Dorr thickeners and a Portland filter, and after a suspension of several months, while this machinery was being placed and other necessary changes made, is now in operation. It is stated that the continuous decantation process is proving more satisfactory than any previous method attempted for treating slime at this mill. The mill crushes about 100 tons daily, 30 stamps being employed. The Richmond mine, at Galena, was a steady producer of small quantities of silver-lead ores, shipped to the Omaha smelter. The Monarch mine, in Two Bit gulch, produced good grade smelting ores, as did a number of properties in the Bald Mountain district. The Forest City mine, at Hill City, erected a 5-stamp mill and is operating continuously. The Golden Summit produced several thousand dollars' worth of high-grade free-gold ore, much of it specimen rock. The Bismarck company, which owns a property adjoining the Wasp No. 2, has practically completed a 300-ton mill, which will shortly be in operation.

The Black Hills Smelting Co., at Galena, has completed a 150-ton smelter, and will blow it in early this year. Title to the Golden Crest was to be adjusted soon, and there was every indication that before the end of the year the mill would be in steady operation. Among the development projects one of the most important finds was that in the Gilt Edge mine, at Galena, where a body of heavy pyrite was found, which it is proposed to ship to the smelter in quantities of about 25 tons per day when the plant is started. The North Homestake, at Maitland, completed the shaft to the 620-ft. level and did several hundred feet of cross-cutting. The Gold King company was organized and started development on a property at Rochford, that at the present time is showing up well in the shaft. The Imperial Copper Co. at Custer Peak, started shaft work, and reports encouraging progress and satisfactory developments. The Deadwood Homestake Co. was organized, and funds are being raised to sink 100 ft. east of the Homestake. The Republic Mining Co., a reorganization of the Golden Gate Co., installed electric machinery and started on a plan of work destined to thoroughly develop the property. The Otho company is developing a property at Spokane, and for equipment a portion of the machinery in a mill at Mystic is being moved. The Cleopatra property has passed to the bondholders under a foreclosure sale, and a new company will be organized for operating it. The Minnesota company paid all of its indebtedness and back taxes, and development work will probably be undertaken before long. The Branch Mint company paid back taxes in full, and will probably attempt to operate this year.

The completion of the hydro-electric plant of the Dakota Power company, on Rapid creek, near Pacola, affords further electric energy for the Black Hills operators. A contract has been made with the Consolidated Power & Light Co. to sell the surplus, about 1000 hp., to the latter.

THE BLACK HILLS DISTRICT.

MONTANA

Operations of smaller companies in Montana are overshadowed by those of the Anaconda Copper Mining Co., which with its copper mines, mills, and smelters, coal mines, and timber lands, is the greatest factor in the mineral industry of the state. To discuss its operations in detail would require too much space, and only general features can be touched upon. Production from the mines was considerably increased, as a reflex of the increased price of copper. Increased use of electric haulage underground, and the progressive substitution of compressed-air hoists for the old steam hoists on the surface, are the most notable features of mining work. The compressed-air hoisting system was described in the *Mining and Scientific Press* of November 2, 1912, p. 554. At Great Falls it is announced that the smelting plant will be reconstructed, at an estimated cost of $2,500,000, the present plant being out of date. At Anaconda the mill is being partly remodeled following an improved flow-sheet developed at the Great Falls plant. The Anaconda company has donated $25,000 toward the construction of a state sanitarium for patients suffering from tuberculosis and miner's consumption. The state recently voted $20,000 for construction and $5000 annually for maintenance, and construction has been started near Anaconda. The former agreement between the mining companies and the workmen expired during the year, and after some parley a new three-year agreement providing for a minimum wage of $3.50 per day underground and $3 on the surface was made. When copper sells between 15 and 17c. per pound, this rate is to be increased 25c. When copper is over 17c. the rate for underground work is to be $4, and when over 18c. for surface work $3.50 will be paid.

Purchase of the Southern Cross mine, in the Georgetown district, by the Anaconda Copper M. Co., and completion of an 18-mile extension of the Butte, Anaconda & Pacific railroad through Warm Springs canyon to the property has greatly stimulated the development of adjacent properties, and good finds have been made in Stuckey's gulch and elsewhere. The Southern Cross ore carries a fair content of gold and contains 20% excess iron, so that it forms a welcome addition to the smelting charge.

The Butte & Superior Copper M. Co. has exhibited a variety of changes during the year. It is a zinc producer, despite its name, and at the beginning of the year shipped its ore to the old concentrator at Basin, while its own plant was under construction. A new hoist has been erected and a new head-frame is under construction in order to permit hoisting of a greatly increased tonnage. The 1000-ton mill was finished about the middle of the year, and in it ordinary concentration was followed by the Hyde flotation process. The Minerals Separation, Ltd., in the employ of which Mr. Hyde had formerly been, promptly brought suit against the Butte & Superior company for infringement. Meanwhile, Hayden, Stone & Co. and the Utah Copper interests acquired the control of the company and certain changes have been made in the mill, which has been treating about 400 tons per day. G. O. Bradley and F. G. Janney will have general supervision of the changes made. The capital stock of the company has been increased to $3,500,000, the increase of $1,000,000 being intended for the exploration and purchase of other properties, and 15 claims lying north of the Butte & Superior have been taken under option for $536,000. A. B. Wolvin has recently organized the Butte-Duluth Mining Co. to take over the Montgomery and Macarona and portions of the Altoona, Amazon, and Colleen Bawn claims, lying east of the East Butte and adjoining the Bullwhacker Copper Co. The ground is supposed to contain large bodies of silicious copper ores, which are to be mined with steam-shovels and treated in a 500-ton leaching plant, of which a 100-ton unit is under construction. A 50-ton leaching plant has also been constructed at the Bullwhacker, which is owned by Patsey Clark, but it is not at all certain as yet that the process can be carried on at a profit.

The East Butte Copper Co. has done well during the year, and under the capable management of Oscar Rohn the plant has been enlarged and improved without interrupting its operation. The discovery of some good ore-bodies has much improved the position of the company, and from the operating profits $2,000,000 has now been paid over on the $2,500,000 bond issue held by Pittsburg banks, and 100,000 shares of East Butte stock has recently been turned over to the old Pittsmont company in payment for its interests. According to the report of the State Mine Inspector, the development work in the Butte district as a whole shows nearly a 60% increase over preceding years. He also estimates that the general introduction of electric power in the mines will finally effect a saving of 1c. per pound in the production cost of copper.

The advent of cyanidation in Butte was signalized by the construction of the 200-ton plant of the Butte Central Copper Co., built by the Colorado Iron Works under the direction of John E. Rothwell, in which it is expected to save 64% of the gold and 40% of the silver by concentration, making an added recovery of 35% of the gold and 43% of the silver by cyaniding the tailing. The plant was expected to begin work at the end of the year.

Interesting experimental work has been in progress at the Butte Reduction Works, where tests have been made upon the tailing dump, in which it is estimated there is 1,500,000 tons containing 1% copper. Both the Minerals Separation, Ltd., process and McQuisten tubes are being experimented with to determine which will make the greater saving at the lesser cost. The Timber Butte Milling Co. was incorporated early in May by W. A. Clark, W. A. Clark, Jr., W. D. Mangam, A. J. Johnson, and J. K. Heslet, with a capital of $100,000, to construct a zinc concentrator for the Elm Orlu and Poser mines on the west side of Timber Butte, 2 miles south of Butte. The Elm Orlu was operated at a loss of $22,000 during the year ended June 1, having been shut down from beginning of 1912 because of the burning of the Butte Reduction Works.

The Boston & Corbin Copper & Silver Mining Co. expects to have its 200-ton concentrator for milling a chalcopyrite ore, at Corbin in Jefferson county, in operation by next February. The Corbin Copper King M. Co. was incorporated to take over the property of the Montana-Corbin Copper Co. The La France Copper Co. at Butte was sold by the sheriff on December 3, and was bid in by a representative of the Lincoln Trust Co., the bondholders, for $100,000. The shareholders will receive nothing.

At Marysville the St. Louis Mining Co. is constructing a 100-ton milling and cyanide plant to handle the bodies of low-grade ore remaining in the Drumlummon mine. Work in the Radersburg district has been greatly stimulated by the repeated announcement that a branch line of the Chicago, Milwaukee & Puget Sound railroad will be built from Three Forks. The Kalispell-Lincoln G. M. Co. has constructed a 3-stamp mill on its property in the West Fisher district, 35 miles south of Libby. At the Bald Mountain mine, in Lewis and Clark county, Thomas Cruse has a 20-stamp mill and cyanide plant at work and is turning out about $40,000 per month. The Kendall gold mine, at Kendall in Fergus county, has finally closed down after 13 years of operation, and having paid $1,500,000 in dividends on an original purchase price of $400,000. In the Cottonwood district, 25 miles south of Billings, a good deal of interest has been awakened in the possibility of developing oil and gas, and the Yellowstone Oil & Gas Co. and the Billings Oil Co. have been formed. Drilling has just been started.

The Barnes-King has purchased the North Moccasin for $150,000, of which $5000 is cash and the remainder is to be paid out of net profits of mining operations. The Moccasin will be worked from the 400-ft. level of the Barnes-King. The Piegan-Gloster has also been secured for $125,000. The Barnes-King started its 100-ton cyanide plant in December. The Calumet & Montana has acquired the King Solomon mine, 2½ miles from Clancy. The Snowshoe mine, 12 miles from Libby, has been taken over by a new management, R. C. Davis in charge, and a mill constructed to treat the silver-lead ore. The Amazon-Montana Development Co. canceled its lease on the Amazon, 30 miles east of Butte, and has taken over the Florence silver-lead mine at Neihart as the Florence Mining & Milling Company.

Development of hydro-electric power and its application

to industry has been one of the marked characteristics of the year. Early in December a $100,000,000 merger, known as the Montana Power Co., was formed in New Jersey to take over the Butte Electric & Power Co., Billings & Eastern Montana Power Co., and the Montana Power Co. The Great Falls Power Co. will not enter the merger, but some of its largest shareholders are interested. This is probably a step in the long-talked-of electrification of the transcontinental railways. The Butte, Anaconda & Pacific has nearly completed the electrification of its line, at an estimated cost of $1,000,000, and will use 8000 hp. The Chicago, Milwaukee & Puget Sound is said to be planning to electrify its line over the continental divide, and possibly the lines through the Belt and Coeur d'Alene mountains. If this is done, it will use 16,000 to 20,000 hp. more.

WASHINGTON

Interest in this state has centred mainly in the Republic and Chewelah mining districts, in Ferry and Stevens counties, respectively. The mines and mills of the former districts were described by Sidney Norman in the *Mining and Scientific Press* of August 24, 1912. Republic was resurrected about 4½ years ago, and there are now over 400 men employed, and a population of over 2000 people. The North Washington Power & Reduction Co. was organized with the idea of treating ore from the Republic mine, and customs shipments. During its year ended May 31, the company shipped 20,646 tons of ore, worth $382,118, and made a profit of $42,737. A power-line was built from Grand Forks, British Columbia, to Republic, and the cyanide plant enlarged to 5000-ton capacity per month. In May 3077 tons was treated. The Republic Mines Corporation, which paid $85,000 in dividends in 1912, opened a stope over 70 ft. long on the 400-ft. level, while good ore was mined from above the 500-ft. level. At the San Poil the 125-ton mill was started. The crushing department consisted of a Williams pulverizer, which has 32 swinging hammers fixed to a central spindle rotating at 600 r.p.m. From Eureka gulch, the Knob Hill company shipped ore averaging $32.31 per ton to smelters, and paid $5000 in dividends. The Hope Mining Co. is building a mill. The Anaconda Gold Mining & Reduction Co. was organized with a capital of $2,000,000 to take options on mines in the Republic district. In an adit 1268 ft. long, the Faithful Surprise Co. intersected two veins. The Quilp Mining Co. pays dividends from royalties on ore mined by the Imperator-Quilp Co. The latter recently sued the former for $410,000, alleging fraud in the terms of working. The Washington Water Power Co., of Spokane, is investigating Republic and Chewelah with a view to extending power-lines into the districts. Spokane people have been largely instrumental in developing the copper-silver veins of the Chewelah district. At the United Copper mine, the largest producer, one vein has been opened by an adit to a depth of 500 ft., and driving has proved an ore-shoot 1400 ft. long. A lower adit, which is being driven from near the mill, will give 600 ft. extra depth. Dividends amounting to $50,000 were paid. The Copper King, north of the United, is working on the same vein to 400-ft. depth. The Aurora group lies north of the Copper King, and is being developed by a drift from the 400-ft. level of the latter mine. A plant to cost $100,000 will be erected. At Blue creek, the Liberty Copper Mining & Milling Co. is building a 100-ton mill. During the year the International Power & Manufacturing Co. decided to utilize 10,000 hp. of the Pend Oreille, and erect a power-plant for various manufactures. The Superior copper mine, at Brown's Lake, was leased, a lode of copper-silver ore 9 ft. wide was opened, and shipments made. Other properties are being prospected with fair results. In Pacific county there was a rush to South Bend, and one party of 50 men came into collision with civil authorities through their occupying the Ellsworth ranch. The Tacoma Smelting Co.'s plant, in Pierce county, was overhauled and enlarged. The electrolytic refinery was treating 30 tons of copper daily, while the balance of production was shipped to Eastern refineries. The Arnold Engineering Co., of Chicago, studied the Sultan district of Snohomish county, and found that 106,000 hp. could be developed by a hydro-electric plant, at a cost of $5,630,000. Spokane has been a busy mining centre during the year for mines in Washington, Idaho, and British Columbia, and the stock market has been well patronized. The Spokane section of the A. I. M. E. met on February 17 and July 26; papers were read and mines inspected. The important meeting of the year was that of the American Mining Congress, on November 25, and following week, when important subjects were discussed and the mines of the Coeur d'Alene district visited.

OREGON

Mining has been conducted on a small scale at a number of properties throughout this state, mainly in Baker, Grant, and Josephine counties. At the Bonanza mine, in which Pittsburg men are interested, several veins are being developed, and an adit 1800 ft. long is being driven. After being full of water for about 10 years, the Mammoth mine is being reopened to 400-ft. depth. The Cornucopia Mines Co. has built an electric-power plant of 400-kw. capacity. Copper ore has been mined from several claims below Ballard Landing on Snake river. In an adit, the Laclede Consolidated Gold & Copper Co., near North Powder, has opened an 8-ft. lode. An electrically-driven 20-stamp mill is in operation at the Virtue mine. The North Pole mine has been shipping about 10 tons of ore per day to the Tacoma smelter. At the Rainbow mine a 15-stamp mill, embodying amalgamation and cyanidation, with a tube-mill, Kelly filter-press, and Merrill zinc-dust precipitation, was built. Power is supplied by the Idaho-Oregon Light & Power Co. A good deal of work is being done at the North Fork placer mines, and the Yuba Construction Co. has built a dredge for the Powder River Dredging Company.

In Grant county, the Ben Harrison mine, at Granite, has 20 stamps, concentrating tables, and a tube-mill working. The mine has been opened to 500-ft. depth by an adit and shaft 100 ft. below this. An electrically-driven 16-drill compressor supplies air for the mine. During the year it was decided to build a railroad from Grants Pass in Josephine county, up the Applegate river, to the mines of the Blue Ledge district. On Grave creek, 14 miles from Grants Pass, 3000 acres of land was bought by the Oro Power & Light Co. of California. Drilling is being done with a view to dredging. The Alameda smelter was started, and a 200-ton mill is to be built. The Oriole company erected a 50-ton mill, costing $70,000, at Grants Pass. On the Rogue river, the Minnehaha Gold Hydraulic & Dredging Co. was building a dredge to cost $50,000. The West Coast company has been producing gold from the Champion mine and mill. Ore from the Musick claim is sent to the 30-stamp mill over an electric line about one mile long. The Eureka corporation was to erect a custom mill at High Grade, in California, just over the state border. At Applegate, in Jackson county, a chlorination plant of 100-ton capacity was erected at the Oregon Strong Ledge mine. In Douglas county the Beaver Hill mine, near Anchor, cut a vein at 400 ft. in an adit, and another adit is being driven. The Oregon-Colorado mine is 900 ft. deep, and a smelter was to be erected for the copper ore. In January lectures on mining geology were begun by the mining engineering department of the Oregon Agricultural College, at Baker City. At Medford, in February, the Southern Oregon and Northern California Mining Congress held a meeting. There were exhibits of ore and machinery, and discussions on various mining topics.

ALASKA

*This territory had a good year in 1912, and preparations in progress indicate that the year just commencing will be one of increased activity, from Juneau to Nome. The past season lasted longer than usual; consequently prospecting, dredging, and other work has prospered. A good deal of

*Based upon advance sheets of the annual report upon the mineral resources and production of Alaska prepared under direction of Alfred H. Brooks of the United States Geological Survey.

development will be done this winter, and each succeeding winter sees more accomplished in this way. The Treadwell group continues to treat 120,000 tons of ore per month, and the erection of a 6000-ton mill for the Alaska Gold Mines Co. should be finished this year and help to swell the output of gold. At Katalla, a petroleum field is being developed, and during the year the Bureau of Mines mined 800 tons of coal for a naval test. In the Copper River district the output of copper ore increased in spite of snowslides and washouts on the railroad. Fairbanks is now more interesting from the fact that there are 16 stamp-mills in operation. At Iditarod more dredges are likely to be erected on Flat creek.

It is estimated that the total value of the mineral output of Alaska in 1912 was $21,850,000, compared with $20,650,000 for 1911. The value of the gold output of 1912 is estimated at $16,650,000; that of 1911 was $16,853,256. It is estimated that the Alaska mines produced 28,940,000 lb. of copper in 1912, valued at about $4,630,000. In 1911 the output was 27,267,871 lb., valued at $3,364,584. The silver production in 1912 is estimated to have a value of $300,000, as compared with $243,923 for 1911. The value of all other mineral products in 1912, including tin, marble, gypsum, coal, and petroleum, was about $260,000, compared with $176,942 in 1911. The total value of Alaska's mineral production since 1880, when mining first began, is, in round numbers, $229,000,000, of which $202,000,000 is represented by the value of the gold output. The total output of copper in Alaska since 1901 is about 90,000,000 lb., valued at about $13,145,000.

The increase in the value of Alaska's mineral output is to be credited to the larger copper output as compared with the previous year. While no new copper properties were put on a productive basis, a large amount of development was accomplished. The gold-mining industry was marked by important advances in developing lode deposits. Work was continued on a number of large lode-mining enterprises in the Juneau district, and considerable advances were made at Fairbanks and in other districts. In addition to this, promising discoveries of auriferous quartz were made at Port Wells and in the Innoko-Iditarod region, as well as in other parts of the territory. The output from the placer mines was less than in the previous year. On the other hand, discoveries of rich auriferous gravels were made on Hammond creek and in the Koyukuk valley, and workable placers were found in the Ruby district. Extensions of gold-bearing gravels were also found in several of the older districts. The building of large plants has not gone ahead rapidly enough to insure the keeping up of gold-placer production. It is significant, however, that the output on Seward peninsula was practically the same as that of 1911. The maintenance of this output is to be credited to the dredges. The data at hand indicate that in 1912 about 40 dredges were operated in Alaska, and a number were under construction. Of these, three are in the Fortymile, one in the Fairbanks, one in the Birch Creek, and one in the Iditarod district, one on the Kenai peninsula, and the rest on Seward peninsula. There has been no change since the previous year in the opening of coalfields. One coal mine was operated for a part of the year at Chignik, on the Alaska peninsula, and the mining of coal for local use was carried on in a small way elsewhere. Investigations were made in the Bering River coalfield under the joint auspices of the Navy Department and the Bureau of Mines, to determine the availability of the coal for naval use. One oil well was drilled at Katalla, and there was a small production of petroleum from this field, the oil being refined near the well, and the gasoline disposed of in the local market.

Except for the continuation of the work of the Alaska Road Commission in the building of wagon-roads and trails, there was no marked improvement in transportation facilities during the year. The total railway mileage for Alaska in 1912 is 465, the same as during the previous year. Most of the railways were operated, except those on Seward peninsula. The Copper River & Northwestern was blocked by landslides for about six weeks in the early fall. In accordance with an Act of Congress, the Alaska Railway Commission was appointed about September 1 and spent about three months in the territory investigating railway routes and conditions of transportation. The report of this Commission is in preparation.

It is estimated that there were about 22 gold-lode mines in Alaska that made some production in 1912, compared with 18 in 1911. In addition to this, development work was done on many lode prospects widely distributed over the territory. The value of the output from the auriferous lodes in 1912 is believed to be about $4,600,000, an increase of about $400,000 over that of the previous year. This increase must in large measure be credited to the Treadwell group of mines, but there was also a considerable production from various small properties in different districts. The most notable mining advances in the territory during the year were those in the Juneau district. The Treadwell mine increased its gold output. Work was continued on the 6000-ft. adit of the Alaska Juneau mine and was begun on an adit for the Alaska Gastineau, which will be about two miles in length. It is to undercut the Perseverance orebody, which, with adjacent properties on Sheep creek, has passed under one management. The ore is to be carried to a mill of 6000 tons daily capacity, which is to be erected at tidewater. The Cliff mine, in the Valdez district, continues to be the only gold-lode property in the Prince William Sound region which has made a considerable output. In the aggregate, however, considerable ore has been recovered from other properties incidentally to development work. Although the output from the Fairbanks placers has decreased, there was far greater activity in lode mining and prospecting than in the previous year. From the stamp-mills the average recovery of free gold is about $50 per ton. Lode prospecting has continued with increasing activity during the year, and probably more than 200 men were engaged in this work. As a result a number of quartz veins were disclosed, some of which promise well. The notable features of the lodes are their great number, small size, and high tenor. Most of the veins from which free gold can be obtained by panning are composed almost entirely of quartz, with sulphides either absent or present only in small amounts. Stibnite is the most common of the sulphides.

The Jumbo and Rush & Brown mines were the only considerable shippers of copper ore in the Ketchikan district. It appears that the Mount Andrew mine was idle for most of the year, but plans have been formulated for systematic development. The Kennicott-Bonanza mine is the only one in the Kotsina-Chitina district from which shipments were made in 1912, but a large amount of development work was done on other properties. The concentrator erected in 1911 at the Bonanza mine was operated during 1912. At the east end of the field, work was continued on the Mother Lode, Nikolai, and Westover properties, and also on a property on an island in the Kennicott glacier. Prospecting and development work were especially active in the vicinity of Kuskulana river. Here the largest operations were those of the Great Northern Development Co., which completed about 5000 ft. of development. The Alaska Consolidated Copper Co. carried on development on Nugget creek, and on the Rarus group of claims. The Alaska United Copper Exploration Co. continued work on the Blackburn group of claims on Porcupine creek. In addition to the above, a large number of claims were being opened in the Kuskulana region during the summer of 1912. This field is now readily accessible from the railway, and a branch has been surveyed which would permit the shipment of ore. On Prince William Sound shipments were made by the Ellamar Mining Co., the Three-man Mining Co., the Landlocked Bay Copper Mining Co., and the Beatson Copper Co., all on Latouche island. In addition to these productive properties, there were a large number of claims at which development was carried on, some of which give promise of soon reaching a shipping stage.

In connection with tin-mining, the dredge which was installed on Buck creek last year was operated throughout the open season of 1912, as elsewhere noted. The Lost River lode-tin property has been bonded, and is now being systematically developed. The results of these operations

in 1912 are reported to justify further investments and the erection of a mill. This property promises to become the first productive lode-tin mine in Alaska.

The returns from the Alaska placer mines are far from being complete, but information at hand indicates that the value of the output in 1912 was $500,000 below that of 1911. The Fairbanks district continues to lead in the production of placer gold. It is estimated that between 130 and 140 different plants were operated, and 900 to 1500 men were employed. In the Circle district 27 mines were worked in winter and 32 in summer, employing from 60 to 100 and 145 to 175 men in each season, respectively. The Fortymile district had a good season, also the Koyukuk section. About 150 men were working in the Ruby Creek district, and production was over $150,000. In the Iditarod district 34 mines, distributed on six creeks, were worked, and 650 men employed.

THE PITTSBURGH DISTRICT

By Stephen L. Goodale

In spite of its being a presidential year, 1912 has been a very satisfactory one in the Pittsburgh district. Prices have been good and increasing, and at the close, in many lines, a considerable bonus is being secured for early deliveries. The mills entered the year with their order books filled, although the prices at which most of the work had been taken were low. The pig iron production for the whole country reached in October and November the remarkable rate of 32,600,000 tons a year—the previous high record being a million tons less. Production and prices in the Pittsburgh district are shown in the following table:

MONTHLY PRODUCTION AND PRICES

	Furnaces in blast	Pig iron output.	Basic iron at Valley furnace.	Bessemer iron at Pittsburgh....	Prompt furnace coke at oven.
January	35	495,099	$12.35	$15.05	$1.82
February	40	525,445	12.25	14.90	1.78
March	44	623,450	12.80	15.10	2.12
April	47	599,774	13.00	15.15	2.39
May	47	634,160	13.00	15.15	2.28
June	45	591,178	13.15	15.15	2.02
July	45	583,745	13.35	15.15	2.21
August	43	584,601	13.85	15.45	2.26
September	42	546,829	14.25	15.90	2.36
October	43	621,813	16.00	17.80	3.52
November	47	567,868	16.40	18.00	3.90
December	40	.....	....	....	...

Ore prices for 1913 have been established at a high level by general buying with no reduction made in the guaranteed iron content. Representative prices were: Old Range, bessemer, $4.40; Mesaba bessemer, $4.15; Old Range non-bessemer, $3.60; Mesaba non-bessemer, $3.40.

The large steel companies have purchased considerable iron during the year in addition to their own output. One firm is said to have bought 40,000 tons of bessemer iron for first quarter 1913 delivery in Pittsburgh at $17 to $17.25 at Valley furnace. At the close of the year practically all the companies in the district are working nearly to capacity. The U. S. Steel Corporation, for instance, is working 95 to 96% of capacity. Prices are good as may be seen from the foregoing table, based on *Iron Age* quotations, and the outlook for a continuance of the favorable conditions seems to be promising. There has been practically no lessening of the steel trade since the election. Car shortage was felt about the middle of February, but did not reach a serious proportion until the fall months. It culminated early in December with a net shortage for the United States and Canada of 50,000 cars. This was severely felt by both blast-furnace and coke operators. Several furnaces were banked for brief periods because of inability to secure coke, and it is now feared that the available coke supply may run short during the winter months. In October the unusual condition prevailed of prompt furnace coke ruling some 50c. per ton higher than contract coke. Among the coal operators in general the year has been good though with but few large new undertakings or striking developments. Several times during the year shortage of cars restricted shipments. The business of the Pittsburgh district has had the help of the cut of 10c. per ton in the freight rate from the district to the Lake, which was made in May.

New Construction.—The usual plant extensions and ordinary improvements were made during the year, and in addition the following more notable new work may be mentioned: The Carnegie Steel Co. has installed two 60-ton open-hearth furnaces at the Clairton plant. Fourteen 80-ton open-hearth furnaces are being built at the Edgar Thomson works. Four to six of these are expected to be completed by next April. The Jones & Laughlin Steel Co. is building a battery of 240 rectangular beehive ovens at Aliquippa, to be ready for operation about the first of the year. The auxiliary waste-heat saving system is expected to develop some 4000 boiler horse-power. The Aliquippa blast-furnaces are now all in blast, and the steel plant was started during the year, including a converter and four large Talbot furnaces. The tin plate capacity was practically doubled during the year, 24 hot mills being now in use. All finishing departments have been active. At the Eliza furnaces two units of Dwight-Lloyd sintering machines have been erected, each of 100 tons daily capacity. The Pittsburgh Steel Co. is building two blast-furnaces at Monessen, Pa., one of which is expected to be ready in April, the other in June. The Pittsburgh Crucible Steel Co. has installed eight 60-ton open-hearth furnaces at Midland, near Beaver, together with 40-in. blooming mill and several finishing mills. The Union Steel Casting Co. has doubled its capacity by the addition of two 25-ton acid open-hearth furnaces, together with the necessary molding space and finishing equipment. An interesting item, as indicating the growing scarcity of natural gas, is that the Pittsburgh Plate Glass Co. has installed three Chapman rotary producers in its plant at Tarentum.

The Union bridge across the Allegheny at the Point is progressing rapidly. The automobile thoroughfare to East Liberty is being completed by the construction of two large reinforced concrete bridges in the Bellefield Shadyside district. One, spanning the Pennsylvania tracks, is being supported on the new steel centring during construction. Steel barges are rapidly replacing the older wooden ones in the river coal and sand trade, both the American Bridge Co. and Jones & Laughlin Steel Co. building a large number of the new craft.

General.—Among the developments in metallurgy during the year, the Carnegie Steel Co. has been trying tar as an open-hearth fuel at North Clairton. An improvement in the mud-gun has been made which permits of closing the tap hole of a blast-furnace without the necessity of shutting off the blast. A considerable number of heat-treatment furnaces have been built, and the temperature control has been materially improved. At the University of Pittsburgh the most interesting technical developments have been the great success of the Industrial Research department and the Co-operative Engineering plan. In the former there are now 29 fellows working, many of them being experienced men, on 15 problems of industrial importance. One of these problems is the smoke nuisance, in connection with which it is interesting to note that at Pittsburgh, in 1911, 19,000,000 tons of coal was consumed and 53,000,000 handled in or through the city as compared with 16,500,000 and 36,000,000 tons, respectively, in the case of Greater New York. The Carnegie Institute of Technology has made notable additions to its metallurgical laboratories during the year; among which may be mentioned an electric steel furnace and a well designed milling plant. Interesting work was also done last summer in the factories of the Westinghouse Electric & Manufacturing Co., where a group of 29 men from 25 different colleges in 19 different states—members of engineering faculties—worked as regular employees of the company under the direction of the head of the department of the electrical engineering of Colorado College. This was done with the idea of bringing instruction into closer touch with practical conditions.

THE YEAR AMONG THE MINES ABROAD

Foreign mines and mining are attracting increasing attention in the United States, as it becomes possible to spare both engineers and capital from home development. We present below in most condensed form summaries of development in 1912 in those countries in which North Americans are mainly interested. Additional details are given in special articles on other pages, and more complete accounts of the present state of mining in the Transvaal, Rhodesia, the Congo, Australia, New Zealand, along the west coast of South America, and elsewhere, have been prepared and will appear in later issues.

CANADA

Ontario and the Eastern Provinces

The principal interest attaches to the Porcupine goldfield, where active production of bullion began during the summer. The Dome mill commenced operations in March, but the delays and accidents incidental to starting a new plant of this character prevented steady work until the end of June. The Hollinger mill started crushing in June, and though for some time only low-grade ore was treated, operations proved so profitable that on November 2 the initial dividend, the first paid by any Porcupine mine, of 3% for four weeks, was declared, accompanied by an official statement that the profits amounted to $40,000 per week, which would enable dividends to be paid continuously on this basis. The latest official figures available as to the output are the returns to the Ontario Bureau of Mines for the 9 months ended September 30, which give the production of gold as 53,488 oz. of the value of $1,117,335, as compared with 2185 oz. valued at $42,637 for the preceding 12 months. The bulk of this year's yield was from the Hollinger and Dome mines, the McIntyre and Vipond also being contributors. The rate of production during the last quarter of the year was expected to show a very considerable increase, but a general strike of miners belonging to the Western Federation of Miners took place. However, it is now considered that the strike is practically over. There are now eight mills either in operation or under construction in the camp, the latest being the 10-stamp mill ordered by the Three Nations which it is expected will be ready early in the spring. The cyanide process has been found a necessary adjunct to several of the plants. In the outlying Swastika district the pioneer mine, the Swastika, will put its 10-stamp mill into commission early in January, having a large quantity of ore in readiness. The Lucky Cross, in the same area, has ordered a mill for erection early in 1913.

While the production of silver of the Cobalt district for the year will probably be somewhat lower than that of 1911 it is expected to show an increased value. Owing to the higher price of silver, operations were resumed during the year on a number of prospects that had been idle. Low-grade shipments have almost entirely ceased and the proportion of bullion shipped as compared with ore shows a steady increase. The completion of the Nipissing mill for treating low-grade, with an aerial tramway for the transportation of ore, is one of the more noticeable economies effected. In October an important discovery made on the Seneca-Superior leasehold from the Peterson Lake gave a considerable stimulus to operations in the neighborhood of Cart and Peterson lakes. A vein of high-grade ore was found at the 200-ft. level underneath Cart lake and has since yielded rich returns. The deep mining policy has been successfully adopted by the Timiskaming and Beaver companies, the latter having attained a depth of 700 ft. and having the lowest level in the district. Exploration in the diabase has been on the whole encouraging, showing that the veins, on entering that formation, do not lose their silver content as a rule. They usually split up into three or four stringers; the wall rock between carries a good deal of leaf silver. Further development at the 700-ft. level will show whether the ore continues to be good for some distance below the diabase-Keewatin contact. The figures of silver production given by the Bureau of Mines for the first nine months of the year show an output of 22,231,451 oz., valued at $12,707,826, being 963,601 oz. less than for the corresponding period of 1911, while the increased price per ounce resulted in increasing the value by $1,114,090. South Lorrain contributed 616,692 oz., and Gowganda 449,281 oz. of this total. Several of the principal dividend-paying mines of Cobalt, the Cobalt Lake being the latest addition to the list, have materially increased their returns to shareholders, the McKinley-Darragh at the close of the year declaring a 20% and the Buffalo a 26% payment. The latter company has completed a refinery with a capacity of from 300 to 400 tons per month, and will hereafter ship its product in the form of bullion. With the construction of the Elk Lake branch of the Timiskaming & Northern Ontario railway, now nearly completed, a period of active development in the Elk Lake and Gowganda districts is anticipated.

The great demand for nickel for naval construction owing to the war in Europe, has caused a revival of activity in the Sudbury nickel mining field, where the old companies are extending their operations and new organizations are preparing to enter the field. The Canadian Copper Co. has enlarged its ore resources by buying a portion of the Northern range from the Lake Superior Co., and has opened up the Frood mine and other old workings which have been closed for years. The Mond Nickel Co. is putting up a large smelter and preparing to turn out nickel-matte on an extensive scale. The Dominion Nickel-Copper Co., which has expended some $250,000 in diamond-drilling and has acquired more extensive holdings than any other company in the field except the Canadian Copper Co., and done extensive development on the Whistle property, is about to erect a large smelter. A great deal of development work has been done in the district this season and the output next year will show a heavy increase. In addition to the production of the Sudbury region another source of nickel has been developed in the Alexo mine on the line of the railway, from which considerable shipments have lately been made to the smelter of the Mond company at Victoria mines.

While the production of iron ore in Ontario shows a decrease, the output of pig iron has increased from 296,856 tons for the first nine months of 1911 to 452,021 tons for the same period of this year. The Helen mine continued to be the principal producer of ore. Those in charge of the Moose Mountain mine, north of Sudbury, have succeeded in perfecting the Gröndal process of magnetic concentration as applied to their ores and have begun the turning out of briquettes of bessemer quality from ore regarded as valueless. The output of the Dominion Iron & Steel Co. of Sydney, Nova Scotia, in pig iron and steel shows a large increase, owing to the blowing in of a new blast-furnace, and the production of coal by the Nova Scotia companies considerably exceeds that of 1911.

British Columbia

By E. Jacobs

Production.—While returns are incomplete, there is good reason to look for final figures showing that the value of the mineral production of British Columbia in 1912 reached a total of between $31,000,000 and $32,000,000. As the highest value of production in any earlier year was that of 1910, with a total of $26,377,066, it is expected that the increase for last year as compared with that total will have been fully 20%. This increase is not due to higher prices so much as to greater production of nearly all minerals that are mined in considerable quantity in the province, the only exceptions being gold and coal, and these in comparatively small quantities. The 1910 output of gold was approximately 20,000 oz. greater and that of coal grew 98,000 tons. A preliminary estimate for 1912 gives the

following figures: Gold (placer and lode), $5,750,000; silver, $1,530,000; lead, $1,400,000; copper, $8,300,000; zinc, $300,000; coal and coke, $10,830,000; miscellaneous, $3,800,000; total, $31,910,000.

Cariboo.—An unusually dry autumn adversely affected hydraulic placer-gold mining, so that the yield was smaller than would have been the case with sufficient water for gravel-washing throughout the season. The output of placer mines in Cariboo division of this district is estimated as having been similar to that of 1911, but expectations of an increase in Quesnel division are thought to not have been realized. The district lacks railway transportation facilities, but lines are being constructed.

Cassiar-placer.—Notwithstanding a short season in Atlin division, an increase in quantity of placer-gold recovered has been reported. In the parts of the Skeena country through which the Grand Trunk railway is being built, development of silver-lead properties has been in progress, in some instances with promising results, so that ore production in 1913 is looked for. The further development of coal measures still awaits the completion of the railway through the parts it will serve. In the Groundhog field, where anthracite has been found, prospecting was done, but until this part of the district shall also be opened by a railway, little important development is likely. The Granby Consolidated company's operations on Observatory Inlet, where it has done much development work on its Hidden Creek property, constituted the most important advance in the middle or upper part of the Coast district, for already between five and six million tons of copper ore is "estimated in sight" and at least as much more "probable ore" is believed to also occur. Construction of smelting works, to have a treatment capacity of 2000 tons of ore per day; railway, buildings, and shipping docks; and development of a hydro-electric power for mine and smelting works have all been contracted.

East Kootenay.—In metalliferous mining, the most important operations have been at the Sullivan lead mine, which is in part taking the place of the nearly exhausted St. Eugene, for years the chief lead-producing mine in Canada. The Monarch, a lead-zinc mine in northeast Kootenay, was also operated. Construction of the Kootenay Central railway is being continued, so other mines are expected to ship ore next year, when transportation shall be available. Coal mining in southeast Kootenay was active, three companies—the Crow's Nest Pass, Hosmer, and Corbin—together mining 1,300,000 long tons of coal, of which 400,000 was made into 263,000 tons of coke.

West Kootenay.—In Ainsworth division, some 33,000 tons of ore was mined and concentrated at lead-silver mines, the Consolidated company and others worked mines in the old Ainsworth camp, and the Utica and Retallack & Co.'s mines also contributed to production. In Slocan there was much activity, with important deep-development at the Lucky Jim (zinc), Rambler-Cariboo, Payne, Surprise, Slocum, Slocum Star, Noble Five, Standard, Van-Roi, and Hewitt-Lorna Doone mines, most of which mine silver-lead-zinc ores. Aerial tramways and new concentrating plants were put in for the Rambler-Cariboo and Standard mines, and similar facilities will soon be completed for the Hewitt-Lorna Doone. The Standard and Van-Roi both shipped much silver-lead and silver-zinc concentrate.

Nelson.—The operations of the Consolidated and British Columbia Copper companies at mines within a few miles of the town of Nelson were features of the year. Gold mining and milling also made progress, near Nelson and in Ymir, Sheep Creek, and Erie. Mining lead ores near Salmo had attention as well. No important advance was made in either reduction of lead-zinc ores or proving that platinum metals exist near Nelson, though much notoriety resulted from claims made in newspapers.

Trail Creek.—Mining at Rossland and smelting and refining at Trail were well maintained. The Consolidated Mining & Smelting Co.'s Centre Star and Le Roi mines are in excellent condition for continued production of gold-copper ore, and developments in them and in the neighboring mines of the Le Roi No. 2, Ltd., assure the maintenance of ore production here on a similar scale to past and other profitable years. Both companies mentioned paid dividends. Many improvements were made at Trail.

Boundary District.—Copper mining operations of the Granby and British Columbia Copper companies gave record results, for about 1,900,000 tons of ore was mined and smelted, and 33,000,000 lb. of copper produced. The Jewel stamp-mill was worked late in the lear. Coal measures were prospected at Midway. Railway construction made good progress along the west fork of Kettle river, where there are several small mines. The Hedley Gold Mining Co. crushed 70,000 tons of ore and recovered gold valued at about $760,000. This company in 1912 declared dividends totaling $360,000, being 30% on its issued capital. It added a valuable group of claims to its property holdings. The B. C. Copper Co. explored copper claims situated near Princeton, using six diamond-drills besides doing much underground development. The Princeton Coal & Land Co. operated its colliery and shipped an increased quantity of coal. In Nicola country, the Nicola Valley Coal & Coke Co. found a new seam of coal, proved by diamond-drilling that its area of coal-bearing land is much larger than was known earlier, further developed several coal seams opened in earlier years, and shipped a comparatively large quantity of coal to outside markets. Mining gypsum has been commenced in Nicola valley.

Coast District.—The Britannia Mining & Smelting Co. made important progress, mining about 193,000 tons of copper ore, from which some 48,000 tons of crude ore and concentrate was shipped to Tacoma. Much underground development was done, and many additions were made to transportation, milling, and power-generating facilities. Coal mining on Vancouver island resulted in the production of about 1,553,000 long tons of coal. New coal mines are being opened by the Western Fuel Co., Canadian Collieries (Dunsmuir) Ltd., and Pacific Coast Mines, Ltd., respectively.

General.—Metalliferous mining companies together paid about $1,200,000 in dividends in 1912. This leaves out of account approximately $1,500,000 of earned profits of the Granby company, held for development and equipment of its Hidden Creek mines. Coal mining companies made ample provision for mine-rescue purposes, as required by provincial law, and the Government also established mine-rescue stations. Much railway construction was undertaken, thereby making new mining districts accessible.

MEXICO

Technical phases of progress in Mexico during the past year have been obscured by the great general interest in the political situation and outlook—matters which are discussed editorially and need no further comment here. It is somewhat surprising that, despite the persistence and universality of political disturbance, the total production of Mexico has not shown a great decrease. Some of the smelting plants, such as those of the American Smelting & Refining Co. at Monterey and Aguascalientes, were not troubled, being in districts not affected by the outbreaks, while the others were able to keep in operation with only a few temporary interruptions. Several of the large plants are increasing their output, the Greene-Cananea, for example, having a larger monthly production this year than ever before, and the decrease due to the general cessation of work by the smaller companies is thus counterbalanced by the increase of the larger ones that continue to operate. The unsettled conditions offer favorable opportunities for purchase by the larger companies, and the Peñoles Mining Co., for example, purchased the Paloma mines for ₱1,000,000 and is negotiating for the Cabrilla mines in Mapimi. The Greene-Cananea has bought properties, and the Naica silver-lead mines in Chihuahua were sold to French investors for several million pesos. The United States Smelting, Refining & Mining Co. has been examining properties with a view to purchase, and the Mezquital del Oro mines, in Zacatecas, the Casados in Jalisco, and other properties are under option to large foreign companies. Shipments of oil from Mexico continue large, and the mineral production as a whole is highly satisfactory, considering the present disadvantage under which the industry labors.

GERMAN MINING IN 1912

Success is written large across the story of German mining this year. In the production of iron, coal, potash, oil, and phosphates, there has been the greatest possible activity. In the first half of this year, the coal produced amounted to 84,710,000 tons; 12,800,000 more than in the corresponding half, and the production of iron was 8,420,000 tons, or 2,170,000 more than in the corresponding period. The production of pig iron increased from 11,507,748 tons between the months of January and September, 1911, inclusive, to 12,859,376 tons for the corresponding months of this year. The progress is steady month by month. The German metal-market has been firm from the start of the year, and has kept all the mines busy. Germany imports large quantities of raw materials, and the Germans are owners of extensive iron deposits in the north of France as well as in other lands; German enterprise in this direction has been particularly evident in Sweden this year, where iron deposits have been bought to such an extent that it has become a question in that country whether special legislation should not be enacted to protect the industry of iron-mining from a complete German monopoly. While Sweden is getting anxious for its natural supplies, the German iron-ore producers are holding meetings to consider the situation generally, and confidence is expressed that they will be able to so coördinate their operations as to make the Fatherland much more independent of foreign ore. This becomes of increasing importance in view of the exhaustion of some of the fields to which European iron-smelting countries have had recourse in the past, notably northern Spain. The anxiety of iron smelters the world over respecting the ultimate resources of iron supply is largely shared throughout Germany, where smelting is advancing with enormous strides. Little need be said of the coal industry, which naturally follows iron on general lines, except in respect to the efforts made by German operators to acquire foreign markets.

The mining industry that strikes the imagination most in Germany, however, is that of potash. As the months roll on, the position becomes more and more a problem. Before the potash law was enacted, the position was clear enough, and the potash syndicate, with the exception of the then two outside houses, Aschersleben and Sollstedt, had fair control of the situation. But it is different now. The law has been enacted which, it is maintained, because of its system of quotas and limits as to export prices, ensures a steady sale to any potash concern that can produce a minimum quantity of potash. The result, whether reasonable or not, has been a great crowd of new potash companies that have offered the shareholders the inducement of a certain sale for the goods, and as a necessary result (for many of them have begun to sink mines) there will be within a few months a largely increased production. The exports of potash this year have been large, exceeding those of the preceding year, but provision will have to be made for a larger export movement to overtake the great output that will result from the activities of the new companies. Meantime the Potash Syndicate appears to have got matters well in hand; for it has roped in the great outside companies, Aschersleben and Sollstedt, and is systematically working to practically coerce all the new companies into its organization as they come along. Conscious, however, of the pressure of supplies that will begin, no doubt with next year, the syndicate at a recent meeting took the wise step of making financial provision for an extensive propaganda the world over to get rid of its products. This propaganda will affect particularly North and South America.

Zinc works in Germany have been working at high pressure and obtaining much better prices than before. The petroleum industry in the country is showing progress, like the rest of the mining business, and is interested in the contemplated new legislation for the institution of a Government monopoly to control the business in the country and oppose the Standard Oil Co. Petroleum production, while not a leading industry, contributes a fair proportion of the country's requirements.

RUSSIAN MINING IN 1912

The Russian mining industries have been characterized by some remarkable features in the course of the year just closed. In neither coal nor iron mining has there ever been such a busy time as the present. All previous records of production have been surpassed, and the demand is so great as to constitute what is fairly described as a state of famine. Lowering of the tariff on pig iron has to some extent assuaged the shortage; but even now, with blast-furnaces working full time and every effort being made to supply the market both in South Russia, which is the principal field, and in the Urals, demand over-runs supply. During the first six months of the current year the quantity of iron ore produced was equivalent to 3,170,000 tons of 2000 lb., an increase over the corresponding period of the preceding year of nearly 23%. Most of this comes from the famous Krivoi Rog field, and the balance comes from the Kerch district. These figures, it should be stated in passing, refer only to South Russia. As to the production of coal, the increase has been extraordinary and yet fails to satisfy entirely the demands of the country.

Gold-mining presents a very unsatisfactory aspect, the principal reason being the deplorable events that took place in connection with the strike on the Lena Goldfields. One result has been a tremendous reduction in the gold output of Russia's premier gold area. Reports of returns are unsatisfactory, too, from the Far Eastern fields, particularly along the Amur railway now being built. Gold-mining is not so remunerative there as to neutralize the attractions of constant employment in railway construction. Farther west in the classic Urals, the gold output has been limited by the extremely high prices of platinum. Judging from the complaints that arrive from the placers to the effect that the high prices of platinum are attracting the workmen from the gold placers to those worked for platinum, it seems probable that in the Urals, too, there is going to be a shortage in the production of gold as compared with recent years. In other auriferous regions of Russia and Siberia the returns will probably be similar, or perhaps even superior, to those of the past. The introduction of dredges, hydraulic apparatus, and the like, is increasing in various Russian and Siberian gold-producing districts, and the gold used outside the areas specified above will probably be larger than ever. Platinum, a large element in Russia's annual contribution to the mineral wealth of the world, is discussed separately.

It is not possible, from data available, to give any idea of the quantity of copper ore that has been mined in Russia. This can only be inferred from the quantity of metallic copper that has been smelted. Monthly reports indicate an extraordinary increase in production. Although this large increase has taken place, it fails to satisfy the demand in the country, and considerable quantities still have to be imported. The leading copper ore areas are the Urals, the Caucasus, and Siberia. The Urals is the classic ground in Russia for copper production, and although for some years the region yielded its premier position as a copper-producing area to the Caucasus, it has again come to the front. The leading position as a copper-producing concern now belongs to the Kyshtim Corporation.

Zinc production of the country, hitherto confined to Poland, has developed rather remarkably in the Far East at Tetyuch, where a German company has been at work for some time and has produced considerable quantities of ore for treatment in the West. The Government hopes to arrange for treatment of this ore in Russia.

The production of petroleum in the country is now a struggling one. It is still large, but is unable to keep pace with past records. The Baku wells show signs of weakness, and production has gone back this year. Grozny is an area which after rapid advances looks due for a prompt collapse; probably more because of neglect on the part of the drillers in shutting off the water than for any other reason. Maikop does not yet respond to expectations, and there is no other oil district in Russia of importance at the moment. Tcheleken and the Ural Caspian areas are of purely local significance.

JAPAN

Figures covering the mineral production of Japan for the eight months, January to September, 1912, are available, and are as follows. The second column indicates the increase or decrease as compared with the corresponding period of last year.

MINERAL PRODUCTION OF JAPAN, JANUARY TO SEPTEMBER, 1912

		Change, %.
Copper, lb.	79,334,100	+0.77
Coal, tons	11,080,346	+1.48
Iron, tons	45,250	+1.32
Silver, oz.	3,344,480	+0.27
Gold, oz.	99,920	+1.16
Oil, bbl.	851,600	—0.75
Sulphur, tons	34,850	+1.12

The copper industry is the most important of all in the metal production of Japan, and the following table, showing the yield of the principal mines for the first six months of 1912, will therefore be of interest. Mines were active in the last quarter, and the total production is estimated at 126,000,000 pounds.

Mine.	Production, lb.	Change, %.
Ashio, Tochigi prefecture	9,169,430	+0.82
Kosaka, Akita "	8,937,690	+3.98
Besshi, Ehime "	8,535,960	+0.57
Hidachi, Ibaraki "	7,511,360	+2.04
Osaruzawa, Akita "	2,302,090	+0.59
Ikuno, Hyogo "	1,780,240	+1.12
Furokura, Akita "	1,773,560	—1.74
Arakawa, Akita "	1,438,220	+1.37

Japanese coal has been extending its market, and as a result of the strike in England was able to invade the Indian and Ceylon market this year, a shipment of 300,000 tons having been made to Colombo by the Chikuho collieries early in the year, and a later contract providing for a series of shipments, amounting to 150,000 tons, to be delivered at Colombo, Bombay, and other Indian ports. Prices show an upward tendency as a result. A reciprocal trade has sprung up in pig iron, of which Japan imports considerable quantities, chiefly from England. The Tata company of India has begun shipment of its pig iron to Japan, the product selling there at $15 per ton. As the cost of production in India is low, and the freight, as compared with England, is considerably less, the Tata company makes a good profit and the Japanese market is benefited as well.

Zinc, though not mentioned in the table above, has become of much importance of recent years, the output of zinc ore in 1911 being over 25,000 tons. The interesting work done at the Kamioka mine of the Mitsui company in the concentration of zinc ores by flotation was described by T. Inouye in the *Mining and Scientific Press* of June 29, 1912, p. 892. An 80% extraction is made, and 30 to 40 tons per month of product, containing 45 to 50% Zn is made. Until recently the zinc ore or concentrate has been shipped to Europe for treatment and spelter imported, as attempts at local reduction had failed for the lack of suitable material for the manufacture of retorts. Suitable clays have now been found, and the Mitsui company has constructed a smelting plant, under foreign supervision, at Omuta, near its Miike colliery in Kyushu, while another company has been organized to erect a plant at Osaka. Attempts at electrolytic refining have been made, but were uniformly unsuccessful. If the work of these smelters is successful, it may be expected that the output of the zinc mines will rapidly increase.

The Japan Petroleum Oil Co., of Echigo, has decided to double its capital, making it 20,000,000 yen. California rotary rigs have been imported, and have greatly reduced the time required for sinking wells. A well recently sunk to a depth of 1030 ft. is yielding at the rate of 1200 gal. per day. The company has started the construction of a 2000-gal. refinery at Raisatsu. The Hoden Oil company is paying dividends at the rate of 12% per year.

Japanese development work in Manchuria is mentioned in the review of China. The iron mines in Korea are developing even better than expected. North of Seoul and not far from Chinnampo deposits of good grade are being worked under government supervision and are producing about 200,000 tons per year. More properties are being developed and the total output will soon be largely increased.

CHINA

The most important change during the year in the mineral industry of China was the amalgamation of the Lanchow mines with the Chinese Engineering & Mining Co., Ltd. The latter is a British corporation which took over the Kaiping mines in 1900. The rights of the corporation have always been a subject of dispute, and a few years ago the Lanchow mines, a short distance north of the Kaiping mines, and in territory in which the Chinese Engineering & Mining Co. claimed the mining rights, were equipped under Government auspices at considerable expense, but showed no profit in working. The two companies have now been amalgamated under a joint administration known as the Kailan Mining Administration. Of profits up to £300,000, 60% is to be allotted to the British corporation and 40% to the Chinese company. Profits above £300,000 are to be divided equally. The Chinese Engineering & Mining Co. produced 1,453,546 tons of bituminous coal in 1911 (another report gives 1,170,163 tons as the output; the discrepancy is characteristic of statistics regarding output of Chinese mines). The Fushun mines, near Mukden, show a steady increase in production. The two large hoisting shafts are now in use, and the novel method of filling the worked-out ground with sand dredged from a nearby river is about to be tried. The completion of the Mukden-Antung railway has made Fushun coal available in Korea, and power plants to supply the gold mines in the northern part of Korea have been constructed. The coal is converted into gas and the recovery of ammonium sulphate, for which there is a good local market, is an important additional source of profit. The mines at Pen-hsi-hu, on the Mukden-Antung line have been developed with joint Japanese and Chinese capital, and as the coal yields coke of a good texture and iron ore deposits of good quality have been found in the neighborhood, an iron smelting plant has been started, also with joint Chinese and Japanese capital and good progress is reported.

The coal mines at Poshan and Fangtze, in Shantung, worked under German supervision, maintain a steady production, but, for a variety of reasons are unable to make any profits. The Peking Syndicate mines, in Honan, are increasing their output. The coal and iron mines and smelting plant of the Han-Yeh-Ping Iron & Coal Co. have been shut down, following the burning of Hankow during the revolution last year. It is reported that the smelting plant at Hanyang is not much damaged and can easily be reopened. At a meeting of the shareholders early in the year it was voted to increase the capital of the company from ₱13,160,000 to ₱30,000,000. If the ambitious scheme of railway building proposed by Sun Yat-sen is actually carried out, the company will be taxed to its utmost to supply railway equipment. It is reported that copper deposits have been found near the Ta-yeh iron mines, but it is probable that they are of no great value.

Antimony has apparently suffered a considerable setback, as a result of the revolution. C. Y. Wang has recently* described the operations of the numerous Chinese companies formed, many of them with little knowledge and less capital, to smelt antimony. The tin smelting plant, near Kochiu in Yunnan, mentioned in the review for 1910, has so far been without either funds to operate or a supply of ore to operate upon, but it is now reported that arrangements have been made to begin work. A French firm is said to be about to construct a branch line connecting Kochiu with the main line at Yuunanfu. Little progress can be made in the mineral industry while the government and finances of the country remain so unsettled. It is said that Sun Yat-sen, who is devoting his energies to the industrial development of the republic, has secured the advice of a well known American mining engineer, F. L. Cole, and when funds are available progress should be made.

**Eng & Min. Jour.*, October 26, 1912, p. 777.

SOUTH AND CENTRAL AMERICA

Interest among mining engineers and investors is turning rapidly toward Latin America. In San Francisco, New York, and London there is a growing conviction that in the great countries to the south are to be found the most important mineral deposits remaining to be mined. Better political conditions throughout the southern countries, increased knowledge of sanitation, and improvements in technology, are opening a field to industry that has long lain neglected. Arrangements are being made to give in the *Mining and Scientific Press* more space to South American development, and several articles have already been prepared for publication. A special review of 'Mining in the West Coast Republics in 1912,' written by Howland Bancroft, will appear in an early issue. For the present it will suffice to mention the more significant events of the year.

In Cuba development of the Mayari iron ore district is going rapidly forward under the effective management of the Spanish American Iron Co. The ore is making a distinct place for itself in the Eastern market. In Venezuela, easily the most important event of the year was the bringing in, late in the fall, of two excellent oil wells on ground controlled by the Barber Asphalt Co. The second of these wells yielded upward of 80,000 bbl. of 18° oil in the first week, and it now seems reasonably sure that an important supply of fuel oil will be developed near the east end of the Panama canal and on the sea. In Brazil, North Americans have been active in development of iron ore, and in December it was announced that arrangements had been practically completed to consolidate the newer American interests with those of English investors already represented by the Itabira Iron Ore Co., Ltd. A railroad to the coast, a harbor, and steamer lines to Europe are promised immediately. That there are great quantities of high-grade iron ore in Minas Geraes is now known, and it bids fair to soon become an important factor in the world's markets. In Goyaz several parties of engineers, under direction of R. E. Cranston, are now testing placer ground with a view to dredging. Lode mining continues to be best exemplified in the St. John del Rey. Diamond mining, at least so far as the United States is interested, received a setback through the ventilating of fraudulent promotions. In Uruguay and the Argentine railway building is active, but interest centres more in agriculture than mining.

For the present mining is most active in Chile, Bolivia, and Peru, the great republics of the West Coast. In Ecuador the South American Development Co. is responsible for the most important lode mining, while in Colombia several American concerns are active in developing both lode and placer mines. Neither of these countries has as yet attained the production of their neighbors to the south. In Peru the Cerro de Pasco, with its shipments of 3,500,000 to 3,700,000 lb. copper per month, stands as the best achievement, though the main supply of vanadium is also brought from that country by the American Vanadium Co. Bolivia, which supplies a fourth of the world's tin and has well founded hopes of furnishing an important share of the copper, attracted unusual attention this year because the completion of the Arica La Paz railway rendered it possible to open districts hitherto inaccessible. A false report of placer discoveries on the Tipuani drew prospectors to the district without result, but other placer fields are now being examined by competent engineers, and dredging or hydraulicking may soon be started. In Chile the nitrate industry continues to be of first importance. Based upon figures for the first part of the year, the output for 1912 may be estimated at 2,400,000 tons, and the reserves are known to be large. The Braden Copper Co. has made an excellent start, Fred Hellmann has gone down to manage the Chuquicamata, the Collahuasi is profitable, and other properties are coming in. Men and money are going rapidly into the West Coast republics, and the mineral industry is responding excellently to the stimulus. In Central America nothing startling has transpired. Wild tales of rich placers in Costa Rica proved unfounded. The New York & Honduras, Butters Salvador, and other well known properties continued their profitable course.

TRANSVAAL GOLD-MINING

By Rowland Gascoyne

Despite the large output previously obtained from the Witwatersrand goldfields, the production for 1912 will again constitute a record. The year, however, has not been a favorable one for obtaining capital for new ventures, and during the year no new producers have entered the field, though the Langlaagte Consolidated and Crown Mines have added to their milling capacity. The increased output of gold is therefore largely due to the dropping of additional stamps at the City Deep, Bantjes, Modder B, and Brakpan, all new producers in 1911, who were able last year to add materially to their output as well as to the grade of ore sent to the mills. If there is one feature of Witwatersrand mining to which attention ought to be drawn, it is the growing importance of that section of the Rand north and east of Boksburg, and known as the Far East Rand. It is only two years ago that attempts were made, on unorthodox geological grounds, to show that the mines in this area were off the Main Reef Series altogether, a theory which received a certain amount of credence in some quarters. This idea has now apparently been abandoned, for today the Far East Rand is not only regarded as a valuable Main Reef area, but one of the most promising future sources of gold production on the Rand. The metallurgical work of the past year is discussed elsewhere in this issue by Alfred James, and the share-market by T. A. Rickard, so this page will be devoted to mining technology.

There is not much that is new to notice with regard to any changes in the method of working. A modification in the ordinary Rand system has been introduced on the flat reefs of the Far East Rand, partaking slightly of the long-wall method of working; but it is too early yet to form a reliable opinion as to whether the strong and rigid hanging walls of the Rand will be able to adjust themselves to this changed method of working. There has, for a good many years, been considerable discussion about the advisability of introducing the long-wall method of mining, or a modification of it, in the flat-running reefs of the Far East Rand, and any tendency in this direction will be watched with interest. The method, described in last year's review, of driving the levels farther apart, and feeding one principal level fitted with haulage, has been introduced at the Crown Mines, and the process of concentrating the underground as well as the surface operations has been concluded during the latter half of the year; but it is still too early to notice any change in the working costs. Since the introduction of coal-mining methods on the Rand, there has been a tendency to use animal and mechanical traction underground to a much larger extent than formerly. As might be expected, universal success and economy have not attended these well meant efforts, because in some cases the underground conditions have not been altogether suited to the new methods; but, where suited, a fair amount of success has been achieved. Mining difficulties continue to increase with depth, and at some of the deep mines 'air-blasts' have been all too common. In the shallower stopes, too, they have taken place where pillars have been left too small or some pronounced line of weakness, such as a dike, has shown itself.

Sand-filling has continued throughout the year and has rendered particularly good service in arresting 'weights' and movements in the neighborhood of shafts, also in the general protection of the surface occupied by buildings, or railways over worked-out stopes. Sand-filling has also been found useful as an aid in the extraction of valuable underground pillars. At the Simmer & Jack Proprietary and several other mines, the use of current sands for filling underground stopes has been extended during the year. The cost of sand-filling on the Rand varies from 10 to 24c. per ton of sand put into the workings, according to circumstances; so that at the lower figure it is about equal to putting sand on to the surface dumps, and it seems strange that sand-filling under these circumstances is not practised even more extensively.

Miners' phthisis has bulked larger than ever in the mining topics of the Rand during the past year, the action of

the Government in introducing compensation and insurance bills bringing the subject into greater prominence than ever. After the withdrawal of what was evidently only a half-considered proposal of the Minister of Mines, legislation was introduced, as a result of careful inquiries, throwing the whole burden of providing for the victims of the disease on the mine-owners and the miners, the Government only contributing a small amount for the relief of mines considered unable to bear the impost, with the object of preventing their closing down. It was anticipated that the compensation would prove a heavy incubus on the mines, but the burden so far has proved much lighter than anticipated. With regard to the compensation bill, it does not seem likely that more than 2000 applications, genuine and otherwise, will be received, and the levy on the mines may amount to $970,000, or say 4c. per ton milled, which is the minimum estimated some time ago that the act would impose on the mines, the majority of the authorities placing the amount considerably higher. With regard to the insurance against miners' phthisis, the outlook is even brighter. The throwing of the burden upon the shoulders of the mine-owners and men, and the greater activity displayed by the Mines Department of the Government in carrying out the mining regulations bearing on the dust question, has produced an almost incredible improvement in the underground conditions on the Rand. The most benefits have been derived from putting into general use the watering clauses of the mining regulations, which in some mines are as well observed as they were neglected before.

THE YEAR IN RHODESIA

By Owen Letchier

The past year has not been a particularly eventful one in Rhodesia. No remarkable discoveries have been made, and there has been no appreciable increase in mineral production. It appears likely that 1912 returns will be a little greater than those of 1911. The situation in the mining districts is at present unsettled on account of the continuance of drought. The rainfall in 1910-1911 was considerably below the average, and the present 'rainy season' has also proved disappointing. The majority of the rivers and ponds on which the mines of the country are dependent for water are dry, and numbers of mills have had to be closed. Unless good rains fall soon, numbers of larger and more important mines will be compelled to restrict their output and possibly hang up stamps altogether. It is therefore difficult to estimate production for the final months of the year. For the first nine months, the gold output has amounted in value to £2,032,677, and the output of other minerals (coal, chrome, iron ore, lead, silver, and asbestos) to £187,028. In 1910 the gold output for the full twelve months was worth £2,568,198, and other minerals £222,930. For the twelve months of 1911 the figures were: Gold, £2,647,895; other minerals, £242,864. Unless the drought has a widespread and damaging effect before the conclusion of the year, the 1912 return will probably be in the neighborhood of £2,650,000 for gold, and £250,000 for other minerals, a total of £2,900,000. Rhodesia will, therefore, probably again figure as sixth on the list of the world's gold-producing countries with a contribution of slightly under 3% of the total and ranking inferior to the Transvaal, the United States, Australia, Russia, and Mexico.

Just as there has been but little expansion or contraction of production, so too the aspect of the industry as regards profits has remained unaltered. The high cost of living combined with the fact that the miners are scattered and but few properties are of a nature favorable to operation on a large scale, have militated against efforts to reduce working costs, and, since there has been no appreciable advance in yield per ton milled, the profits earned have been about the same as in the preceding year. A large number of Rhodesian ventures are small privately owned or leased mines, and it accordingly is impossible to estimate with any degree of accuracy the total profit secured. At a very rough approximation, however, the gross earning may be placed at between £900,000 and £1,000,000 for the twelve months. The Globe & Phoenix, Eldorado, and Giant have each distributed substantial sums among shareholders, and a new dividend-payer in the Lonely Reef has entered the list. Development has proceeded satisfactorily and, taken on the whole, has been gratifying. At the Shamva mine (a large 4 to 5-dwt. deposit under 'Gold Fields' control in the Abercorn district), 2,141,992 tons of nearly 5 dwt. value had been developed at the end of June, and at the Cam & Motor mines (Gatooma area) about one million tons of ore of 10 dwt. value per ton has been blocked out. Both these mines are expected to commence milling operations next year and to pay dividends at an early date. In addition to the Shamva and the Cam & Motor, the Falcon (a gold-copper venture in the Blackwater district) and the Antelope, to the southwest of Bulawayo, are being equipped with crushing plant and should commence drilling within the next nine or ten months. While developments in these ventures have been highly encouraging, there have been two or three severe disappointments. The Jumbo mine virtually has exhausted all its profitable ore. the Giant Mines Co. has not yet found the lode in the lower levels, and apparently the underground position in the Eldorado Banket mine is less satisfactory.

An improvement in native labor conditions has been witnessed. The Labor Recruiting Bureau has organized in a most creditable manner; so much so that the rather unusual development of supply exceeding demand was announced a month or two ago. As usual, a large amount of prospecting has been carried on all over the country. Several small and rich quartz shoots have been found, but apparently no new deposits of much promise have been opened. The Geological Survey has continued its labors, and a number of reports have been issued—mainly, it is to be regretted, of purely scientific value.

As regards minerals other than gold, the bulk of the production has been derived from the Wankie colliery and the chrome iron deposits near Selukwe. At the colliery coking ovens are built and it is intended to furnish coke to the Katanga copper mines. Large quantities of chrome iron ore of good quality have been shipped to Europe, but the high freight charges render the margin of profit small. The cassiterite discoveries on the Victoria area of Mashonaland have proved most disappointing. On the other hand, a highly promising occurrence of tin stone is being opened to the east of Salisbury by an influential Johannesburg syndicate. In regard to copper ores the Umkondo mine near the Sabi river is being opened again and work at the Edmundian on the Rhodesian-Portuguese frontier has been resumed in a small way. The English law courts finally decided in favor of the De Beers Corporation in the case of De Beers *v.* Chartered Co., and thereby established the right of the great Kimberley corporation over all the diamondiferous areas in the country. The deposits so far discovered have therefore remained inactive. Altogether 1912 may be characterized as a year in which the rates of production and profit-earning have been maintained, while development has been pushed and foundations for the building up of a more prosperous industry have been laid. That, I think, is the sum total of Rhodesian endeavors in the field of mining during the past year.

AUSTRALIA

The past year's work in this country has been one of much interest from several points of view. The drought, which had interfered with the previous year's agricultural industry and threatened to do so again, was not felt so severely as anticipated, and the season should show an increase in mineral production. A great deal of gold was exported, which fact was argued by many to be a bad sign; and the finances of two of the states are in poor condition, one from too much borrowing, and the other from continual deficits resulting from its general internal condition. The Federal Government has, on the whole, done fairly well in its administration, and the most important work undertaken was the starting of construction of the transcontinental railroad, which will be 1060 miles long and cost about $18,000,000. This Government also started a public savings bank. The country has rich iron deposits in sev-

eral states, and, stimulated by the large imports of iron and steel goods, increased railroad construction, and shipbuilding, the Broken Hill Proprietary is erecting works on a large scale at Newcastle, in New South Wales. Gold production showed a further decline. On the other hand, the continued high price of metals was felt in all the metal-mining districts. Several new goldfields promised well for a time, but nothing is heard of them now. The following table gives the approximate gold output from the various states, those from South Australia and Tasmania being estimated:

	1911. Fine oz.	1912. Fine oz.
New South Wales	181,121	165,000
Queensland	381,845	354,000
South Australia	11,000	9,000
Tasmania	32,992	30,000
Victoria	503,541	447,000
Western Australia	1,370,867	1,270,000
Total	2,481,366	2,275,000

In New South Wales, interest has centred on Broken Hill, which place is quite prosperous and has been practically free from labor troubles during the year, although would-be agitators have tried to stir up strife. The water-supply is also in safe condition, and will be augmented according to Government plans under construction. The South and Central mines have opened in a satisfactory way, and the Proprietary decided to work two shifts underground. The flotation plants have treated large tonnages of old tailing, and paid dividends, while metallurgically, general results from the complex silver-lead-zinc ores have been good and promise to be better. Mt. Boppy is the chief gold mine in the state, and its plant has been under reconstruction. There was excitement for some weeks over rich specimen ore in the Long Tunnel mine in one of the southern districts. The Great Cobar copper mine is improving its position, and, besides the smelters, a concentration plant has been built. The coal production of Newcastle maintains a high tonnage and should increase.

Each state has its great centre, and Queensland directs a keen eye on work at Mt. Morgan. A change of management was effected in 1912, smelting practice altered, and now the monthly output approximates $500,000 in gold and copper. Charters Towers has been struggling hard to find new ore-shoots at depth, and the local people deserve all credit in trying to stop the decrease in gold output. At Gympie, the Scottish Gympie is treating low-grade ore and is to add considerably to its equipment. Otherwise this old field is quiet. Mt. Elliott and Hampden mines have produced copper steadily, and Chillagoe has had a busy but unprofitable year. Queensland is rich in fine gems and rare metals, and the annual output of these is quite important. South Australian mining includes the Northern Territory, which belongs to the Commonwealth Government, but work in that tropical country is unsatisfactory and little is heard from it. Nearly all the mineral production of the former state is from copper, which is produced by the Wallaroo and Moonta mines, which are not opening so well as formerly. At Port Pirie the great smelters of the Broken Hill Proprietary are situated, work here being of an exceptionally interesting character.

In Tasmania the price of metals has made itself felt. Mt. Lyell has been unfortunate in having a fire, and bad fall of rock, which killed over 50 men in all. The North Lyell mine is still producing good ore. A hydro-electric plant is being constructed for the company. Another large hydro-electric plant is being built for another company, which will sell power over a large area and also manufacture calcium carbide. The Zeehan district, with its complex ores, has been quiet, while Mt. Bischoff and the Briseis mines have been crushing and sluicing their tin ores, respectively, with profit.

Working the sidelines of 'reef' at Bendigo, in Victoria, helped production and revived the field generally. The big mine of the year was the Central Red, White & Blue. From a metallurgical point of view, Bendigo is improving slowly. Work on the 'deep leads' was not of much interest. In Gippsland, the well known Long Tunnel mine does not offer much hope, and the complex ore of the Cassilis has led to much management and experimenting. The State Government's coal mine at Wonthaggi has been opened remarkably well and produces a large tonnage of fair-grade coal.

Several new mines in Western Australia have started to yield gold during the year, but the downward tendency of production in the state cannot be checked. At Kalgoorlie, the Associated Northern parent mine is in the hands of tributors; but its Ora Banda property promises to be profitable. This is a low-grade district, and should give a fair account of itself in time. The Associated is making small profits, but development is unsatisfactory. At the Horse-Shoe, the deeper work may help matters in 1913, but the past year has been unprofitable. The Ivanhoe is probably the best mine on the 'Golden Mile' from a development point of view and future prospects, although the grade of ore treated had to be reduced. The Meekatharra field is one of promise, but Paynesville was disappointing. New producers were the Yuanmi, Mountain Queen, and Gimlet South Extended, while the Bullfinch should be operating in a short time. There were many wage troubles in the state, those affecting the mining industry being that of the engineers, molders, and the discussion during the past three months between the Chamber of Mines and the various unions at Kalgoorlie. As the year closed it seemed inevitable that a general strike would occur at Kalgoorlie before long.

NEW ZEALAND

This country had a rather troublesome year, due solely to the stupidity of men who did not know when they were well off, and gold production declined from 411,390 fine oz. to about 330,000. If the mining industry of this little Dominion suffered, its agricultural pursuits were not affected, and they will continue to expand with such rich soil and good seasons. Labor conditions, or rather the attitude of labor toward general mining operations, was one to be remembered and the most productive districts in both islands were at a standstill for several months. Through the firmness of the mining companies, the thinking people, the free workers, and the Government, a stage has been reached where conditions will probably remain peaceful, and the gold yield may be expected to return to usual figures. In the Waihi district the trouble arose between two unions, and the companies were gradually drawn into it; while at Reefton the question was one of deciding who should say how many men should work a 'baby' drill. No new goldfields have been discovered or opened in New Zealand for many years, and the prospect is not bright, although there is a large area of mountainous country which has not been thoroughly prospected, even near those districts worked at present.

The Waihi company has seen its best days; but production of gold and silver bullion should continue on a fairly large scale for many years. During the strike, a general clean-up was made, resulting in an output of $240,000, but the bullion from the first run since restarting has been absorbed in the plant. Work on the hydro-electric scheme, to supply mines and mills with power, is well under way, and will cost $750,000. Strikes come hard on mines like the Grand Junction, which had paid one dividend after about 18 years' development. The Waihi-Paeroa Gold Extraction Co., which is dredging and treating tailing from the river below the Waihi district, is now dealing with 18,000 tons per month, yielding $30,000 and paying dividends. The old Thames and Coromandel mining centres are very quiet, yet a considerable population remains. Coal-mining also suffered from labor troubles for a short time, but the total production should be about 2,000,000 tons, produced from the west coast of the South Island and the Auckland province. North of Auckland a company is making about 50,000 tons of high-grade cement per year, and is doing well for a local concern. Although mines in New Zealand employ a fair number of men, the industry is small compared with that of farming, and is likely to continue to decline.

MARKET REPORTS

NEW YORK SHARE MARKET

A review of the conditions prevailing in the mining markets of New York during 1912 is inevitably the review of a period of masterly inactivity. The opening of the year just departed saw the much heralded boom in Porcupine showing its first signs of collapse, and the entire year has seen absolutely no mining promotions of any importance, outside of deals made in the 'coppers.' The conditions at Cobalt were such that notwithstanding the fact that 1912 has shown a but partly expected increase over the output for 1911, it has nevertheless been recognized on all sides that the greatest possibilities of Cobalt are now known. Inasmuch, therefore, as the general public is never interested in a mining district except where its possibilities have not yet been revealed, it is not surprising that the Cobalt following has dwindled. It has been continually deplored throughout 1912 that the Mexican situation has been such as to render it impossible to finance anything in the way of a Mexican mining enterprise. The improvement in the price of silver was one for which Mexican mining companies had waited long, and it was a perverse turn of fate that brought with the higher price of the metal the downfall of the Diaz regime, and the apparent inability of the Maderistas to establish an adequate police surveillance of the country.

The really important mining matters of the year took place in copperdom and may be briefly summarized as the concentration of control of the copper industry. Throughout nearly the whole of the year of 1911 there was much talk of a copper merger which was to embrace the properties controlled by the leading groups, and it was at one time stated that everything had been prepared for offering to the public shares in a copper company to be second only to the United States Steel Corporation; that steps had been so far taken as to have certificates all completed save attaching of signatures. This flotation was finally abandoned on account of the increasingly hostile attitude of the law department of the Federal Government. Early in 1912 the formation of the present Inspiration Consolidated Copper Co. was completed, and as a result there sat down around one directors' table representatives of all of the copper producers of first magnitude in the United States. Finding that legal obstacles blocked the formation of a copper merger as a distinct entity, the copper producers succeeded in arranging a most effective but intangible combination indirectly. It can be said with a fair degree of certainty that were a copper merger to be completed its board of directors would in all probability vary but little from that of the Inspiration Consolidated. The list includes Thomas F. Cole and John D. Ryan, the latter now recognized as the working head, while the Cole-Ryan-Amalgamated group of mines includes so many of the best known copper properties that enumeration is hardly worth while. The president of the company is William B. Thompson of the stock exchange house of Thompson & Towle, and who, in conjunction with Mr. Ryan, was one of the principal figures at the various conferences held in New York and in London, as a result of which the differing interests were finally harmonized. Among the directors is Edmund C. Converse, who is one of the principal figures in banking circles in New York, being president and director in both the Astor Trust Co. and the Bankers Trust Co. and a director in the Guaranty Trust Co., which last-named institution is one through which a vast number of the many hydro-electric power plants have been offered to the public. Mr. Converse is ordinarily looked upon as a representative of the Morgan intrests. The United States Steel Corporation is represented on the Inspiration board by its ex-president, William E. Corey, and the Standard Oil Co. by William Rockefeller. The Guggenheim-Morgan interest is represented by Eugene Meyer, Jr., while Phelps-Dodge are represented by the presence of Albert H. Wiggin, president of the Chase National Bank, and Francis L. Hine, president of the First National Bank and a director in the Chase National. The Inspiration Copper Co. may be fairly considered to reflect the close community of interest which has come to prevail in the mining, smelting, and marketing of copper. It was in January of 1912 that the bonds of the Inspiration-Live Oak combination were offered for sale. These securities are now quoted at 105, the high mark during the year having been 110½. The financial weight of the combination began to make itself felt in the copper metal market early in 1912, and by June quotations had reached 17c. The stabilization of the market is apparent when it is noted that during the latter half of the year just closed there has not been a variation of as much as 1c. per pound. The skepticism with which the movement was first greeted, the rumors of hidden stocks of copper, the accusations of blister copper held up at the refineries, were all matters of incidental market news, for the most part treated with obvious indifference by the powers in control. That control having been achieved, and the consumers and producers at a deadlock, the forces on each side avowing a determination to starve the other into submission, it is fitting that at the close of the year there should now be promised another federal investigation. In conclusion, it is worth while to remark that there have been several important accessions to the list of dividend payers among the copper mines, the public has not vouchsafed to the copper share list any proportionate degree of market support. Some particular instances of market-making having been conspicuous, as in the case of Chino, Braden, Inspiration, and some others, but as a whole the public has assumed and maintained an attitude of apathy.

The year 1912 has seen determined efforts to clear the field of mining finance of the makers of dishonest markets, and it is sincerely to be hoped that these efforts may result in better financial methods. At the opening of the year George Graham Rice, whose pyrotechnics have taken up much valuable space in the press of the country, was on trial for using the mails to defraud, his campaigns in Ely Central and other mining issues having finally reached their inevitable collapse. Rice eventually pleaded guilty, served his sentence, and is again at large. At the close of the year there is in progress a trial of a similar nature where, however, the principal figure among the accused receives an infinitely greater degree of sympathy. For some weeks the prosecution of Julian Hawthorne and his associates has been in progress. The son of one of the great figures in American literature, and himself a literary man of no small talent, Mr. Hawthorne appears to have lost his bearings entirely in the marketing of the shares in so-called Canadian mining properties, which properties appear to have been, as a matter of fact, landscapes solely.

A review of the events of the year includes the incorporation of the Ray Central into the Ray Consolidated, the enlarged property being looked upon as second only to Utah Copper in its possibilities. The Tonopah district acquired a new leader in Tonopah-Belmont which, as result of a long period of development, came into its own as one of the greatest silver mines of the world. The early part of the year saw the final collapse of some of the promotions in Guanajuato, Mexico. The assets of the Securities Corporation, Ltd., were sold at auction. In this corporation were shareholders all over New England and the Middle Western states, comprising one of the best groups of people ever brought together in a mining enterprise not dominated by Wall Street capital. In the collapse of the Securities Corporation and the collapse of the smaller Development Company of America, the mining industry lost the support of people which it could ill afford to lose. The Development Company of America was best known by reason of its attempt to restore the old Tombstone Consolidated property in Arizona to a productive basis. The activities of the Guggenheim group included a great deal of what was of interest in mining during the year. Guggenheim shares were distributed in the French market, their interest in the old Esperanza in the camp of El Oro, Mexico, was liquidated, while the development of Chino and Braden Copper into properties of the first magnitude and the acquirement by affiliated interests of the Alaska Gastineau and organization of the Alaska Gold Mines Co., are matters of current news, as is for the most part the

recent strike at Bingham, Utah, and the sympathetic movement at Ely, Nevada.

The copper mining industry lost in April, 1912, its great statistician in the death of Horace J. Stevens of Houghton, Michigan, whose 'Copper Handbook' had grown from the size of an old-fashioned McGuffey's Third Reader in 1901 to two bulky volumes in 1912, which have not even yet gone to press. Mr. Stevens was a man of great originality and of untiring industry as such a compiler must be; his most engaging characteristic was his ability to make terse and expressive comment concerning those companies which he believed to lack the element of good faith. At times his denunciations could well be described as eloquent.

In the mid-year there was completed in New York a rather formidable organization, known as the Canadian Mining & Exploration Co. with a $5,000,000 capitalization in shares at par value of $5,000 each. The directors include Percy A. Rockefeller, William E. Corey, J. R. DeLamar, Ambrose Monell, and Sir William MacKenzie. The concern was promoted, for the purpose of taking over, financing, and developing meritorious mining enterprises, but whatever its activities may be have since its organization, they have been accompanied by no public announcements. In October the followers of copper in Boston, and this includes the greater number of its citizens, received a very severe jolt, that is if Boston could be said to recognize anything so vulgar as a mere 'jolt,' in the failure of the Dow promotions. The companies concerned appear to have withstood the shock and development at the Franklin, Indiana, and North Lake mines are proceeding as originally planned.

Mines and mining to the eastern mind are, outside of the Engineers' Club, connected with financial and market operations almost invariably. Along this line of action 1912 has accomplished as nearly nothing as could well be done in any similar period of time. The year saw the culmination of a wild ballooning in wireless issues, it also saw a quiet boom in the shares of public utility companies, of industrial issues, and hydro-electric properties—but in mining little or nothing was done. It is only fair to say in conclusion that with better methods and elimination of undesirable elements great improvement in this direction may be expected, and that with these things accomplished the industry may be assumed of assured of hearty public support.

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. December 26.		Closing Prices. December 26.
Alaska Mexican	$ 1⅜	McKinley-Darragh.	$ 1¼
Alaska Treadwell	42⅛	Miami Copper	25⅛
Alaska United	23	Mines Co. of America	3⅛
Amalgamated Copper	79⅛	Nevada Con	19⅜
A. S. & R. Co.	74	Nipissing	9
Braden Copper	10⅜	Ohio Copper	1
B. C. Copper Co.	4⅛	Ray Con	22
Chino	47⅛	Tenn. Copper	39⅛
First National	2	Tonopah Belmont	9
Giroux	3⅛	Tonopah Ex	2⅛
Goldfield Con.	2⅛	Tonopah Mining	6⅛
Greene-Cananea	8⅛	Trinity	8
Hollinger	15⅛	Tuolumne Copper	3⅛
Inspiration	19	Utah Copper	60⅛
Kerr Lake	2⅛	West End	1⅛
La Rose	3	Yukon Gold	3
Mason Valley	10⅛		

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	January 2.
Camp Bird Ltd	$ 5⅛
El Oro	4
Esperanza	9⅛
Oroville Dredging	1⅛
Santa Gertrudis	7⅛
Tomboy	6⅛

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Beg. Belcher	52	Jan 2	Jan. 31	.02
Union Con.	32	Jan. 4	Jan. 30	.15
Con. Imperial	77	Jan. 4	Jan. 29	.01
Ophir	91	Jan. 18	Feb. 14	.15
Sierra Nevada	33	Jan. 28	Feb. 20	.10

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, December 31.		Closing Prices December 31.
Adventure	$ 5¼	Mohawk	$ 61½
Allouez	42	North Butte	33½
Calumet & Arizona	71	Old Dominion	55⅜
Calumet & Hecla	510	Osceola	105
Centennial	18	Quincy	78
Copper Range	52¼	Shannon	13
Daly West	3¼	Superior & Boston	1½
Franklin	8¾	Tamarack	85
Granby	72	Trinity	4½
Greene Cananea, ctf.	9	Utah Con	10¾
Isle-Royale	32½	Victoria	1¾
La Salle	5½	Winona	3¾
Mass Copper	5	Wolverine	71

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 2.

Atlanta	$ .19	Montana-Tonopah	$1.80
Belmont	8.85	Nevada Hills	1.40
Big Four	.70	North Star	.20
Buckhorn	.85	Ophir	.19
Con. Virginia	.23	Pittsburg Silver Peak	.70
Crown Point	.20	Round Mountain	27
Florence	.59	Sierra Nevada	.19
Goldfield Con.	2.12	Tonopah Extension	2.25
Halifax	1.15	Tonopah Merger	.86
Jim Butler	.69	Tonopah of Nevada	6.25
Jumbo Extension	.31	Union	.14
MacNamara	.18	Vernal	.10
Mexican	.87	West End	1.27
Midway	.32	Yellow Jacket	.15

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 2.

Associated Oil	$12.50	Monte Cristo	$ .75
Brookshire	.50	New Pa Pet	.53
Caribou	1.00	Palmer	.19
Claremont	.60	Palmer Union	.18
Coalinga Central	.20	Premier	.30
De Luxe	.60	Republic	.21
Maricopa 36	.34	United Oil	.32
Maricopa National	.20	W K Oil	1.95

COMPARATIVE QUOTATIONS ON LONDON MARKET

(In pounds sterling, except as indicated.)

	December 10. 1911.	1912.		December 10. 1911.	1912
TRANSVAAL.			Broken Hill Proprietary	47½s.	46s.
Central Mining	10¾	9¾	British Broken Hill	57s.	53s.
Rand Mines	6⅞	6⅜	North Broken Hill	5½	8
Consolidated Gold Fields	4⅜	3⅜	South Broken Hill	6⅝	8½
Crown Mines	7	7	Mount Morgan	2⅝	3¼
East Rand	3¼	2¾	Great Boulder	15s.	13s.
Randfontein Central	1 11/16	1⅜	Ivanhoe	5	3½
Robinson	6½	3½	Kalgurli	2¾	2¼
City Deep	2⅝	3	Sons of Gwalia	1 7/16	1⅛
Modderfontein	11½	12⅛	AMERICA.		
Brakpan	2⅞	4 1/16	Alaska Treadwell	8⅜	8⅞
RHODESIA.			Alaska United	3 7/16	5
Globe & Phoenix	2 1/16	1⅝	Alaska Mexican	2⅞	2⅞
Shamva	4 9/16	3¼	Oroville Dredging	5s.	6½s.
Giant	2 9/16	1 7/16	Camp Bird	30s.	21½s.
Gaika	1½	1	Tomboy	1 3/16	1½
Eldorado	3 1/16	1¾	El Oro	23s.	17s.
Lonely	3½	2⅞	Esperanza	1 7/16	2
Cam & Motor	34s.	37s.	Mexico	7⅝	7⅜
British South Africa	31s.	26s.	INDIA.		
Tanganyika	3	2½	Champion Reef	10s.	12s.
WEST AFRICA.			Mysore	5⅛	5⅝
Ashanti Goldfields	1⅜	1 1/16	Nundydroog	36s.	30½s.
Prestea	1	1	Ooregum	17½s.	18½s.
Abosso	1¼	1 1/16	RUSSIA.		
Taquah	1¼	¾	Spassky	3¾	4
Broomassie	5s.	5s.	Kyshtim	1⅞	3¼
Anglo-Continental	13s.	15s.	Athasar	1½	1¾
Rayfield	2⅜	3½*	Lena Goldfields	4⅞	3
Naraguta	1⅝	1⅜	Siberian Syndicate	2⅞	3¼
Bisichi	1⅜	1¼	Siberian Proprietary	¾	¾
Gurum River	10½s.	2½s.	Russian Mining	⅞	½
AUSTRALASIA.					
Waihi	2⅞	1⅝			
Talisman	2⅜	2			

*In terms of the old 5s. shares.

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco January 2.

Antimony	12—12¾c	Quicksilver (flask)	38.50
Electrolytic Copper	18—18¼c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, December 31.—Copper prices are firm with active buying for early shipments. American consumers are showing more interest in the market. Lead is firmer and a considerable volume of business has been done at somewhat better prices. Spelter remains unchanged. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Dec. 26	17.38	4.13	7.08	—
" 27	17.43	4.13	7.08	62⅜
" 28	17.43	4.13	7.08	62¼
" 29	Sunday.	No market.		
" 30	17.45	4.15	7.08	62¼
" 31	17.45	4.15	7.08	62⅜
Jan. 1	Holiday.	No market.		

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09¼	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.50	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10¼	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12¼	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	3.00	4.35
Borax, powdered, bbl., ℔ 100 lb	3.25	4.25
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.50	13.50
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 50 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27¼	0.28¼
Cyanide, 129%, 200-lb. case, ℔ lb	0.26¾	0.27¼
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	11.50	13.50
Litharge, com'l, ℔ 100 lb	8.00	9.50
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—¼% Fe)	36.00	47.50
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.10¾	0.12¼
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	12.05	13.50
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.25	11.50

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.05	0.05¼
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01¼	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	500.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Sulphur, 80%, ℔ ton	16.50	18.50
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	475.00	500.00
Tungsten ore, 65%	425.00	475.00
Vanadium ore, 15% V_2O_5, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

Petroleum Production of California

Final figures for the month of December are not available, but the total gross production for the first eleven months of the year is shown below with details for January and November. It will not be far wrong to assume that December production equalled that for November, in which case the total for the year would be 90,615,194 barrels. This shows an increase of 8,000,000 bbl. Complete figures for the United States cannot yet be given, though on other pages the Illinois, Midcontinental, and Gulf Coast figures, all showing decreases, are quoted.

Field.	Jan.	Nov.	Jan.-Nov.
Coalinga	1,670,733	1,702,538	18,163,245
Kern River	1,087,881	986,015	11,660,665
Lost Hills	45,668	280,408	1,844,967
McKittrick	521,026	402,792	5,158,527
Midway	2,180,391	2,504,710	25,556,303
Santa Maria	616,331	560,438	6,372,422
Sunset	459,593	409,151	5,026,768
Summerland	6,522	6,800	74,065
Coyote	118,342	144,847	1,187,737
Fullerton	480,027	503,963	5,323,977
Los Angeles	36,108	31,344	368,532
Newhall	10,531	8,997	112,988
Salt Lake	221,277	226,869	2,492,637
Ventura	48,616	65,914	634,898
Whittier	66,338	56,064	668,740
Totals	7,569,384	7,890,850	82,754,344

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

STEEL MAKING on a large scale in Canada is foreshadowed by the announcement that the United States Steel Corporation will build at Sandwich, Ontario. With blast-furnaces running to capacity and unfilled orders equivalent to three months capacity, new works are inevitable, and trade makes light of international boundaries.

REFORM is searching out the hidden corners in New York, and the Stock Exchange is seriously considering radical changes. It is certainly anomalous that in these days of rapidly increasing public supervision an institution that so vitally affects the whole people has been left to its own devices. Possibly there is a connection between ventilation of the known abuses and the disinclination of the public to 'trade.'

QUICKSILVER enjoyed a prosperous year in 1912, as related by Mr. Clifford G. Dennis in our review number. An unfortunate error in our draughting room lead to transposition of lettering on the curves of production and price used in illustrating his article and appearing on page 61. The price for the year closed at about $40 per flask, as shown by figures in the article itself, and not $20, as the curve indicated.

LOSS of the Government suit against the Canton Mining Company, wherein application for patent to mineral claims in the bed of the North Fork of Feather river was contested on the ground of the land being non-mineral and probably desired for water-power development, seems to indicate, as maintained by Mr. W. C. Mendenhall, that the United States Land Office favors the miner where the evidence warrants.

GOLDFIELD, as shown by the report for December, is pouring out a lessening stream of gold, and the time has come when the company owning the great bonanza must seriously consider treatment of low-grade copper-bearing ore. It will be remembered that Mount Morgan, in Queensland, changed from gold to a copper mine, and at Butte copper replaced silver in depth. What may prove true at Goldfield is still uncertain, but all will join in the hope that the analogies cited prove good in Nevada.

FOREIGN money involves difficult calculations by both travelers and those who stay at home. In Peru the standard coin is the pound, divided into 10 soles of 100 centavos each. The Chamber of Commerce and Exchange has just adopted a standard form for written expressions of Peruvian currency. The pound is to be indicated by the abbre-

viation Lp., and periods are to be placed between the figures representing pounds, soles, and centavos. When a number includes pounds only, the figures are to be followed by a period and a dash; thus, Lp. 10.—. Commas are to be used as in the United States, to point off integral fractions. The expression Lp. 10,250.8.15 would be read 10,250 pounds, 8 soles, 15 centavos. Such efforts to clarify writing are highly to be commended, though we join *The West Coast Leader* in protesting at the substitution of Lp. for the familiar £ used for the British pound, which has the same value as that of Peru.

ELECTION returns are not always conclusive where the vote is at all close until the final counting of the ballots, and the apparent victor on the day after election may prove to be the loser in the end. Comment has been widely made upon the amendment to the Colorado constitution by which mills and smelters were defined as public utilities and put under the regulations governing such utilities. Final certification of the returns indicates, however, that the amendment failed of passage. In this we believe the state to be the gainer. Whatever possible advantage might have accrued from the power to regulate the rates of large smelting corporations, there can be little doubt that the law, which applied to all mills, would have interfered to some degree with the operation of small producers: the very ones which need most to be encouraged. We assent to the general principle that the state should supervise the industries carried on within its borders, but supervision may easily be extended beyond the limit of profit.

MINE inspection is to the fore again in California, and several bills have been prepared for introduction at Sacramento. This state is almost the only one remaining in which there is no inspection of mines by a state officer. A bill making provision for such inspection of mines was passed by both houses of the last legislature, but being considered defective, failed of signature by the Governor. We believe that state inspection of mines is a wise and necessary measure, but having waited so long California may well take time to formulate a really good system. Most important of all is to provide for non-political appointments and for pay and authority ample to attract high-class men to the service. The operators can have no fault to find with mine inspection if honest and competent men be appointed. We believe that they have as much to gain by impartial inspection of their works as have the men. Practically all users of boilers carry special insurance on them, and it is well recognized that the most valuable feature of boiler insurance is the inspection. In Illinois the coal operators organized a mutual insurance company to carry their indemnity risk, and they have found that the periodic inspections made by competent men on behalf of the insurance company, are worth the whole cost of the insurance. That official inspection in some states has been worthless is a result of defective laws and the making of political appointments. Inspection itself is good and should be welcome.

Flotation Methods

Adoption of flotation for the recovery of copper from its ores by the Britannia Mining & Smelting Company, Ltd., operating in the New Westminster district of British Columbia, as announced by one of our advertisers in another column, is evidence of the rapid progress recently made in the application of flotation to the recovery of copper. The highly successful results attained at the Braden mine, in Chile, where the plant employing the Minerals Separation, Ltd., process makes a greatly increased recovery, as compared with wet concentration, are already well known, and the adoption of the same process by the Britannia company will, it is to be hoped, yield equally good results. The ore at the Britannia consists of silicified schist impregnated with sulphides of iron and copper, and though the mine has been thoroughly developed and its equipment is good, the refractory character of the ore has militated against profitable operation. Extensive experiments have been made with ordinary concentration and magnetic separators and the final adoption of flotation is the result of long and careful study. It is reported that the present 400-ton mill will be altered to a flotation plant and that later a 1000-ton flotation plant will be built. Oil flotation for copper ores is of the greatest importance, because of the high recovery thus made from slime, the bugbear of ordinary wet concentration. The work of the new plant will, accordingly, be watched with unusual interest. The final instalment of the admirable review of ore-dressing progress, by Mr. H. S. Munroe, deals with flotation methods in some detail. Perhaps the essential characteristics in the various processes employed for this purpose can be more clearly brought out by suggesting an alternative method of classification to that employed by Mr. Munroe. Thus the processes may be grouped as follows: (1) Oil rafting, or bulk flotation, where the oil, through its lighter specific gravity, is made to bear up a certain amount of included sulphide. This may or may not be modified by the use of gas bubbles, and forms the basis of the Everson, Elmore, Kirby, and Wolf patents. (2) Granulation by oil, in which the oil is employed to cause the sulphides to cohere in aggregates which will fall in a rising current of water, as in the Cattermole and Minerals Separation patents. (3) Froth flotation by chemical reaction without use of oil, as in the Potter and Delprat processes. (5) Film flotation, with or without the use of oil, as in the MeQuisten, Minerals Separation, De Bavay, and Wood processes. (6) Agitation froth, secured by the combined use of oil and agitation. The theoretical principles of flotation are interestingly set forth in the recent valuable book on this topic by Mr. T. J. Hoover, and we are promised an elaborate study of the principles of concentration processes which employ surface tension, in a forthcoming volume by Messrs. H. L. Sulman and H. F. K. Pickard, who are entitled to speak with authority. Meanwhile the application of flotation methods is making progress that is of enormous probable benefit to the mine operator. It is to be hoped that news will henceforth be less concerned with the progress of litigation and more with practical results.

Federal Administration of the Public Lands—II

By W. C. Mendenhall

*Lands valuable because of their metalliferous deposits are not affected either by the withdrawal act or by the creation of National Forests. It was specifically provided at the time of the creation of the latter that location and entry upon mineral claims should continue precisely as though the reserves were not in existence. In the act of June 4, 1897, occurs the clause.

It is not the purpose or intent of these provisions or of the act providing for such reservations to authorize the inclusion therein of land more valuable for mineral therein or for agricultural purposes than for forest purposes * * *. Nor shall anything herein prohibit any person from entering upon such forest reservations for all proper and lawful purposes, including that of prospecting, locating, and developing the mineral resources thereof; Provided, That such person shall comply with the rules and regulations covering such forest reservations, * * *.

Under the law and under the regulations that have been prepared in pursuance of law, miners have full access to the National Forests. They universally exercise the rights which this access gives them, despite the statements that are made to the contrary. Since, however, the administration of the reserves is not within the jurisdiction of the Department of the Interior, except when questions as to patent or other alienations of lands arise and a representative of the Department of the Interior therefore does not speak with authority on forest administration, I shall quote from officials of the Department of Agriculture on the question of miners and the National Forests. H. S. Graves, the Forester, in an address delivered before the American Mining Congress at Spokane during the latter part of November, said:

A * * * charge is made that National Forests are blocking mineral development. * * * The statement that the prospector is interfered with is not true. He is absolutely free to prospect where he will in the National Forests. * * * The only restriction that is placed on him is that he shall be careful of fire. * * * I have repeatedly asked for specific cases where it was claimed prospectors were interfered with. Usually the statements have been general, and those making them could not tell me of any specific instances. In the instances where I have had definite cases given me, I have found either that a prospector has taken offense because a ranger cautioned him to be careful of fire, or it was a case five or six years ago when the Service was first being organized and the personnel was not as efficient or did not understand our instructions as well as now.

Another charge is that when a mineral claim comes up for final proof the Forest Service needlessly and with inadequate information protests it to the Land Office, often holding up patent without cause. My answer to this is that no adverse report ever goes to the Land Office except from a qualified mining expert, the best I can secure under the law. * * * The interests of the Forest Service in this matter are identical with the interests of the public and of the mining industry itself. If a man has a mine and has complied with the law, he should be given the land with the least possible delay and trouble. If he has not a mine as defined by the law or has not complied with the conditions laid down by the law, the land should not pass from government ownership.

Many of those interested in mining have insisted that when claims come to patent the officers of the Government should not make any field examination to determine whether the law has been complied with. It would seem hardly necessary for me to call attention to the reason why such examinations are necessary. The fact is that over and over again the liberal mining laws have been fraudulently used to secure title to land desired for other purposes than mining. I have taken occasion during my incumbency in office to look up this very question and have been amazed by what I have learned. I have specific instances where the mining law was fraudulently used to secure very heavy timber for speculative purposes, to secure sites for water-power development, * * * to secure water holes to give control of extensive stock range, to secure control of valuable areas for summer resort development, to secure areas controlling valuable rights of way for speculation, and various other purposes. Can anyone go before the country in the name of the mining industry and ask that the Government be prohibited from undertaking to prevent such frauds? Does anyone who has the real interest of the industry at heart acknowledge that the enforcement of the mining laws is not the very thing which will protect it from the blight of the wild-cat promotor who has already often enough brought discredit upon it? Let me cite the opinion of the local county mining congress which met at Yreka, California. One of its resolutions urges as follows:

'*Be it Resolved*, that it is the sense of this Congress that the National Forest policy and service has proved an efficient agency, not only in preserving for the prospector the undiscovered mineral deposits in the district, by preventing their acquisition through non-mineral entries, but in facilitating their location, enjoyment, and patenting by good faith mineral claimants in accordance with laws passed in the interests of miners.'

* * * In the National Forests the miner or prospector has the full right to the timber on his claim for the purposes named in the law. If he needs more he can get it without charge through the liberal free-use policy of the service. This policy of free-use is applied with great liberality to prospectors. Thus it is well understood that in case of need for timber off the claim which can not be foreseen, a permit is not required but the prospector is allowed to cut and use such timber as he needs, with the understanding that he will later on notify the ranger regarding the amount taken and its location. Where his mine has become a productive one, and further timber is needed, it may be secured at reasonable prices. In other words, the Government gives him timber and all he needs until his mine begins to yield ore for the market.

This subject of mining claims in National Forests is discussed somewhat more specifically by the Forester in his Annual Report for 1912. I again quote at length:

Mining claims are perfected and new mining claims initiated (in the forests) under the same laws which apply on the unreserved public domain; and no restriction of any kind is imposed on the prospector in his search for valuable minerals. He may go freely where he pleases, and except on the small areas withdrawn by the Government for its own use in administering the forests, may stake out his claim wherever he finds indications that seem to him worth following. If he desires to build a cabin on government land not included within the limits of his claim, he is given a free occupancy permit and free timber for its construction. On his own claim he need only comply with the law to remain in undisputed possession as

*Continued from p. 34.

long a time as he may desire before making final proof. Both the timber and the forage on it are reserved for his use in so far as he may need either in connection with the development of his claim; and if the supply on his own claim is not sufficient for his needs, free use of National Forest timber within reasonable limits and of range for his work animals may be had for the asking. When he desires to make final proof no requirements are imposed upon him other than those laid down by the general mining laws for all public lands. Moreover, by the protection which National Forest administration affords against fire and by the provision made for permanence of timber supplies for local needs, he gains both in security against fire loss and insurance against the danger of having to bring timber from distant markets at a heavy cost in order to work his mine.

Yet the charge is frequently made that the National Forests are closed to mining development and that restrictions have, without legal warrant, been imposed upon the patenting of mineral claims within them.

In so far as these charges are not the result of misapprehensions or misrepresentations, they arise from the fact that before claims to land within National Forests are patented they are examined by forest officers and reports upon them are submitted to the Interior Department, which has sole jurisdiction over all questions of land title. These reports are made in accordance with the request of the Secretary of the Interior and under authority of an express provision of law. Doubtful claims bearing evidence of fraud or failure to comply with the requirements of the mining laws, are always examined on the ground by a practical miner or mining expert and adverse recommendations are made only when such officers certify to the *malafides* of the case.

In reporting upon mining claims the question first considered is whether the patenting of the claim will in any way affect adversely the interest of the public in the land for National Forest purposes. If the claim is not located on land which is valuable for its timber or of high value for purposes other than mining, the good faith of the applicant is taken for granted, if bad faith is not apparent, and the question whether or not the mineral law has been fully complied with is not raised by the Forest Service. The claim is reported upon favorably as not prejudicial to National Forest interests, leaving further consideration of it to the General Land Office on the basis of its customary requirement of proofs in the form of affidavits offered by the claimant and his witnesses.

When, however, the examination of the land by the forest officer develops the fact that a public interest is involved because of the value of the land for national forest purposes —that is, for the present stand or permanent production of timber, the protection of waterflows, use for water-power development, or some other form of occupancy under special-use permit, or public use—a favorable report is made to the Land Office only after it has been shown that the requirements of the mineral law have been fully complied with. Adverse reports on the ground that the requirements have not been complied with (the only ground, of course, on which any claim is ever reported adversely) are never made unless the claim has been examined by a mineral examiner * * * or by a practical miner competent to pass upon the questions involved. Further, before an adverse report is transmitted to the Land Office the showing of facts made by the examiner is scrutinized, with reference to the evidence submitted and the law involved, by the district assistant to the solicitor of the Department of Agriculture; and only if this officer is satisfied that the evidence offered is sufficient to prove failure to comply with the mining laws is the chief of field division of the General Land Office notified that the Forest Service desires to protest the claim.

Such notification is in no sense a rejection of the claim. It merely places before the Land Office the facts as found upon the ground by the examining officer, and the conclusions which the Forest Service believes to be warranted by them. The commissioner of the General Land Office decides, with the evidence and charges recommended before him, whether a hearing will be ordered. His action is necessarily largely influenced by the recommendation of the chief of field division, but is, of course, subject to review by the Secretary of the Interior.

The General Land Office is, under the laws of Congress, a land court. The objectors to the present procedure practically deny the right of the Government to appear before that court, on behalf of the people of the United States, as against a private claimant to mineral lands, in order to introduce evidence of non-compliance with the law under which the claimant seeks title. It is alleged that because the Department of Agriculture is not refused the right accorded any private citizen to seek cancellation of a claim thought to be illegal, when an adverse interest exists, the mining industry is oppressed and a bureaucratic despotism is permitted to overthrow and displace the law.

To deny the right of the public to its day in court would be to open the door to frauds of every conceivable character. It is an undeniable fact that there is a great deal of valuable land in the National Forests. Land valuable for agriculture is open to entry upon regular classification. The requirement of prior classification makes it impossible to use the Forest Homestead Law as a vehicle for fraud. There is no such restriction placed upon mineral entries; the final report made upon these claims is the only barrier to securing under the mineral laws, by means of false representations, patent to land of untold value for other purposes.

The system of requiring reports on each claim before patent issues is necessary * * * to the preservation and good standing of the mining industry itself. * * *

* * * Many classes of frauds * * * are attempted under the guise of the mining laws. In every case the real miner is the victim rather than the beneficiary. In very few instances are doubtful operations promoted by practical miners or prospectors. A few recent examples will serve to illustrate this very important fact.

A supposedly rich mineral find was made in one of the National Forests, and there was a great rush of people to that vicinity. Indications were favorable to the establishment of a permanent gold mining camp, and immediately people not directly interested in mining, but in other related enterprises, flocked to the vicinity of the new find, and began to establish settlements and places of business. Owing to the topography of the country, there was only one favorable place for establishing a town, and this place was immediately covered by mining locations. These mining claims were immediately placed in the hands of professional townsite boomers, who surveyed the land off into building lots under the guise of mining leases, which leases carried an option of sale. By distorting the purpose of the mining laws to suit their special case, these speculators were enabled to retard, if not actually to prevent, bona fide settlement and the establishment of business much needed in connection with the mineral development of the country. It came out in the proofs regarding this case that the leveling that holders of these mining leases did, who in fact were the actual purchasers of the ground, was construed by the townsite speculators as mineral development, as was also the grading and the digging of cellars. The worst feature was that there was no means whereby the purchasers of these lots could secure an actual title to the land purchased, the deeds being only quit-claim deeds carrying no further obligation on the part of the townsite company or the locators of the claims. There actually exist in Nevada, at the present time, townsites a portion of which are upon mining locations, the validity of which can probably never be established, and the holders of the quit-claim deeds for the surface of these claims will never be able to acquire actual title to the land until the mining claims are held to be invalid, and the residents enabled to proceed to secure title to their holdings under the townsite laws. Here the townsite boomer misused the mining laws.

In another instance a large live stock company purchased the majority of the stock grazed in a certain section of the country splendidly adapted for cattle range, except that water was scarce, the only available supply consisting of small lakes or ponds and small springs. This cattle

company, in order to establish a complete monopoly of the range, proceeded to put mining locations and millsites upon all the watering places, with the exception of two or three which were covered by scrip location. No mineral development was, however, attempted on any of these claims. The locations were upon formations containing no mineral showing whatever, and alleged development work consisted of driving adits and trenching for the collection of water, and in the building of the corrals, tanks, and pipe-lines for the handling and watering of the cattle. Part of these locations were in the National Forest and part without. The knowledge of the situation on the part of the forest officers as to the locations within the forest prevented their patenting, except in one instance in which, for some cause or other, the patent was procured without reference of the matter to the Forest Service. Owing to there being no government officers available to submit reports thereon, all of the locations outside of the forest were actually patented, notwithstanding the fact that there was not the slightest evidence of mineral showing in a single case, the work being done in sandrock barren of any trace of mineral and being clearly intended for water development. In this way title was secured to water holes which gave control of approximately 500,000 acres of valuable range. Here the cattlemen misused the mining laws where there was no one to protest or report.

In another instance a sheep man was occupying and grazing a certain area of range within a National Forest in a country mineralized to some extent, and in which the water supply was limited. Some old placer diggings existed in a certain canyon within the vicinity of a small spring, which placer diggings had been abandoned for years, with the exception of the fact that some Chinamen, when out of anything else to do, would occasionally work the claim for what they could get out of it. The sheep man proceeded to locate a mining claim covering the spring and the old placer diggings, established a shearing or dipping corral, and applied for patent to the ground, claiming as his $500 worth of development the work done by men who had abandoned the claim as not sufficient mineral value to be worth further consideration, and work done by the Chinamen mentioned. Here the sheep man attempted to misuse the mining laws.

Another instance illustrative of purposes or motives that actuate individuals in making mining locations, is shown in a case in which a large power company attempted to procure title to a valuable power site by locating mining claims extending up and down the streams upon which the plant is located. These locations were placer locations, and the mineral alleged to exist in the claims was asserted to be lime, and the claims were known as the "limestone placers." A government expert made examination of these claims and submitted an adverse report. Here the hydro electric power company misused the mining law.

Not far from these last-mentioned claims, individuals made application for the patenting of placer locations, alleging the existence of valuable minerals. The location happened to be within a National Forest, and, under the regulations of the two departments, the Forest Service made an investigation in connection with a representative of the General Land Office, and the following facts appeared: There was no showing of mineral whatever upon the locations except a sort of shale, which the locators alleged had some value for cement-making. In the application for the patent the locators alleged that $1500 worth of work had been done. Investigations showed that all the work that had been performed was in grading for driveways and for building locations, and that it actually amounted to less than $300, at a liberal estimate. It further developed that the locators had incorporated a company for the exploitation and sale of building sites for summer homes, this location being in the mountains within easy reach of a thickly populated section of country, and directly on an electric car line leading from a city of considerable size. Here the dealer in suburban summer homes sought to misuse the mining laws.

Not long since, a large mining company, operating mines just upon the border of one of the National Forests, applied for the purchase of a tract of timber situated within the Forest, desiring and in fact being in actual need of the timber in its mining operations. The local forest officer proceeded with usual preliminaries necessary in making a sale. While he was doing so, it became known in the neighborhood generally that the mining company was making a purchase of the timber on a certain tract of land; whereupon some individuals immediately proceeded to the tract and placed thereon mineral locations, alleging the existence of valuable minerals, and endeavored to compel the mining company to pay them as well as the Government for the timber. Failing in this plan of blackmail, the locators abandoned the claims, admitting that all they wanted was the timber. Here the grafters tried to misuse the mining law and exact tribute from the miner.

In a California case an effort was made by means of mining locations to secure control of the most valuable and important bodies of timber in one of the National Forests. One man, with the aid of two or three others and the use of the names of others, covered thousands of acres of valuable timber land by means of placer locations. The report by government experts and the decision of the Commissioner of the General Land Office held the claims to be invalid because of insufficient discovery and the absence of showing of valuable mineral deposits. Here the timber grabber tried to misuse the mining law.

* * * The men who engage in mining as a legitimate permanent industry have no incentive to evade the law, since they are not limited as to the time within which they must apply for patent, but are at liberty to develop the ground and extract the mineral to any extent, subject only to the mining laws of the state. The miner has no trouble in applying for patent under the mining laws for ground chiefly valuable for mineral. The man who has trouble is the man who tries to secure under cover of the mining laws a townsite, a summer resort, valuable timber land, a water-power site, watering places in the desert, or mineral springs in the mountains. Such frauds in no sense connected with the mining industry, would thrive and multiply if mining claims were not reported upon before being passed.

Whether or not legitimate mining development has been handicapped by the examinations made in the recent years since the making of such examinations began may be judged in the light of the facts that more than four out of every five of the claims examined during the entire period have been reported upon favorably. Usually the fifth claim was not actually a mining claim, but was a power site or some such fraud masquerading as a mine.

Experiences similar to those related by the Forester of attempts to misuse the mining laws or the right of way acts within the Forest Reserves are duplicated in the experiences of the Department of the Interior on the public lands outside the forests.

Many of the objections to the so-called policies of the departments amount to nothing more nor less than a demand that government officers shall sit supinely by and permit the laws to be violated in order that valuable public resources may be acquired in an illegal way. In the language of the Forester—"the real miner is the victim rather than the beneficiary of these unlawful acts." They are not advocated by bona fide miners or by the genuine constructive business man. If such men believe that the laws are wrong they endeavor to secure their revision, but do not devote their energies to attempts to evade them.

There has been much discussion in the press recently and in gatherings like this of certain departmental decisions of which that in the East Tintic case (40 Ld.,.271) is a type, and these discussions have revealed a wide misapprehension of the tenor and

scope of these decisions. I quote from the syllabus of the East Tintic case:

To constitute a valid discovery upon a lode mining claim for which patent is sought there must be actually and physically exposed within the limits thereof a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes.

The exposure of substantially worthless deposits on the surface of a lode mining claim; the finding of mere surface indications of mineral within its limits; the discovery of valuable mineral deposits outside the claim; or deductions from established geologic facts relating to it; one or all of which matters may reasonably give rise to a hope or belief, however strong it may be, that a valuable mineral deposit exists within the claim, will neither suffice as a discovery thereon nor be entitled to be accepted as an equivalent thereof.

It has been loosely stated that this and other decisions of similar tenor have constituted a new construction of the mining statutes. For instance, the Salt Lake Stock and Mining Exchange recently passed a resolution in which occurred this phrase:

Whereas the Department of the Interior by these decisions, revolutionary in their effect, has announced that it is no longer sufficient for the locator of a lode mining claim before securing patent to discover mineral-bearing rock in place, but that such locator must prove that ore of commercial value exists within the limits of each and every claim before the department will pass such claims to patent.

This is a clear misstatement of the department's attitude, and similar misstatements and misconceptions have had wide circulation. The department has said that there must be discovery of a lode possessing "a present or prospective value for mining purposes." This is not holding that there must be discovery of ore of commercial value, but is clearly in accord with the letter and the spirit of the statutes which require that there must be a discovery of a vein or lode containing a valuable mineral deposit. I quote verbatim a recent comment by Mr. Adams, assistant secretary, upon some criticisms which have been made upon these recent decisions.

It has been very frequently asserted that recent decisions of the department require the applicant for a mineral patent to show that he has uncovered ore of commercial grade and quantities. This is apparently founded on a misconception of a statement in the decision in the East Tintic case, which requires the discovery of a vein or lode possessing a present or prospective value for mining purposes. Obviously, this is a very different thing from requiring the exposure of ore in commercial grades and quantities. All that the decision of the department requires is that the vein or lode on account of which patent is asked shall be such a vein or lode as either has present value for mining purposes, or is of such nature as to have a prospective value. In order that it may have a prospective value it is not required that ore of commercial qualities and quantities be exposed, but simply that the vein be of such nature as to lead to the belief that it contains ore worth mining. Obviously there is no justification for issuing a lode patent on a vein that does not either have present or prospective value. Also, obviously, the decision of the department is not a strict construction of the statute, which provides: that "all valuable mineral deposits in lands belonging to the United States" are free "to exploration and purchase." That declaration of the mining law is the foundation on which all mining patents are issued.

The officers of the Department of the Interior recognize, as have all students of our mining laws, that these laws are not perfect, and that they may well be amended to the great benefit of the mining industry. For instance, the law at present does not create any rights in supposedly mineral land except after discovery. Mr. Fisher suggests that the law should be so amended as to give the prospector for a term of years an exclusive right of possession for prospecting purposes within a limited area. If discovery were made within the time given, patent should issue. Meanwhile, the prospector should be obliged to perform a reasonable amount of work during the life of the permit in order to make evident his good faith in attempting to find mineral within the limits of his claim. Such a change would mean the recognition under the federal law of the possessory rights prior to discovery, of which the federal law now takes no cognizance. I presume that no argument is needed before this body to convince it of the advantage of making its filings before federal officers and having them of record in the department which is charged with jurisdiction over the public lands. Such a clause would amply protect the miner during a period sufficiently long to enable him to make those deep explorations that are sometimes necessary in order to make the physical discovery of actually or prospectively valuable mineral which has been required by the law since the earliest mining days in California. This provision appears to be fundamental to American mining customs and practice and I presume that no substitute for it is to be seriously considered.

Let me repeat in closing that the executive departments are charged with the complex task of administering the laws enacted by Congress. They are in this respect the agents of the law-making body, which in turn is your agent as well as that of all other citizens. If you believe that the laws are wrong it is your duty to endeavor to have them changed; it is your duty and it is not to the interest of your industry to engage in the futile task of opposing their enforcement so long as they remain upon the statute books, nor in attacking the officers who are engaged in that enforcement. I believe that the officers of the government who are performing this task, faithfully and disinterestedly, are the best friends of the prospector and the mining industry as a whole. By protecting the public domain from illegal alienation, it remains available for acquisition as the laws direct, and the mining laws provide what to you are the most important of these methods. It is beside the point to state that the departments by their decisions and the bureaus by their regulations are making laws or modifying laws. Regulations are still all in accord with and authorized by the law. Statutes lay down the principles. The details of procedure along the lines of these principles are supplied by the regulations. This, and this only, is their function. Departmental decisions, like court decisions, are interpretations of points in the law about which citizens disagree. So long as there are disagreements as to the meaning of a statute there must be an authority to determine what that meaning is. Without such an authority there is no settlement of the point at issue and anarchy results. The Secretary of the Interior and those who aid him are wholly impartial. They have no interest except in the correct settlement of the questions.

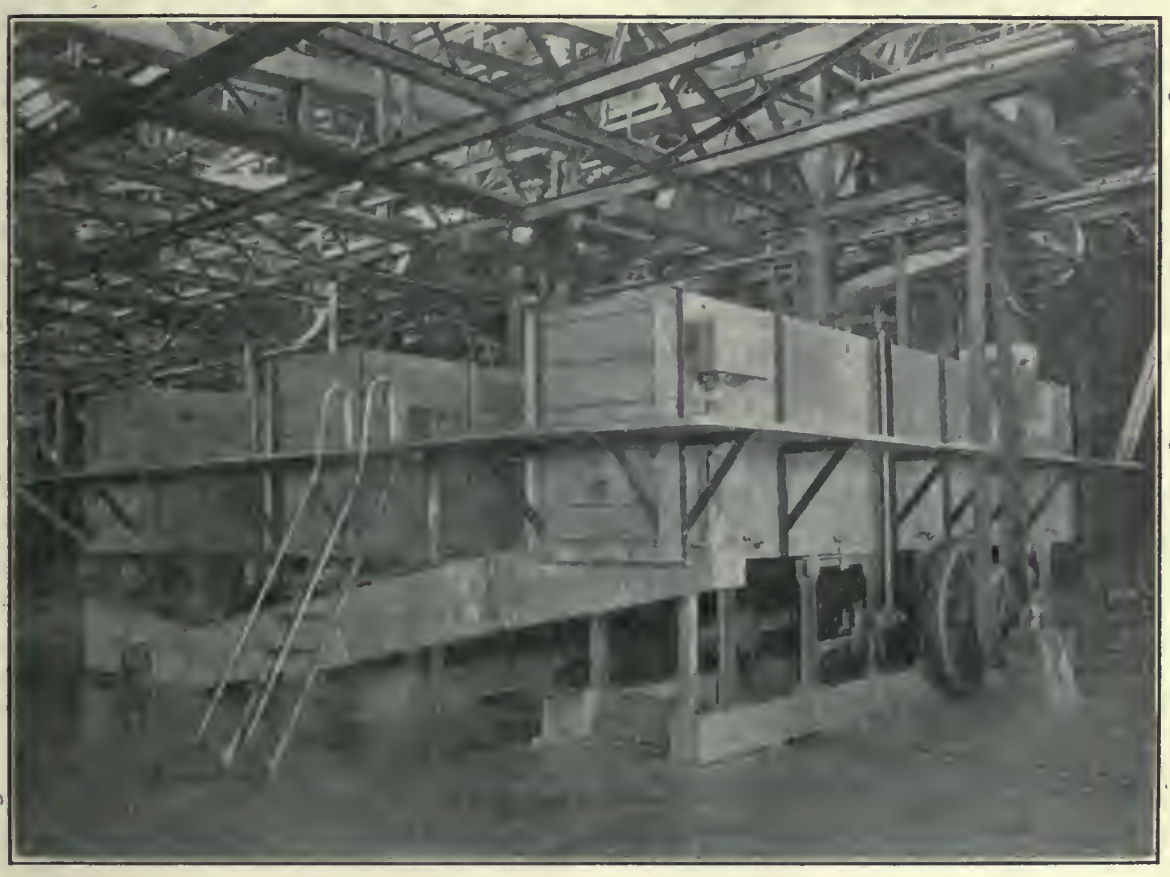
Progress in Ore Dressing

By Henry S. Munroe

Jigging

*Jigging practice tends toward the use of jigs of large capacity designed for the treatment both of sized and unsized material. The Hancock jig is replacing the old Harz jig in the larger mills in the lead and zinc regions of Missouri, and is finding increased application in other parts of the country. The new Doe Run mill No. 3, at Rivermines, Missouri,[31] has now four sections, each having a capacity of about 800 tons, and containing two Hancock jigs, treating 300 tons each of material sized between 2 and 9 mm., and a third Hancock jig treating re-crushed and sized middling from the other two. The stuff below 2 mm. is classified and treated on Wilfley tables. At this mill[32] the Hancock jigs are supported 18 ft. above the ground on structural steel frames. The dead load is 45,000 lb. The jig tray is also steel, consisting of two 18-in. plate girders 20½ ft. long, made of ¼-in. plate, with 2½ by 3 by ¼-in. angles top and bottom. The screen frames and top slat frames are of wood.

The Leadwood mill of the St. Joseph Lead Co. is equipped in a similar manner, except that the four Hancock jigs each treats its own middling after re-crushing and classification. The old Bonne Terre mill of the same company is to be shortly remodeled and Parsons jigs replaced by Hancock jigs, while the Parsons-Rittinger tables have recently been replaced by Wilfleys. The Federal mill No. 3 at Flat River has been equipped since 1909 with twelve 25-ft. Hancock jigs, replacing 132 Harz jigs. Six of these jigs treat over 500 tons each of material sized between 1¼ and 10 mm., and six treat re-crushed middling over 1½ mm. Hancock jigs do excellent work on low-grade ores, but at the expense of the re-treatment of a large tonnage of middle product, much of which is tailing. On ore containing a large percentage of heavy mineral the work is less satisfactory, and they should be used as roughing jigs with re-treatment of the tailing.



HANCOCK JIGS, FEDERAL LEAD COMPANY.

At the mill of the St. Lawrence Pyrites Co., in northern New York, it has been found necessary to run the tailing of the Hancock jigs over three-sieve Harz jigs with siphon discharge. These jigs serve as a guard, and by their use the loss in tailing has been reduced 30 or 40%. At the Desloge mill, Missouri, of the St. Louis Smelting & Refining Co., four Hancock jigs are supplemented by two Hancock jigs treating the tailing. At the Great Falls mill, Montana, of the Anaconda Copper Mining Co., Hancock jigs are used as roughing jigs only, and their tailing and middling are re-treated. At concentrator No. 6 of the Arizona Copper Co., at Morenci, six Hancock jigs are used in a three-stage treatment, the tailing being re-treated in every case.

*Continued from p. 56, January 4, 1913.

[31] O. M. Bilharz, private communication.

[32] *Eng. & Min. Jour.*, Vol. 93, p. 1177, June 15, 1912.

These examples serve to confirm the statement above.

Some of the defects noted are not confined to the Hancock jig and the middle products from Harz jigs will often show a large percentage of barren material which should have gone into the tailing: while the tailing will contain a considerable amount of middle product which should have been saved. This is largely due to the action of the surface current, which tends to bank up the middle product and lighter concentrate toward the discharge end of each jig, and carry material from one compartment to the other and into the tailing which should be retained. This effect is especially noticeable when the jigs are crowded beyond their capacity. In other words, jigs as ordinarily designed and operated do not accurately classify material unless the difference in specific gravity is large. In every ore, however, the specific gravity varies by insensible degrees from that of the rich mineral to that of the barren gangue, and for satisfactory work it is necessary to separate and save a middle product differing but little in specific gravity from the gangue. If jigs are operated so as to save all of this low-grade middle product a large amount of barren gangue will inevitably be brought into the middling, increasing the work of the re-crushing plant and the cost of treatment. On the other hand, if it is attempted to make a rich middle product a large amount of equally rich material is likely to find its way into the tailing, increasing the loss to an undesirable degree. It is thus evident that some method should be found for perfecting the work of jigs and obtaining more complete and accurate separation of minerals differing but little in specific gravity.

These difficulties are increased when a jig, or other concentrating machine, treats its own crushed middling and is operated in closed circuit. When this is done, such material tends to accumulate in the circuit, crowding the machine at times beyond its capacity and lessening its efficiency. The introduction of rolls, screens, or classifiers in the circuit does not always prove effective. Such closed circuits should always be tested from time to time to determine the amount of material actually in circulation. Even when there is no congestion, closed circuits should be examined and carefully tested to determine how and where the surplus material is escaping.

In the Joplin region a jig of large capacity, the Foust,[33] has been adopted at a number of dressing works. In this jig the sieves are of large area, 48 by 54 in., and sometimes 54 by 60 in. In order to secure uniform velocity of water currents over this large area two pistons are used for each sieve. The two eccentric shafts are joined by a connecting rod so that they move in unison. These large jigs have proved very successful, there being up to the present fifty such plants in the Joplin district alone. The larger size has a capacity of over 700 tons in 24 hours. These jigs are built in five or more compartments and treat unsized material, with re-treatment of the hutch-work on finishing jigs, as is usual in the Joplin mills.

The Woodbury system[34] of jigging has found extended application in the Lake Superior copper region and elsewhere. This system is a development of the method of jigging without sizing, which has long been characteristic of that region, and consists in the use of roughing jigs followed by re-treatment of the hutch-work on finishing jigs. In the Woodbury system the roughing jig is provided with a slime overflow and a separate discharge for the sand tailing, so that the jig serves as a classifier for the preliminary separation of sand from slime, and thus avoids the necessity of installing a separate classifier for this purpose. The roughing jig thus makes five products: (1) Fine sand and slime, including material below 60-mesh. (2) Fine hutch sand from second sieve, which goes directly to sand tables, with or without preliminary classification. (3) Coarse middling from siphon discharge above second jig sieve, which is recrushed. (4) Concentrate from first sieve and hutch. (5) Tailing. The Woodbury system has been adopted by the Calumet & Hecla Copper Co. and has recently been installed in the remodeled Tamarack mill.

The Hooper jig, a new type of vanning jig, has now been in successful operation at North River, Warren county, New York, for a number of years. This jig is described by Richards.[35] It is a one-sieve jig, of the movable-sieve type, which has a pendulum swing at one end and an up-and-down movement by an eccentric at the other. The effect of this combined swinging and vertical movement is to bank the heavier material near the head end of the sieve, and thus effectively counteract the tendency of the feed-water to move both heavy and light material toward the tail end of the jig sieve. When several minerals are in the feed the different heavy products lie in inclined layers, thick at the head end and thinner toward the tail end of the jig sieve. The material treated at North River is garnet with a hornblende gangue, with specific gravities of 3.9 and 3.4, respectively. The separation effected is remarkably good, a clean concentrate and low-grade tailing being obtained at a single operation. The hutch-work of each jig is elevated and fed to the next jig of the series, screening and jigging being done simultaneously. A geometrical screen ratio of 1.5:1 is adopted, the coarsest material treated being ¼ in. and finest 30 mesh, six sizes being made between these limits. The possibility of treating successfully minerals differing but 0.5 in specific gravity, and of doing such work on a one-sieve jig, opens a promising field for improvement in jigging practice and should make it possible to perfectly separate middle products from tailing on the one hand, and concentrate on the other; not only insuring rich concentrate and low-grade tailing at a single operation, but producing at each stage a minimum amount of middle product for recrushing, thus greatly cheapening and simplifying ore dressing operations. It is possible that equally good results may be obtained on other types of jig, but to the present this has not proved to be

[33] J. L. Bruce, *Eng. & Min. Jour.*, Vol. 93, p. 459, March 2, 1912.

[34] E. F. Wright, *Met. & Chem. Eng.*, Vol. 10, p. 759, November, 1912.

[35] R. H. Richards, 'Ore Dressing,' Vol. 1, p. 505.

true as far as records may be used to determine.

The Richards pulsating jig[36] has been tested at a number of dressing works in different parts of the country. Comparatively few installations of an important character have as yet been made. Owing to the small size of the jig cells, this jig has proved exceedingly sensitive to variations in richness of the feed and requires constant adjustment of the discharge gates. This is more noticeable with the lighter sulphides and with middling. Again, the high velocity of the current of feed-water, the volume of which is increased at each cell by the pulsion water, tends to prevent a sharp separation between the concentrate, the middle product, and the tailing. F. E. Shepard[37] plans to remedy these defects by placing dewatering devices between the several jig compartments and providing separate pulsator valves for each, permitting more satisfactory adjustment of the pulsion and lessening the disturbing effect of the surface current. With these modifications it is believed that more accurate work can be done.

Jigs of reinforced concrete have recently been designed and constructed at Cananea, Mexico.[38] These are ordinary three-sieve jigs of the Harz type. The feed-box, side walls, and longitudinal partitions are 3 in. thick and reinforced by 1½-in. mesh $^3/_{16}$-in. wire cloth. The ends and transverse partitions, which are continued as legs, are made 5 in. thick, and are reinforced in the same manner, but with the addition of ¾-in. rods bent so as to strengthen the legs. After removing the forms, these jigs are painted inside with several coats of thin cement to which alum and potash are added. The cost of these jigs is $145, not including the forms, which cost $138 and which are used again. The original description contains working drawings and many details as to methods of construction.

At the Franklin Furnace mill of the New Jersey Zinc Co. jigs built of cast-iron plates, designed by George C. Stone,[39] have been adopted. The plates are designed so that they can be assembled with water-tight joints without the necessity for machine work. The screen frames of jigs, ordinarily constructed of wood, or of wood with flat steel crossbars, may also be made of cast iron.[40] In the case described by Mr. Rice, the frames are 30 by 42 in. and 3 in. high. The sides and ends of the frame are made 1 in. thick and the longitudinal and crossbars ⅝ in. The frame has 54 openings about 4 in. square. The junction of the ribs, at the corners of each opening, is enlarged and cored to receive a ½-in. square wooden plug, to which the wire screen may be attached. These screen frames are not used with ores having a cherty gangue, as often found in the Joplin region, which requires the usual cast-iron grates instead of wire screens.

[36]J. L. Bruce, *Eng. & Min. Jour.*, Vol. 93, p. 460, March 2, 1912.

[37]*Eng. & Min. Jour.*, Vol. 93, p. 546, March 16, 1912; *Met. & Chem. Eng.*, Vol. 10, p. 215, April 1912.

[38]F. J. Strachan, *Eng. & Min. Jour.*, Vol. 92, p. 698, October 7, 1912.

[39]G. C. Stone, private communication.

[40]C. T. Rice, *Eng. & Min. Jour.*, Vol. 93, p. 1080, June 1, 1912.

Fine Sand and Slime Concentration

The Wilfley table still holds its position as the leading concentrating machine for the treatment of sand, although many modifications of the Wilfley have appeared, some of which have obtained a considerable degree of success, notably the Deister, Overstrom, and Card tables. Another of these, the Garfield table, has been introduced on a large scale at the mills of the Utah Copper Co., the Chino Copper Co., and the Ray Consolidated and other mills under the same general management. This table is provided with high riffles, ¾ in. at one end and ⅜ in. at the other, extending over the whole surface of the table. This construction permits the treatment of large tonnage: 175 tons or more per 24 hours. These tables are used for a preliminary rough separation of concentrate from sand, but make no finished product; the tailing being classified, the coarser material crushed, and this recrushed material subjected to similar rough separation on other Garfield tables, the final separation of tailing taking place only after three such treatments, accompanied by considerable reduction in size at each stage. The concentrate from these roughing tables is re-treated on Wilfley tables in each case, yielding a finished product. The tailing from the Wilfleys treating this rich material is recrushed and re-treated. The introduction of the Garfield tables as roughing machines permits the treatment of large tonnage in each section of these mills, while the re-treatment both of tailing and concentrate secures rich concentrate on the one hand and low-grade tailing on the other. The method is thus similar to the double treatment by roughing jigs and finishing jigs of the Lake Superior copper region and followed in the Joplin mills treating lead and zinc ores.

Gelasio Caetani[41] has shown that middling from a Wilfley table is what he terms a 'counter-classified' product: that is, larger grains of heavy mineral (true middling and some concentrate) associated with smaller grains of light mineral (tailing). Table middling should always be classified and re-treated on separate tables. The tailing from the table which is fed from the first spigot will contain all the material requiring further crushing. The tailing from tables treating the finer classified material will be poor. Sometimes classification may yield a finished product.

C. T. Rice[42] suggests some inexpensive and easily extemporized attachments to Wilfley tables; namely, cleats to throw wash-water along the discharge end and avoid dry spots, adjustable fingers near corner to throw heavy concentrate to end and middling to side, and saw-tooth drip-plates on the discharge end to facilitate division of galena and blende concentrate.

A new table for the treatment of fine slime, the Deister slimer, was introduced in 1908 and has attained wide acceptance and installation on a large scale throughout the country. This table has two shallow slime pools which retain a large volume

[41]Gelasio Caetani, *Mining and Scientific Press*, Vol. 104, p. 495, April 6, 1912.

[42]*Eng. & Min. Jour.*, Vol. 93, p. 1129, June 8, 1912.

of thick pulp under treatment. This pulp is kept in suspension by the movement of the table. This gives opportunity for the settlement of the heavy mineral and its separation by displacement from the lighter mineral. This table is provided with wide channels and with riffles by which the separated mineral is guided toward the discharge edge. The Deister slimer has about the same capacity as a 6-ft. vanner, which is its principal competitor, and has the added advantage of making a middle product and requiring less skill and much less attention for its operation. The repair and maintenance cost is less.

For the treatment of the very finest slime, canvas tables[43] are still retained at a number of large mills. Three-deck Craven slimers are in use at the Steptoe Valley concentrator[44] at McGill, Nevada, and riffled concrete tables[45] were installed a few years ago at the Pinguico mill of the Guanajuato Development Company.

An interesting modification of the canvas table is the Darrow-Hambric concentrator,[46] which consists of a revolving frame 28 ft. in diameter with 6 to 10 decks carrying 21 to 24 small trays, 3 by 4 ft., on each deck. These trays were formerly covered with canvas, but recently asphaltic felt, or wood painted with asphalt paint and sanded, has been used instead of the canvas. It is said that these modifications of the canvas table have proved very successful, and that the ratio of extraction is much better than on the ordinary canvas table. It is interesting to note that the development of blanket and canvas tables has been steadily in the direction of the use of smoother surfaces. Originally brussels carpet, blankets, gunny cloth, cocoa matting, and similar rough material was used, and these are still common on gold-dredges. These rough surfaces have given place to the comparatively smooth canvas, which sometimes is painted, making it still smoother. Now a further step seems to have been taken in the use of a painted and sanded surface on the Darrow-Hambric machine. It has long been recognized by the best authorities on ore dressing that for the successful treatment of very fine material a smooth surface will give higher extraction than a rough surface, the introduction of rough surfaces having been brought about in the attempt to increase the capacity and decrease the sensitiveness of this form of concentrator. This has resulted in large loss of fine mineral by reason of the stronger current required to move the pulp over the rough surface. The extraction ratio in these canvas plants is not often more than 30% and sometimes falls below 20%. The adoption of smoother surfaces is a development in the right direction. Tests which I made in 1889[46a] show an extraction of over 85% in −240-mesh slime on Parsons-Rittinger tables covered with smooth enameled duck. In this connection it is interesting to note that cement-top round tables have been retained in the tailing plant of the Boston & Montana mill at Great Falls, Montana, where they have proved to be the most satisfactory concentrator for treating the very finest material. The Darrow-Hambric revolving frame with its small trays is a step toward a return to round-table treatment.

Some years ago I designed and constructed an 18-ft. round table for the laboratory of the School of Mines of Columbia University, with a conoidal surface of large radius in place of the conical surface usually employed. In this table the curvature has been designed so as to compensate as closely as possible for the reduction in depth and carrying power of the films, of feed-water on one side of the table, and of wash-water on the other, as they spread outward in their flow toward the edge of the table. By this simple modification the conditions of settlement and movement of the pulp on the table are rendered practically uniform and the whole surface of the table is rendered available. In the ordinary conical form the separation takes place on the outer part of the table only, the central portion being so flooded with water that but little effective work can be done. By the use of a conoidal surface it should then be possible to reduce greatly the diameter of round tables and lessen materially both the cost of construction and the floor space occupied in the mill.

A. R. Wilfley has designed a multiple-deck slime concentrator.[47] This consists of 12 light decks, 6 by 12 ft., covered with riffled linoleum, assembled in a heavy tilting frame which is shaken endwise by an eccentric. Each deck is fed with slime, and the operation and adjustment of the whole series is controlled by observing the movement of the pulp on the upper deck. The cycle of operations, lasting about 15 minutes, includes: (1) flowing of slime, the decks being nearly level; (2) washing with pulp water; (3) flushing with wash-water. During the second and third phases the decks are inclined. One of these machines has been tested during the year at the mill of the Miami Copper Co. Its capacity is said to be equal to that of eight vanners operated at equal efficiency. Duplex machines with two units of three decks, operated in alternating cycles, have been installed in a number of mills.

The Deister Machine Co., of Fort Wayne, Indiana, has introduced a new multiple-deck tilting slimer which has had eight months' trial at the Miami concentrator, the results of which have proved sufficiently encouraging to warrant the equipment of one section of this mill with these new machines. Each machine contains six decks, each 10 ft. wide by 12 ft. long, covered with oiled and painted canvas which is coated, while the paint is wet, with 50 to 60-mesh sand. These decks are

[43] *Eng. & Min. Jour.*, Vol. 94, p. 207, August 3, 1912; W. H. Storms, *Mining World*, Vol. 34, pp. 581, 681, 783, March 18, April 1 and 15, 1911. See also R. H. Richards, 'Ore Dressing,' Vol. 2, pp. 699, 1017, and 1038, and Vol. 4, pp. 1628, 1696, and 1779.

[44] S. S. Sorensen, *Mining and Scientific Press*, Vol. 106, p. 70, January 4, 1912.

[45] C. T. Rice, *Eng. & Min. Jour.*, Vol. 86, p. 997, November 21, 1908.

[46] A. H. Martin, *Eng. & Min. Jour.*, Vol. 94, p. 542, September 21, 1912.

[46a] *Trans.* Amer. Inst. Min. Eng., Vol. 17, p. 676.

[47] C. J. Downey, *Min. Sci.*, Vol. 16, p. 52, July 25, 1912; *The Mining Magazine*, Vol. 7, p. 221, September 1912.

pivoted at the centre on transverse axes, and are automatically tilted forward during the spreading of the slime and backward while washing off the concentrate. The capacity of a six-deck machine is about equal to that of four standard Deister slimers. The tailing from the new machines is poor, and the saving is approximately 10% over the slimers. The concentrate has to be re-treated on a Deister slimer, the tailing going back to the tilting tables.

The Allis-Chalmers Co. has introduced the Isbell vanner, which embodies some interesting and novel features in design, tending to increase the efficiency of this type of concentrator. The Isbell vanner is mounted on a heavy transverse axis which carries the operating mechanism as well. The vanner frame, including the belt with its rollers and feed trough, is mounted on two longitudinal steel leaf springs set on edge, extending nearly the full length of the machines. These springs are attached at the middle to the tilting axis and provide an elastic support permitting the horizontal movement of the frame. The new type can be built at about half the cost of erection of the older Frue vanner, and has the additional advantage that the side movement of the belt is in a horizontal plane without the side tilt which accompanies this movement both in the older Frue machines and in the newer suspended vanners. Over 1700 Isbell vanners have been installed since the introduction of this new type. The Ray Consolidated and Chino mills and some of the sections of the Utah Copper Co.'s mill are equipped with this machine.

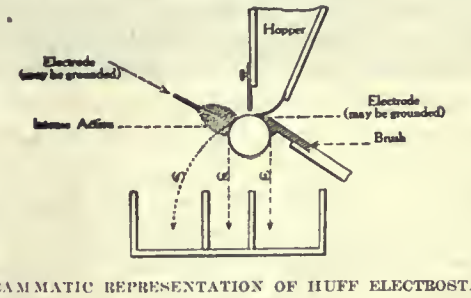
The Peck centrifugal slime separator[48] is a machine operating upon the same principle as a concentrating table in which centrifugal force takes the place of gravity and in which the velocity of the pulp and wash-water currents is controlled by mechanical means. Theoretically, it should be possible to make a separation by the aid of centrifugal force on material too fine to be separated by gravity alone. The Peck machine is the result of many years experimenting and slow development, and has been used on a large scale at Virginia City, Nevada, and at Corbin, Montana, during this time. In the annual report of the Anaconda Copper Mining Co., B. B. Thayer states that experiments with this machine were conducted at Great Falls during 1911 which were successful so far as the concentration was concerned, but that the machine could not be run continuously. He stated further that a new machine will be constructed and tried out in 1912. It is understood that experiments have been made with the Peck machine during the present year at Cananea, Mexico. Should this machine finally prove successful, it will have important bearing on the whole problem of slime treatment, and it may have extended application in the many large mills in which this problem yet remains to be solved satisfactorily.

Magnetic Separation

This method is finding increasing application in the treatment of zinc middling containing iron. Two Colorado mills are described[49] in which magnetic separation is used to supplement mechanical treatment. In both mills a preliminary magnetic roast is necessary. In both cases the Ball-Norton belt machines are in use, in one case replacing a Cleveland-Knowles machine formerly employed. Magnetic treatment has also been applied in Cornwall for the separation of cassiterite from pyrite and wolframite.[50] At this mill a new type of magnetic separator is used, consisting of a solenoid with mushroom-shaped pole pieces between which two feed belts bring the ore into the magnetic field, while the concentrate is removed by an endless-rope drive which serves also to rotate the magnet slowly about the vertical axis.

Electrostatic Separation

The following zinc plants using this process[51] are now in operation or will be during the next month or so: Midvale, Utah, capacity 90 to 100 tons of zinc middling per day; Cananea, Mexico, capacity 40 tons; Eureka, Colorado, Sunnyside Mining Co., 15 tons; Ouray, Colorado, custom plant, 20 tons; St. Elmo, Colorado, Mary Murphy Mining Co., 20 tons. From zinc middling containing 25 to 30% of zinc there is obtained a blende product with 40 to 50% zinc containing small amounts of galena and pyrite and a pyrite product carrying gold, silver, lead, and copper content containing from 7 to 10% of zinc only. The richness of the blende product depends largely upon the amount of gangue present in the middling, the greater part of which goes with the blende. A wide range of sizes is being treated. At one plant the maximum is 2 mm., while at another almost the entire tonnage is through 100-mesh and a large part through 200-mesh.



DIAGRAMMATIC REPRESENTATION OF HUFF ELECTROSTATIC SEPARATOR.

The Wisconsin plant at Plattville ran successfully for several years, but was destroyed by fire about a year ago, just after a complete overhauling and increase of capacity. It is probable that this plant will be replaced soon, but will be situated farther south in order to utilize a larger variety of ores than was commercially possible at Plattville. The Cananea plant has been operating successfully, but is temporarily shut down, due to a change of management. There is also in operation at Buffalo, New York, a plant for removing impurities from artificial carborundum which has been in successful operation for over a year. A plant has recently been shipped

[48] *Eng. & Min. Jour.*, Vol. 94, p. 222, August 3, 1912; *Met. & Chem. Eng.*, Vol. 10, p. 235, April 1912.

[49] H. C. Parmelee, *Met. & Chem. Eng.*, Vol. 10, p. 527, September 1912.

[50] M. Ruthenberg, *Ibid*, Vol. 10, p. 411, July 1912.

[51] *Eng. & Min. Jour.*, Vol. 92, p. 1080, Dec. 2, 1911; *Ibid*, Vol. 93, p. 1872, June 29, 1912.

to Australia for the purification of molybdenite. It is probable that in the near future this process will be extended to the treatment of graphite, silver, copper, and iron ores, for which purpose large-scale plants have been planned.

Decrepitation

Decrepitation[52] has been successfully used experimentally for the separation of barite from blende. In each case the material is sized and then brought to a red heat by feeding through a revolving tube, 6 to 8 in. diameter and 6 to 12 ft. long. The blende is not affected, but the barite decrepitates to a fine powder which is easily removed by sifting. The fine tailing contains but a small amount of zinc. This method is applicable to other minerals containing a small percentage of water. In some cases blende has the property of decrepitating and can be separated in this way from pyrite.

Flotation

Separation by flotation is now practised on a large scale in Australia and elsewhere. It is said that one-quarter of the zinc production of the world is now obtained from ore concentrated by this means. An elaborate investigation of the physical conditions determining the flotation of minerals has been made by K. A. Mickle,[53] of Melbourne University, who read two papers on this subject before the Royal Society of Victoria, one in 1911 and a second paper in 1912.

Flotation processes have been developed by a number of inventors, each of whom has contributed something to the process as it is now used, and several different companies are now operating under these patents. The development of flotation methods has been attended with much litigation among the conflicting interests. Without attempting to cover the subject in detail, or to describe the numerous methods in use, they may be broadly classified into four groups: film and bubble flotation, oily scum, and froth flotation. All flotation processes depend upon the surface tension of liquids and on the coefficients of adhesion between liquids and solids, and possibly on similar adhesion of gases to solid particles. Surface tension and adhesion are modified by heat and by the presence of acids. According to Mickle, selective adhesion is affected by the presence of adhering films of carbon dioxide and other gases on the grains of the metallic mineral. This has been denied by other experimenters.

In the film flotation methods, minerals which have a high coefficient of adhesion with water quickly become wetted and sink below the surface. Minerals, on the other hand, which are not readily wetted will float, the coefficient of adhesion in this case being insufficient to break the surface tension of the water. The De Bavay process, the McQuisten process, and the Wood flotation method belong to this class.

The second group depends upon the buoyant effect of gas and air. If gas be generated below the surface of a liquid the particles to which water does not adhere strongly will become attached to the bubbles of gas and float to the surface. The particles to which the water adheres strongly will remain at the bottom, or will quickly break the surface tension inside of the bubbles and sink. The evolution of gas is secured by the action of acids upon carbonates and other minerals, or by conducting operations in a vacuum, which releases the dissolved air and gas with similar effect. The Potter, Delprat, and the Elmore vacuum process depend largely upon gas or air-bubble separation.

The greasy scum flotation group depend upon the strong coefficient of adhesion between metals and metallic sulphides and oil, while the silicate, oxide, and other gangue minerals are less easily wetted by oil than by water. If a small quantity of oil be added to a pulverized mass of mixed minerals, the oil will by selective adhesion attach itself to the former and not to the latter group, especially in the presence of water. Heat and the presence of acid aid this selective adhesion of the oil. By adding more oil the grains of mineral previously coated will be bound and cemented together in a greasy scum which readily floats. The scum also contains bubbles of gas or oil which aid the flotation. The original Elmore process, using thick oils, depended largely on this property.

The froth flotation group depends upon the use of thin oils having good adhesion coefficients but also having the property of forming an emulsion and froth with water and thereby entangling air and gas bubbles. The presence of some slime in the pulp is essential, and heat and the presence of acid are helpful. Among such oils, oleic acid and eucalyptus oil (from the *Eucalyptus amygdalina*) give the best results, although cottonseed oil, pine-tar oil, red oil, and other common oils answer well, especially when mixed with a small amount of oleic acid. The mineral oils seem to possess the necessary properties to a less degree. The Minerals Separation Co., Ltd., has developed the froth flotation process and has recently equipped many plants for its use.

The different processes, however, shade into each other, and it is impossible to assign any one of them wholly to one or the other of the above groups. All of them, except the film flotation group, make use, when necessary, of both acid and oil and mechanical agitation to aid in securing effective flotation. The addition of acid not only releases gas from carbonates and other minerals, but also modifies the adhesion coefficients and surface tension. It is believed that acid has also advantageous effect on colloidal slime. Heat facilitates flotation processes by increasing the effect of acids and also by modifying adhesion. Heat increases surface tension. The most important recent installation is at the Braden mine, in Peru,[54] where three units of 600 tons each have been con-

[52] H. E. Wood, *Eng. & Min. Jour.*, Vol. 93, p. 1184, June 15, 1912; F. C. Bryant, *Ibid*, Vol. 93 p. 929, May 11, 1912.

[53] *Proc.* Royal Soc. Victoria, Vol. 23, March 1911; *Ibid*, Vol. 24, March 1912; reprinted in *Australian Mining Standard*, April 1911, pp. 343, 368, 394, and 416; *Ibid*, April 1912, pp. 333, 357, 381, and 403; abstracts in *Mining and Scientific Press*, Vol. 105, p. 12, July 6, 1912; *Eng. & Min. Jour.*, Vol. 92, p. 307, August 12, 1911; *Ibid*, Vol. 94, p. 71, July 13, 1912; *Jour.* Chem. Met. & Min. Soc. of South Africa, Vol. 12, p. 136, November 1911.

[54] *Mining and Scientific Press*, Vol. 105, p. 408, Sept. 28, and p. 643, Nov. 16, 1912.

structed, and the mill will finally be increased to 3600 tons capacity. Over an 80% recovery is made as compared with 61% by ordinary concentration, and it is hoped eventually to bring the recovery to 85%. This ore contains carbonates, and the recovery upon the sulphides is over 90%. At the 1000-ton plant of the Butte & Superior Copper Co. flotation is used for the treatment of blende middling, and is auxiliary to treatment on jigs and tables. A small plant is built and running at the Cuba Copper Co. At the Kamioka mine, in Japan,[55] the zinc middling from wet concentration is re-treated by flotation, using heavy oil in a hot acidulated solution. The temperature used is 80 to 85°C. and the solution contains about 1½% sulphuric acid.

A 60-ton plant at the Kyloe copper mine, New South Wales,[56] has been in successful operation since July 1911. The ore contains 5 to 24% of copper and is concentrated 5 into 1, yielding concentrate of 22.65%, with an extraction of 86.36%. The cost of treatment is 8s. per ton, of which 3s. 6d. is chargeable to regrinding and flotation. This includes a royalty of 6d. per ton. Of the ore milled, 0.67%, or 40 tons per day, is treated by flotation. The Minerals Separation plant and process is used, but without heat or acid. Eucalyptus oil costing 8.5d. per pound is used, 0.65 lb. per ton, making the cost of oil 5.5d. per ton. The paper and the discussion that followed constitute a valuable contribution to our knowledge of the subject.

THE new hydro-electric power plant which the Cerro de Pasco Mining Co. is building at Oroya will be one of the most important in Peru. Power will be generated for the company's metal mines at Cerro de Pasco and Morococha, for the coal mines, the smelter, and the railway company's shops at Oroya.

[55]T. Inouye, *Mining and Scientific Press*, Vol. 104, p. 892, June 29, 1912.

[56]J. W. Ashcroft, *Bull.* Inst. Min. & Met. 97, October 10, 1912; H. L. Sulman, T. J. Hoover, W. Broadbridge, and others, *Ibid*, *Bull.* 98, November 14, 1912.

Goldfield Consolidated Report

The estimated December production of The Goldfield Consolidated Mines Co. is as follows: Total tons mined, 27,946; gross value recovered, $423,000; operating expenses, $170,000; net realization for month, $253,000.

According to the monthly report of J. F. Thorn, superintendent, the total production during November 1912 was 27,775 tons, containing $451,987, or an average of $16.27 per ton, of which 27,402 tons was milled with an average extraction of 92.80%, and 373 tons was shipped of an average value of $19.78 per ton, the net recovery from all ore being $15.12 per ton. The net realization was $250,371, or $9.01 per ton. During the month 3528 ft. of development work was performed. The total cost of mining, development, transportation, milling,

GOLDFIELD CONSOLIDATED MILL.

office, and general expense was $6.11 per ton, distributed as follows:

Mining (including stoping and development)	$3.41
Transportation	0.07
Milling	2.06
Marketing	0.06
General expense	0.49
Bullion tax	0.06
Marketing ore	0.03
Total cost of operation	$6.18
Miscellaneous earnings	0.07
Net cost per ton	$6.11

Considerable new ore was developed in the Combination mine during the month, especially on the second level about 300 ft. northwest of the shaft. The 136BX sill was extended and produced 203 tons of ore averaging $49.20 per ton. The 112X drift on the same level has cut a new orebody and produced 101 tons averaging $36.40 per ton. This new orebody should produce a large tonnage of excellent grade ore. The 210X drift on the third level is being extended to find the downward extension of the

112X ore. The 3-J sill, on the 150-ft. level in the old Sheets-Ish country of the Mohawk, was extended, and produced 170 tons averaging $20 per ton. The 3-P sill being cut on the orebody in 40 drift produced 243 tons of an average value of $16 per ton. The 170-T stope being extended in the orebody cut by the 107-X drift on the 250-ft. level, under the old Sheets-Ish workings, produced 170 tons averaging $21.20 per ton. The 490-R sill on the intermediate between the third and fourth levels, was extended and produced 31 tons averaging $11 per ton. The 490-B sill, on the same intermediate, just north of the 490-R, was extended, and produced 574 tons of an average value of $18 per ton. The 408-I stope in the Clermont has been brought up above the 600-ft. level, and the sill of the 600 produced 805 tons averaging $21.40 per ton. The development work in this mine during the past month has been confined principally to the 1300 and 1400-ft. levels, where some very promising discoveries have been made. On the 1400-ft. level, about 430 ft. south of the shaft, the shale and latite contact was reached on December 7, and since that date the cross-cut has been entirely in latite, well silicified and mineralized and carrying amounts of gold, silver, and copper.

Peruvian Smelting

The fully equipped smelting plant of the Peruvian M. S. & R. Co., at Rio Blanco, which was blown in for a short run about three years ago, was sold at public auction at Lima, on October 26. E. E. Marshall of Lima, was the purchaser for $93,000, the original cost being $576,000. The bond issue under which the plant was foreclosed was $1,250,000. It is said that the plant is ahead of its time, the proper components of a good smelting charge not being economically available at present. Rio Blanco is 83 miles by rail from Callao, at an altitude of 11,306 ft., and 31 miles from Morococha, which is at 15,050 ft., and was to have been the principal source of ore supply. In the province of Cajatambo, north of Lima, and west of Cerro de Paseo, on the western slope of the Andes, are situated the silver and copper mines of S. P. Dunstan, which are producing ore containing 60 to 80 oz. of silver and 10% of copper, treated locally.

Labor Conditions in New Zealand

The principal New Zealand labor unions are once more at peace with the mining companies. Strikes at Waihi and Reefton have been declared off, after having lasted 29 and 25 weeks respectively. The Waihi mine started work in a small way early in October, but the strike continued until the end of November. At Reefton the men will work the 'popper' drills single-handed, but another man will be near at hand to help if necessary. It would be difficult to find in the whole annals of industrial warfare, more senseless or ill-advised strikes. If the Federation of Labor has been beaten, it is due in no small degree to the overwhelming preponderance of moderate opinion among the workers themselves. Lack of public sympathy and condemnation by public opinion, and firmness of the government, has not only prevented the strikes from being successful, but has completely destroyed the power and prestige of the Federation of Labor. During the Waihi strike, the output of bullion from the Waihi and Grand Junction mines was reduced by $2,250,000, and the Waihi Municipal Council, which under normal conditions, has a revenue of $85,000 per year from gold duty, lost about $48,000. Prior to the strike 1500 men were employed in the district, drawing $23,000 per week in wages, so the idle period cost them $670,000, against which only $125,000 was received in strike pay.

Stamp Mill Practice at the Homestake

The table below shows the weight, dimensions, and approximate life of stamp-mill parts in the mills of the Homestake Gold Mining Co., as given in the recent paper by A. J. Clark and W. J. Sharwood on metallurgical practice at the Homestake.

	Material.*	Dimensions.	Approximate Weight.	Approximate Life.‡
			lb.	
Cam-shaft	Wrought iron	5·36 in. diam.	1050 to 1085 †	4 years.
Cam	Chrome steel	2·5 in. face × 35 in., hub 12 in. diam. × 5·75 in.	262	No data.
Cam	Cast iron		256	2 years and up.
Tappet	Chrome steel	9 in. × 12 in.	150	No data.
Tappet	Cast iron		132	20 months and up.
Stem	Wrought iron	3·125 in. diam. × 15 ft.	380 to 390	4 mths. between breakages.
Boss-head	Cast iron	9 in. diam. × 18 in.	236	4 to 12 years; average 6.
Shoe	Special chilled cast iron	9 in. diam. × 8 in.	115	60 to 90 days.
Die	Hard cast iron	9 in. diam. × 5·5 in.	110	30 to 35 days.
Mortar	Cast iron		5500	3 years.
Screens	Cold-rolled re-annealed O.H. steel	9 in. × 50 in. × 0·035 in.	4	10 to 16 days
Plate	Lake copper	4·5 ft. × 12 ft. × 0·125 in.	320	

* Iron castings, with the exception of shoes, which are purchased in lots of several thousand, are cast in the Homestake Foundry, and charged to the various departments at a uniform rate of about 3 c. per lb.

† The shafts in different mills differ slightly in length.

‡ These figures are averaged from a record covering breakages over the whole plant for about three years. At the North-side mills, with lower and slightly faster drop, and somewhat softer ore, the average life of mill parts is considerably longer than in the Lead mills. In the case of chrome steel cams and tappets the period covered by the record is too short to give even approximate data.

Copper Producers' Association Report

The Copper Producer's Association statement shows an increase during the preceding month in accumulation in this country of 19,000,000 pounds.

The changes in surplus since January 1, 1912, have been as follows, in pounds.

	Increase.	Decrease.
January 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431
April	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....
October	13,679,380	.....
November	9,419,095	.....
December	19,000,000	.....

Review of Australasian Mining in 1912

THE EASTERN STATES

By Our Regular Correspondent

The Australian Commonwealth and its dependencies may, as regards mineral production, be divided into three groups —(a) those areas in which the predominant output is that of gold; (b) those in which gold occupies a prominent but not predominant place; (c) those in which the gold output is relatively unimportant. The first group contains two states: (1) Western Australia, in which 95% of the total value of the mineral production is gold; (2) Victoria, with 87% from gold, and 12% from coal; (3) Papua, with 83% from gold, and 17% from copper; (4) the Northern Territory, with 52% from gold, and 48% from other metals. Despite Victoria's small but not negligible output of coal, and despite the proportion, large in the one case and consider-

THE EASTERN STATES.

able in the other, of the industrial metals in the total mineral output of the territory and of the dependency, respectively, these are all to be described as distinctively gold-producing areas though in all probability the Northern Territory will ultimately become principally a producer of the baser metals. Queensland stands by itself with 45% of the value of its output provided by gold and 45% by other metals, a small 9% coming from coal. The states of the remaining group fall into two divisions, one of them comprising South Australia (with 93% of its total proceeds from minerals coming from the baser metals); and the other consisting of Tasmania, which has a small output of coal, making 10% of its total output, and from which 88% is provided by the industrial metals, New South Wales, of whose output 62% comes from the industrial metals, while the coal output is also large (31%), and the gold small, but not quite insignificant (7%). These three states are then preeminently producers of the industrial metals, while of Queensland's production a large though not predominant proportion comes from the same source. The greatest diversity is shown by New South Wales and Queensland, and the most onesidedness by Western Australia. These facts are worthy of consideration because, in consequence, the appreciation in the prices of metals which has characterized this year's markets has had much more effect upon the mining in certain states than in others. Western Australia and Victoria have been unaffected, while the other states have all benefited considerably. In Queensland there has been much activity in fields that have hitherto 'hung fire' while in the great New South Wales silver-lead field, at Broken Hill, record outputs have been the rule.

The Northern Territory

In making a review of the various portions of the Commonwealth, it may be well to take the least important first. From Northern Territory there is no news. Last year the value of its mineral output was a little under $300,000 and its figures for the current year are not likely to show much change. If anything, there may be a slight decrease. There is reason to believe that there are extensive mineral deposits that will well repay exploitation when the country has been opened and the fields made readily accessible. The territory has the finest navigable rivers on the continent, but is hampered by a trying climate, by its distance from the chief Australian markets, by sparseness of population, and by the lack of railway connection. The Federal Government is under engagement to the state of South Australia, from which the Territory was taken over, to construct a railway line through Adelaide, but it is not showing any undue eagerness to commence operations, realizing thoroughly well that there is no likelihood of the line paying expenses for many years. There is also a scheme for connecting Darwin, the capital of the Territory, with Brisbane and Sydney, by means of a Federal railway to Camooweal on the Queensland border. If that line should be constructed, or even the Adelaide line, there is a chance of the developing of much good mineral land in the Territory which must await scientific exploration until such connection is provided. Next to gold, the principal contributors to the mineral production of the Northern Territory are tin (39%) and wolfram (7 per cent).

Papua

If the Northern Territory is but little known and little developed, Papua (or, to give it its old name, British New Guinea) is known still less and is even more backward in development. Official figures are not available beyond the middle of 1911, the value of the output for the pending twelve months having been about $370,000. The gold lode mining is practically confined to Woodlark island; and there is a promising copperfield at Astrolabe. Inaccessibility, climate, vegetation, and absence of means of transport, are the chief stumbling blocks in the way of progress, and development has not been carried sufficiently far to warrant a prediction as to the future of the dependency as a mineral producer.

South Australia

Of the six states of the Commonwealth, by far the most insignificant is South Australia, the value of whose last year's mineral production was about $1,940,000. Figures for even the first half of 1912 are not yet obtainable, a fact not surprising when one takes into consideration the way in which the affairs of the Mines Department of the state are conducted. What is called a 'Review of Mining Operations in the State of South Australia During the Half-Year Ended June 30, 1912,' has been issued; but all it contains in the way of statistics of production is a statement of the amount and value of the gold recovered from battery and cyanide treatment for the period. As in 1911 copper represented 86% of the total output, it would have been more to the point to give the figures relating to the production of this metal than to give plentiful details regarding the insignificant output of gold. Indeed, with the exception of a small production of iron (7% of the total) used for fluxing, South Australia's mineral output spells copper

and nothing else, and almost the whole of it comes from one mining property, the Wallaroo and Moonta. During this year rather more ore has been won from this property than was won last year, but, as stated in a recent letter, the prospects of the company are anything but favorable, as early closing of the Moonta being well within the bounds of probability, while the Wallaroo is dependent upon the continuance of the present high price for copper.

Tasmania

Last year the little island of Tasmania produced mineral wealth to the value of nearly $6,750,000, some 38% of the total coming from tin, 25% from copper, and 22% from silver and lead (jointly). The value of the production has been more than maintained this year, the value of the output for the first six months being set down officially at almost $3,600,000. The chief advance is in gold which has improved from less than 10% of the whole to nearly 13%. Tin, on the other hand, has fallen to 32%, a surprising fact in view of the present high price of the metal. The decline in tin is not merely relative, but absolute, the 3953 tons put out in 1911 giving place to 1611 in the first six months of 1912, making a drop of about 18½%. The Bischoff, which is still the chief tin mine of Australia, has almost kept up to its last year's output, and the Briseis has maintained a steady production, but the Pioneer has put out 111 tons per quarter as compared with 143 per quarter last year. The high price of tin has induced the making of a renewed effort to get the old Northeast Dundas tinfield going. There are some important tin lodes, and there may be a future for the field.

Of the Tasmanian silver-lead mines, by far the most important is that refractory property, the Hercules, which has greatly increased its output, as shown by the fact that while in 1911 it put forth 19,260 tons of a value of about $300,000, it produced in the first six months of 1912 material to the value of nearly $260,000, of which about 5% came from zincblende. The output would have been still further increased had miners been available. The 'E' orebody is opening up well; and if the present internal dissensions in the company are satisfactorily settled, the property may have an important future. Everything, however, depends upon the suitability of the process selected for the treatment of the ore, and this, as regards either of the rival schemes contending for the business of the company, may, with all due respect to those concerned, be considered problematical. The one great copper mine of the state, the Mt. Lyell, has, owing to a variety of circumstances, produced rather less blister copper than last year, but the net return has been higher as a result of better prices. Indeed when the shortage of labor is considered, the company has done remarkably well. The North Lyell branch of the property is supplying excellent ore. It is certain, as the outcome of diamond-drilling, that the orebody extends into the recently acquired property adjoining. The company now has a great work on hand in the shape of a hydro-electric installation, the fountain of light and power being found in Lake Margaret. The month of October saw a bad setback to the company, a fire breaking out in the workings, doing damage, the extent of which is hardly known as yet, and causing the loss of many lives.

Victoria

This, once the greatest of the Australian states as a mineral producer, by reason of its wealth in gold, fills now only the fourth place. Its gold yield has been on the decrease for years. In 1906 it stood at 772,290 oz. fine, last year, at 570,363 oz., this year will apparently show a still further falling off, since the yield for the first six months was only 228,135 oz. Victoria has no big mines, but it has especially deep ones. In Bendigo alone there are no less than 15 with shafts down over 3000 ft. from the surface, the deepest being the Victoria Reef, generally known locally as the 'Victoria Quartz,' which is down 4585 ft., and has a winze which descends an additional 28 or 29 ft. In the rest of the state there is but one mine, the Long Tunnel at Walhalla, with a shaft down more than 3000 ft. But it is really only in deep sinking that enterprise has been shown. As regards the importance of the fields, Bendigo is first, and the rest nowhere; and yet in Bendigo there is not a single mine fitted with up-to-date appliances. The one idea, when gold has given out, has been to sink. The ores occur as 'saddles,' occurring one below the other to unknown depths. Hence, if a reef proved poor where intersected, the rule has been to sink, and try the value of the next. But not only is there a succession of reefs one below the other, there is also a succession of parallel lines of reefs along the surface. The amazing thing is that practically only three of these many lines have been exploited to any extent, and one of these for only a short distance. Bendigonians have too readily assumed that the other lodes (contemptuously spoken of as 'side lines)' were valueless. At the present time on only one of the three main lines is mining at all flourishing, and the actual prosperity of the field is due to one of the despised 'side lines,' the Sheepshead, on which is situated the Central Red White & Blue, which last year distributed $285,000 in dividends. Its nearest rival is the South New Moon, with $70,000. The line on which this mine stands is another 'side line' though it was long supposed to be a continuation of the famous Garden Gully line. It now proves to be a line between them. Of the mines on the main lines, one paid dividends a trifle more than half of what the South New Moon distributed, and the rest were far behind it. The present time marks the triumphs of the 'side lines.' The Central New Red White & Blue has not maintained this year the fine record it put up last year, when 16,457 tons of ore treated yielded $25 per ton. The present value of the ore is less than $11, and the dividends will probably amount to less than $200,000 for the year. It will be noticed that the dividends are not expected to show the same rate of decline as the yield; that is because working costs have been reduced from about $4.50 per ton to about $3.30.

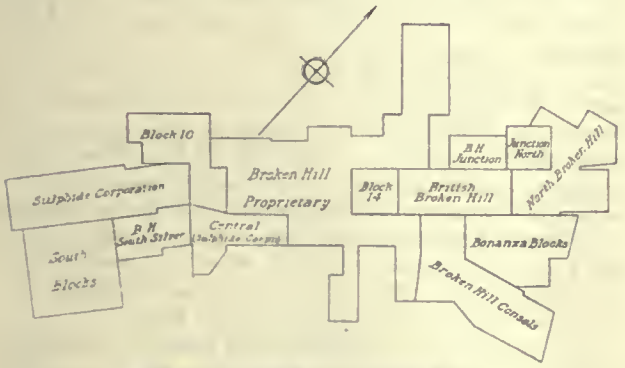
Queensland

Queensland is just about maintaining its last year's record. The gold yield has fallen, but copper and tin (which last year accounted for 32 and 8½% respectively) have both advanced, though the advance is principally on account of improved market prices rather than on account of increased output. The chief decrease in gold has been in the principal goldfield, Charters Towers, where it has been sufficiently heavy to more than counterbalance small increases elsewhere. The drop in value for the year will probably be not less than $600,000 or $700,000. In the copper fields, the Hampden and Mt. Elliott have aroused the greatest hopes, and both mines have been yielding excellent returns. Mt. Elliott is putting out about 600 tons of copper per month, and the Hampden is expected to do equally well when in full operation. That great gold and copper mine, the Mount Morgan, whose products last year were valued at about $4,250,000, is now putting out to the value of between $450,000 and $500,000 per month, so that its production for the year should show a marked advance. The gold yield has increased slightly and the copper yield enormously.

New South Wales

New South Wales, by far the greatest of all the states as a mineral producer, does not put forward any quarterly or half-yearly statements of output except as regards gold, which is far from being its most important product. In this state, as in others, the gold yield is on the down grade, the drop for the first nine months of the year amounting to 8694 oz. fine, or about $180,000. The great Newcastle and Maitland coalfields keep up their output steadily when the miners and surface hands will allow carrying on of work full time, but the companies are getting so bound down with perpetual strikes and wrangles with their employees that some are becoming disheartened. It is small wonder. The copper of the state mostly comes from Cobar, where over-capitalization is a great stumbling block. Australia's great mineral wealth is in its silver-lead-zinc mines at Broken Hill. The value of the state's output of minerals last year was, according to the *Mining Standard's* figures, between $50,000,000 and $55,000,000, and of this total, silver accounted for 15%, lead for 21%, and zinc for 13%. In other

words, practically 50% of the whole came from the Broken Hill field. Here everything has been booming, owing to the high price of silver, lead, and spelter. September was the record month, the export of the mineral products reaching a value of over $2,000,000 net. For the first nine months of the year the value, not including tin, copper, or gold, ran to over $15,000,000. The Proprietary, which is still the great mine of the field, has been working on a somewhat reduced scale, owing mainly to the difficulty of obtaining labor, and yet has, in consequence of the improved price of metals, done better than last year. The company is now planning to enter the iron and steel industry, and is thus turning into a vast industrial concern. As a mining concern, it has paid nearly $50,000,000 in dividends. In Block 14 the carbonate workings are still remarkably good. In Block 10, the lode has practically cut out at 1815 ft., and the main interest lies in the development of the 500-ft. level, which is not proving very satisfactory. The Central (Sulphide Corporation) is proving good at depth and is one of the big properties of the field. The company is going in for electric smelting, an experiment which will be closely watched. At the Zinc Corporation's South Blocks mine, re-



PROPERTY LINES AT BROKEN HILL.

cent development has added considerably to the estimated value of the reserve, but it is not yet certain that the mine has justified its purchase. At the Broken Hill South the concentrate is of lower grade than formerly, but recovery is higher, and the life of the mine has been extended by the proving of a new orebody. The Junction North has been doing much better, making a profit of from $10,000 to $15,000 per week on purchased ore and slime. The British looks remarkably well, and this year's development has added enormously to the life of the mine. No mine in the field is doing better at the present time than the North, which is working on a rich lode at the 1250-ft. level. For a mine that was supposed to be worked out years ago, it is extraordinarily lively. The mill work is excellent. The one drawback of the whole field is the insufficiency of labor. Were all the required labor obtainable, the preëminence of the district in silver, lead, and zinc production would be far more pronounced than it is, yet even as now, it is marked enough. Broken Hill is a marvelous field, and will remain such for perhaps another twenty years.

WESTERN AUSTRALIA

By Our Regular Correspondent

The year 1912 will long be remembered as one of the most stagnant in the mining industry of this state. Enterprise has been severely checked by a drought. No new finds of any importance have been made, save the finding of several nuggets, one weighing 230 oz., in two claims, two miles apart, on the Kurnalpi goldfield, caused a wild rush, which was quickly over. A smaller rush took place to Binti Binti, 50 miles northeast of Kalgoorlie, but the district is nearly deserted. In the Kalgoorlie district there have been no discoveries of any importance, but the cross-cuts, driven from the 2500, 2650, and 2800-ft. levels of the Great Boulder in the Golden Horse-Shoe ground, confirmed the diamond-drill bores of the previous year, and proved that the boundary lode had passed out of the Great Boulder into the Horse-Shoe. Practically the whole of the 2,175,000 tons, which has yielded $41,475,000, and allowed dividends amounting to $19,455,000 to be paid to Great Boulder shareholders, was mined from this lode. This means that, when the present ore reserves, last estimated at 780,000 tons, are exhausted, the Great Boulder mine will come to an end. As in the previous year the Golden Horse-Shoe has been worked at a loss, and will continue to be so worked for some months longer, till the ore from the boundary, or No. 4 lode, becomes available about the middle of next year. The ore-shoot in the Ivanhoe is short in the three bottom levels, and the grade of ore low, but there is still a four years' supply for the mill above the 2420-ft. level. Lake View & Star still has possibilities of a long life, as the Star portion of the property is almost a virgin mine, and, since Mr. Vail took charge, new finds have been made in the Lake View. The sinking of the shaft has been resumed, after remaining at 500 ft. for seven years. Associated is not looking well, but is being more systematically opened. Boulder Perseverance, South Kalgoorlie, and Hainault are treating 35,000 tons per month between them with a small margin of profit. Kalgoorlie has shown such poor results at the 185-ft. level that shaft sinking has been suspended at 1900 ft. for three years, and, during that period, the reserves have declined 180,000 tons. Oroya Links holds such a large area that it is impossible to predict its future. Golden Ridge has become so impoverished at the bottom level that the life of the mine is limited. Associated Northern is now being operated by tributors, the management concentrating its energy on the Victorious mine at Ora Banda. The treatment plant erected on the property was designated to treat 12,000 tons monthly at an estimated profit of $24,000 per month. This estimate has been completely upset by the action of the mineralized salt water on the filter cloths reducing the output of the Ridgway filters to 2500, instead of 4000 tons monthly. Chemical experiments are now being made to see if this difficulty can be overcome. This mine has 200,000 tons of oxidized ore reserves of an extractable value of $4.50 per ton. It is doubtful whether the sulphides will pay to treat, but that is a question for the future to decide. Outside of Kalgoorlie the goldfield, which shows most promise, is Meekatharra, whose leading mine, the Fenian, is now producing $36,000 per month from 3000 tons. Adjoining it on the south is the Marmont, now under option to the Great Fingall company. The Marmont yielded $675,000 from 41,500 tons, from above the 300-ft. level, and the price asked is $150,000. On the northwest of the Fenian is the Queen of the Hills owned by the Lake View & Oroya Exploration, Ltd. There are 26,000 tons of an assay value of $11.50 in this mine. A Holman pneumatic stamp-mill of a monthly capacity of 4500 tons is to be erected, and should start crushing early next year. There are half a dozen other producing mines adjoining those mentioned, but, as the district was entirely neglected by capitalists till last year, they are all worked on a small scale. In fact, till W. J. Loring, of Bewick, Moreing & Co., took an option on the Queen of the Hills, the field was entirely in the hands of working men. W. A. MacLeod, the present resident partner of Bewick, Moreing & Co., was so impressed with the district, when paying his first visit to the Queen of the Hills a couple of months ago, that he secured an option on the Marmont. The Great Fingall, at Day Dawn, which has already produced $32,920,000 from 1,780,000 tons, and paid $8,672,000 in dividends, seems to have a fresh lease of life. In 1909 the consulting engineers advised the directors to invest $375,000 of the reserve fund in the Taquah Central mine, in West Africa, as the Fingall was worked out, the lens having cut out at a depth of 1370 ft. Since then the Taquah Central has been abandoned, after the Great Fingall had added and lost another $125,000 to the original amount ventured. However, after sinking through 740 ft. of country, in the Great Fingall mine, a new orebody was found, and has been opened at three levels down to 2500 ft. The Sons of Gwalia at Lenora, which has already produced $18,200,000 from 1,832,500 tons, and paid $4,418,000 in dividends, has recently been driving on ore in No. 17 level worth $12.75

over a width of 76 in., and, in No. 18 level, ore averaging $21.50 has been found. The grade of ore recently treated by the mill has only averaged $7.50 per ton. The Yilgarn goldfield, which extends over a length of 220 miles, has shown increased activity since the flotation, in London, of the Bullfinch, two years ago, for $2,250,000. Since then the mine has been undergoing development, and a treatment plant, of a monthly capacity of 12,000 tons, is being erected, and is expected to start early in 1913. Twelve miles south of Bullfinch is the Corinthian North, one of the biggest low-grade mines in the state. The ore reserves above 100 ft. amount to 158,000 tons assaying $6 per ton. Quite recently an abundant supply of water has been met with in the shaft, which will ensure a supply for running the mill, now in course of erection. Twenty miles south of Southern Cross, and 32 miles south of the Corinthian marsh, is the Mountain Queen, controlled by Bewick, Moreing & Co. This mine has so far treated 40,100 tons with a return of $176,000 exclusive of gold in residues. A vacuum-filter is now at work, and this is expected to increase the average to $6.50 per ton. The Mountain Queen company also owns the Transvaal, situated about 12 miles away. This mine has a lode 12 ft. wide, and has ore reserves

WESTERN AUSTRALIA.

of 48,000 tons assaying $11 per ton. A treatment plant has been ordered, and should be at work early in 1913. Ten miles south of the Mountain Queen is the Victoria, on which R. Hamilton, manager of the Great Boulder, recently had nine sampiers at work for six weeks. The lode on this property is 150 ft. wide, and has a recoverable value of $6. Mr. Hamilton has now taken a twelve months' option on this property to thoroughly test it on behalf of the Great Boulder company. The price asked is $250,000 in cash, or shares, as later to be agreed on. During the year the Lancefield was shut down after producing $4,140,000 from 540,000 tons at a loss to the shareholders of $500,000. The presence of arsenical pyrite in the sulphide zone was the cause of the disaster. The mine is expected to be re-opened during the year with a new treatment plant. Another mine shut down, owing to the refractory nature of the ore, is the Gwalia Consols at Wiluna, 100 miles from the Leonora railway station. A metallurgist from Freiberg has been at the mine for a year experimenting with the ore, but has been quite unsuccessful. The Siberia Consols, situated 60 miles northeast of Kalgoorlie, may be a big producer in the near future, as the owners are at present in Adelaide with the view to an early flotation. Out of 5000 tons raised from cross-cuts and drifts on a schist ore lode 100 ft. wide, 876½ tons of picked ore yielded $103,900 at the Government mill, or the high average of $118.75 per ton. The balance of the ore raised and untreated is worth $5 to $6 per ton. Owing to the lapse of the wages agreement at Kalgoorlie, which embraces all unions in the eastern goldfields, the mining industry is abnormally depressed at present, but, once the difficulty is surmounted, prosperity should return. The gold output for the year will amount to $27,200,000 against $29,115,000 for 1911, owing to the decline in grade of the older mines, but some of the new mines should help to counteract this in the near future. Tin and copper mining have shown little increase in production, in spite of the high prices ruling for these metals, and any new finds have not so far yielded any pronounced result.

NEW ZEALAND

By F. Baxter

Although a lot of development has been accomplished during 1912 in the mines situated in the Hauraki peninsula, yet, owing to some of the principal mines in the Waihi district having been closed for several months because of labor troubles, the total output of bullion only amounted to $2,940,000 up to November, against the usual $4,000,000. Some time ago the Waihi Miners' Union withdrew from working under the provisions of the Arbitration Act, and affiliated with the Federation of Labor, which left the men free to quit work at a moment's notice. Last May the hoisting engineers at Waihi decided to form a union of their own. This was resented by the miners, and the 1200 went out on strike. Work ceased at all mines in the Waihi district until October, when operations were resumed, with other men in most cases. In November, the non-unionists were strong enough to resent being called 'scabs' by members of the 'Red Federation,' and things culminated by a striker shooting a constable, who afterward clubbed him so severely that death resulted within two days. The free workers then took matters into their own hands to a certain extent, and cleared the leading Federationists out of Waihi.

Up to the time of closing down, the Waihi mine had been yielding from $203,000 to $225,000 per month, the output to date totaling $52,400,000, out of which $22,400,000 has been distributed in dividends. The work of bringing in electric-power from the Hora Hora falls on the Waikato river, has in the meantime been pushed, and early in 1913 less labor will be required in the mine, and lower-grade ore can then be treated with a fair margin of profit. The new power-plant will cost $740,000, which sum has already been provided out of profits. The Waihi Grand Junction mine also closed in consequence of the strike. Up to April 20, 1912, this mine had yielded $3,000,000, out of which $192,000 had been paid in dividends. The work of erecting a power-station and electric pumping plant, capable of lifting 1,000,000 gal. per day, is now at hand, and unwatering of No. 3 shaft has been resumed, so that mining operations should start with the new year. The Junction mine looks well at the lower levels, and had just started paying dividends when the strike occurred. Shafts are being sunk on the line of the Waihi vein system by the Consolidated and Extended companies and the Waihi Standard Co. is also carrying on operations, having just purchased a stamp-mill, when it had to close with the other mines in the district. Owing to a deposit overlying the auriferous area in the Waihi district, the opening of mines is both slow and expensive. As the Ohinemuri river has been the sludge-channel into which the mines in that county have deposited their residue since 1895, a company has been formed, called the Waihi-Paeroa Gold Extraction Co. for the purpose of dredging the material and recovering the bullion which has been lost by the Waihi, Talisman, and Crown companies. The government returns show that over 5,000,000 tons of tailing has discharged into the river, and tests made have proved that these can be worked at a profit. The largest dredging plant in the southern hemisphere has been erected with tube-mills to treat the tailing which is finally treated by cyaniding. So far, 75,000 tons of tailing has been treated, yielding $135,000. In November, the directors declared the first dividend of 25c. per share. Full details of this plant will be given in a later issue of the *Mining and Scientific Press.*

At Karangahake, about nine miles from Waihi, three-

companies are carrying on mining operations. The Talisman Consolidated Co. has been crushing steadily through the year, and $9,200,000 has been won to date, of which $3,750,000 was paid in dividends. The New Zealand Crown Mines property, which adjoins the Talisman, has also been producing regularly, but of late returns have shown a decrease in the value of the ore treated. The total output from the Crown Mines to date is $451,000. The Dominion Company's property adjoins the Talisman, on the other side of the mountain, and an adit-level is being driven to cut lodes found on the surface. Recently a fault was cut, the rush of water from which was so strong, that work had to be stopped for some weeks. As, however, pieces of quartz which assayed over $10 per ton were found among the débris forced into the drift, it is anticipated that a lode is near. In the Komata district, the Komata Reefs Co. has been crushing steadily during the year, the total output to date being $1,950,000. Although the monthly reurns are not large from this property, they are sufficiently profitable to allow a surplus of $24,000 to have accumulated, besides covering the cost of working.

In the Maratoto district the Silverstream company is working a telluride ore, some of which has assayed as high as $260 per ton. Shipments sent to smelters in Australia have returned satisfactory averages. Tellurides of silver have also been found in an adjoining mine named the Tellurides Proprietory. In the Waioraongoami district, near the Te Aroha thermal springs sanatorium, there are a number of large lodes in the hills, but so far these have not proved amenable to treatment by the ordinary mill methods. A company called the Waitawheta has been carrying on operations for the last three years, and has found several large lodes which give good assays. It has now acquired a stamp-mill with ditch for water-power, and the directors are sanguine that it will prove a profitable proposition. Mining has been dull during the year at Coromandel, the district where gold was first discovered on the Hauraki peninsula in 1852. Work has gone on steadily at three or four mines, but nothing of importance has been reported.

The main interest at Thames centres is a cross-cut which is being driven at a depth of 1000 ft. for the purpose of testing the deeper levels. Five companies have joined in making this cross-cut, which has also been subsidized by the government to the extent of $29,000. The work has now been completed for about three parts of the proposed distance, but although one or two small veins were found and ore showing gold was opened, nothing of a sensational nature was intersected. As the cross-cut is now approaching the end of the field where the richest mines were situated in the early days, it is hoped that the downward continuation of some of the rich shoots may be found. The May Queen mine is working at 1000 ft., but so far nothing of importance has been reported, although the outlook is considered encouraging. The Saxon company has deepened its shaft 100 ft. and opened out a level which is now being driven to cut two well known veins which paid in the upper workings. The Waiotahi mine, which has yielded $3,360,000, and paid $1,920,000 on an actual capital of $74,000, is opening No. 7 level, and has intersected a lode 48 in. wide which is yielding about $20 in gold per ton. In the shaft also a large lode was found, but further sinking had to be stopped on account of the water, which, it is hoped, will be drained by the cross-cut mentioned at the 1000-ft. level. At the Tararu end of the field, three companies have done a lot of development during the past few years. The Watchman has opened up some large gold-bearing lodes, and just started a crushing of 1000 tons to prove the value by bulk test. The Waitangi Consolidated Co. mined good ore from the upper workings, but a low level put in at considerable cost, has not so far revealed profitable orebodies. The New Sylvia has opened a number of lodes, and although the ore has been low in grade, yet the last two or three shipments have shown a margin of profit. The Occidental Consolidated mine, at the other end of the Thames district, has opened an ore-shoot, and from present indications seems likely to prove profitable. It has now paid expenses for a few months and accumulated a reserve of $14,400. At Waiomo, the Monowai company has done a lot of work, and been shipping concentrate to Swansea, in England, for treatment, but there has not been anything out of operations for the shareholders so far. Kuaotuna is really part of the Coromandel field. In it three companies have been working at a profit. The New Waitala looks promising, the low level which was driven for a considerable distance has opened a good ore-shoot and the company has just completed crushing 52 tons, worth $5000, including specimen ore. The Mountain King and Handsworth mines are also mining ore, the latter company having crushed 12 tons in October which returned $2700.

Throughout the year mining shares have been neglected on the Auckland stock exchange, but apart from that fact the outlook for the goldfields is decidedly good at the present juncture, as the absence of speculative buying means that only genuine propositions are being worked.

With regard to the Reefton field, on the west coast of the South Islands, of New Zealand, an unfortunate state of affairs has also existed, due to miners in and about July last going out on strike, refusing to work 'baby' machine-drills single-handed. As a result, the well known Blackwater, Progress, Wealth of Nations, and other properties were shut down for some months. Dredging on the West Coast and in the Otago district was interesting in its usual way, but production is steadily on the down grade. On the whole, New Zealand has had a really bad year from a mining point of view, entirely through the stupidity of labor agitators; but, from the way events have turned out, they will have had a lesson which should be sufficient for many years.

After 29 weeks of idleness the Federation of Labor in New Zealand has declared the strike off at Waihi, and the Waihi and Grand Junction mines will gradually be operated to full capacity again. The men lost $675,000 in wages, against which they received a total of $125,000 in strike pay from various sources. The district's production of bullion during the strike was reduced by $2,175,000; and in the end the men gained nothing but contempt from the public generally. The strike at Reefton, in the South Island, was also declared off after 25 weeks' struggle, and the men here seem to have gained as little as those at Waihi.

Progress in Mexico in 1912

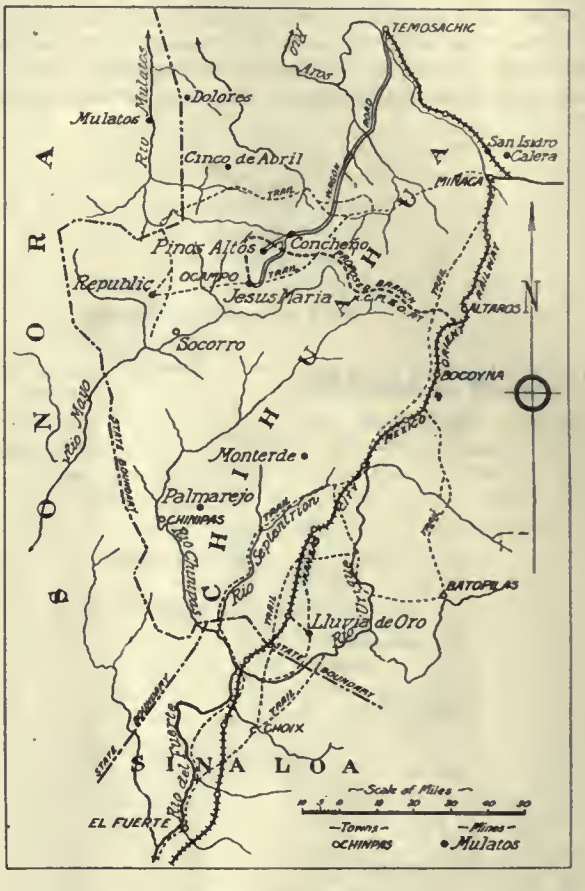
Government statistics for the fiscal year 1911-12, which includes the first six months of the present year, place the production of silver at ₱89,664,665, an increase of ₱8,750,866, compared with the production in the preceding fiscal year. The higher price was a factor in the increased production, but in addition the output was 8637 kilograms greater than in 1910-11. The gold production is placed at ₱48,686,965, a decrease of ₱928,324. In the fiscal year Mexico produced copper and copper ore worth ₱33,501,873, an increase of ₱7,201,645 over the corresponding 12 months. The increased price figured in this. Lead and lead ore produced had a value of ₱6,019,121, a decrease of over ₱800,000, and the value of the zinc ore mined and exported was ₱908,694, a slight increase. The value of the petroleum produced in 1911-12 is placed at ₱15,000,000; iron and steel, ₱7,000,000; and coal and coke, ₱9,000,000. The grand total for mineral products is ₱209,781,343.

With the favorable markets for silver and copper, normal conditions during the year would have meant heavy investment of foreign capital for new activities, and much more would have been invested for extensions and betterments. The Government was successful in putting an end to the revolutionary movement of Pasqual Orozco, launched in Chihuahua early in the year, but no crushing defeat was administered to the rebels, and in the end the forces scattered as marauding bands. Some crossed into Sonora, and by attacks on Nacozari and El Tigre came near causing international complications. Railroad lines in Chihuahua, Sonora, Durango, and Sinaloa have been cut repeatedly, and the securing of supplies has been a serious problem at many points. Mines in the states mentioned have been raided, and companies have suffered heavily. In the south the Government has had the 'Zapatistas' to contend with, and has made little progress against them. Their activities have practically put a stop to mining in important districts of the states of Mexico and Guerrero. In Oaxaca, also, mining has been interfered with extensively. In the north recently several Americans have been taken and held for ransom. During the past month there has been a decided increase in rebel activity in Chihuahua. In the taking of towns and villages in both the north and south all manner of outrages have been committed. Gen. Felix Dias, who attempted to start a revolution against the Madero government at Veracruz in October, was promptly made a prisoner.

Rebel activity has interfered with work on the Durango-Cañitas line of the National Railways, but the road has been completed for 87 kilometres out of Durango, and that stretch is now in operation. The Penjamo-Ajuno branch of the National was completed without interference. Work has been in progress during the year on the Tampico-Veracruz line of the National, which includes a connection that will give Mexico City a short route to Tampico. The Southern Pacific, which opened its West Coast line to the Tepic capital early in the year, has done no construction work.

The oil industry of Mexico has continued to develop without interruption, and the country now ranks third as an oil producer. The Doheny interests are making regular shipments to the United States under contract with the Standard Oil and associated companies, and are opening markets for oil and asphaltum in Brazil and other South American countries. The Pearson interests are exporting to England, and will soon have a new fleet of oil-carrying vessels in service. Several other concerns of the Tampico territory have reached the producing stage, and extensive exploration and development work is in progress.

In the first 10 months of 1912 Greene-Cananea had an output of 38,690,000 lb. of copper, 1,146,960 oz. of silver, and 5856 oz. of gold. The total output of copper for the year, exclusive of the product of the Miami concentrate, will not be far below 50,000,000 lb. The company has been paying a quarterly dividend of 25c. per share, placing the stock on a $1 a year dividend basis, and in addition a substantial treasury surplus is being maintained. The company's production cost during the year has been between 9 and 10c. per pound. Much important mine development and mine improvement have been in progress during the year, and the latter will result in a more economical handling of ores from the mines to the concentrators and smelter. The copper production of the Moctezuma Copper Co. (Phelps-Dodge) in the first 11 months of 1912 was 28,986,309 lb., or more than 3,000,000 lb. greater than the total production in 1911. The production in the 11 months would have passed the 30,000,000-lb. mark had it not been for the interruptions in September, due to rebel activity in the Nacozari district of Sonora, the output for that month falling to 771,884 lb. The Lucky Tiger Gold Mining Co. has been earning profits of from $45,000 to $75,000 per month, and has been paying a dividend of 5c. per share monthly,

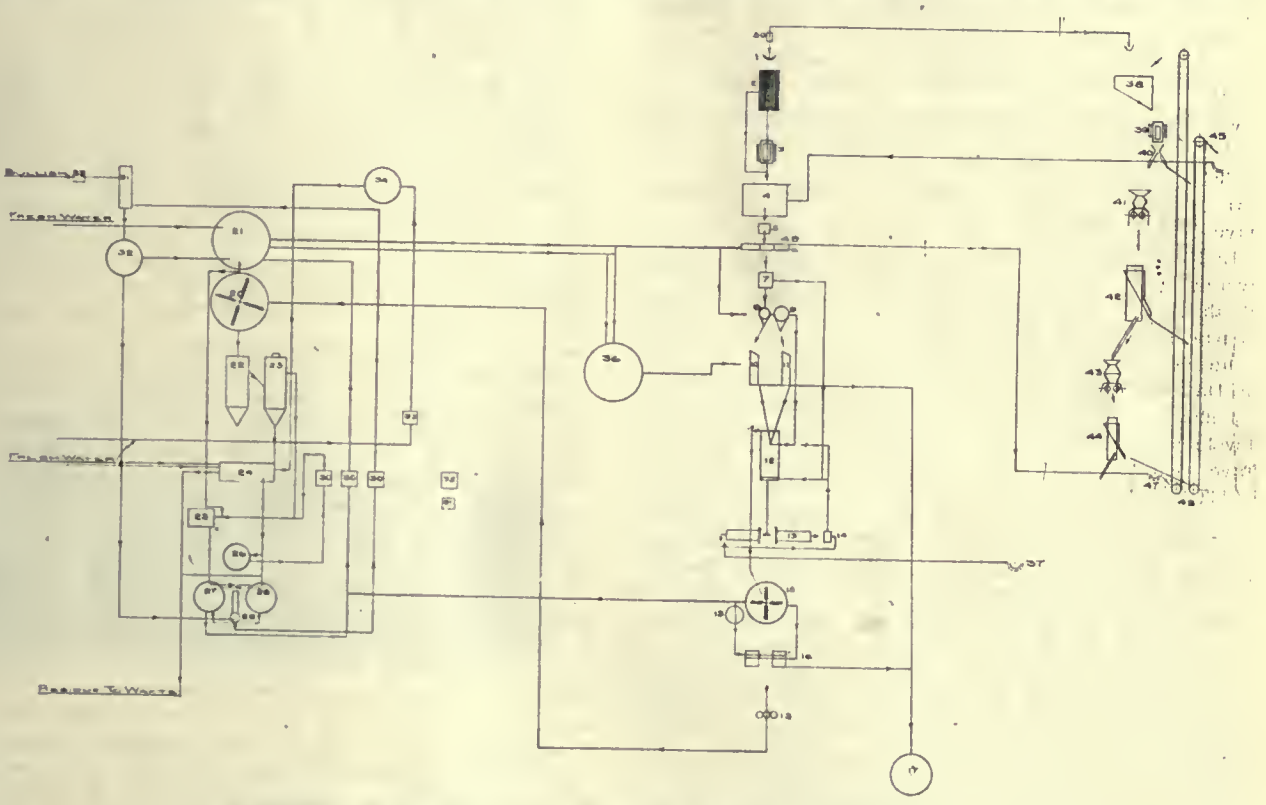


PART OF CHIHUAHUA.

amounting to $35,750. In December 2c. was added to the regular dividend, making a disbursement of $50,050. High copper prices permitted the Democrata to resume operations at its properties at Cananea. Runs have been made at the old smelting plant, and the new smelter, built before the shut-down, will be soon in operation. The Calumet & Sonora has been producing about 300 tons of zinc and copper concentrate and 50 tons of lead concentrate per month, and has been carrying on important development. Control of the Superior-Bonanza properties near Imuris was secured by the Greene-Cananea interests, and extensive work has been in progress for several months. Surveys for a railroad to Imuris have been made, in connection with plans for heavy shipments to the Cananea smelter. The San Antonio Copper Co., a Cole-Ryan concern, has continued development, and has made arrangements for the construction of a seven-mile railroad to Tonichi, the terminus of the Yaqui river branch of the Southern Pacific. The company has a great tonnage of ore blocked out, and will become an important producer. During the period of rebel activity in Sonora, operations in the Yaqui river region were affected, but shipments of ore and concentrate have been in progress for some months. The Minneapolis Copper Co. closed down at the time of rebel activity near Cumpas, but has resumed and will proceed with the erection of a smelter. The Transvaal Co. and several other concerns in the district infested for a time by rebels, have resumed. The Mexican Metals Co. has been operating

steadily, and is shipping concentrate from its 100-ton mill. The Sonora Copper Co., which has a new 100-ton smelter at copper mines near Noria station, resumed operations late in the year.

The Chihuahua smelter of the American Smelting & Refining Co. was able to continue operations through the year, treating principally ores from the Santa Eulalia district, which has continued to rank as the most important lead-silver district of the republic. Late in the year announcement was made of a deal for the transfer of the big mines of the Cia. Minera de Naica to French interests for ₱8,000,000, old stockholders assuming the responsibility of placing a part of the stock of a new company. The Mines Company of America, controlling the Dolores and El Rayo enterprises in Chihuahua and the Creston-Colorado and curtailed by traffic interruptions on the Mexican Northwestern railway, but much development has been in progress during the year. Batopilas was raided by rebels, and supplies taken, but operations were not seriously affected. The Batopilas company has been making shipments of bullion monthly. The generally unsettled conditions caused the Palmarejo & Mexican Goldfields to suspend work on its reduction plant, and the Sierra Consolidated shut down in March to await normal conditions. Rebel activity caused temporary suspensions at the Concheño and Yoquivo camps. Work on the big Conchos river power project has been in progress steadily, and every effort is being made to complete the power-plant by the middle of the coming year. Canadian interests, represented by Paul Ginther and said to be identified with those financing the power project,



FLOW-SHEET OF PROPOSED MILL, PALMAREJO & MEXICAN GOLDFIELDS, LTD.

1—Aerial tramway bucket.
2—9 grizzlies, 12 by 4 ft. by 1½-in. space.
3—Bigelow breakers.
4—Ore-bin, 1900 tons.
5—Pepler feeders.
6—Stamp battery, 36 head, 1250 lb.
7—Callow screens, 3-in. simplex.
8—3 hydraulic sizers, 3 ft. 6 in.
9—3 hydraulic sizers, 5 ft. 6 in.
10—3 Wilfley tables, coarse sand.
11—9 Wilfley tables, fine sand.
12—3 Dorr separators, double.
13—6 tube-mills, 52 in. by 16 ft.
14—3 Frenier pumps, 10 by 54 in.
15—3 Dorr thickeners, 30 by 10 ft.
16—30 Johnston slime concentrators.
17—Concentrate tanks.
18—2 wash-water tanks, 5 by 4 ft.
19—3 three-throw pumps, 9 by 12 in.
20—3 Dorr thickeners, 35 by 10 ft.
21—2 battery solution supplies, 35 ft. by 8 in.
22—6 Brown agitators, 45 by 15 ft.
23—2 Cyanippus decantors, 45 by 15 ft.
24—3 Merrill slime presses.
25—Dehne clarifier.
26—Dirty-solution sump.
27—Weak-solution sump.
28—Strong-solution sump.
29—Zinc-dust feed.
30—3 solution pumps, 7½ by 10 in.
31—3 Merrill precipitation presses.
32—Precipitated-solution tank.
33—3 sluicing-water pumps, 7½ by 10 in.
34—Sluicing-water tank.
35—Compressors for agitators.
36—Wilfley tables wash-solution tank, 20 by 5 ft.
37—Flint conveyor to tube-mills.
38—Two-compartment sample-bin.
39—Jaw-breaker, 7 by 9 in.
40—Divider, 1/6
41—Rolls, 16 by 10 in.
42—Sampler No. 1.
43—Rolls, 10 by 8 in.
44—Sampler.
45—8-in. elevator for rejects.
46—Conveyor to battery ore-bins.
47—12 conveyors from feeder sampler.
48—8-in. elevator to sample-bins.
49—Sampler at feeders.
50—Ore weighing machine.
51—Electric light dynamo.
52—3 tilting furnaces.

La Dura in Sonora, which early in the year decided to pass its dividends because of unsettled conditions and the possibility of extraordinary requirements, recently declared a dividend of 1¼% for the last quarter of the year, payable in January. A report for the first six months of the year shows bullion sales of $1,309,913, and an operating profit of $360,404. The Dolores mines was raided by rebels, resulting in a direct loss and the temporary suspension of operations. In the Parral district the Alvarado M. & M. Co. has continued uninterruptedly, and has placed additional machinery in its big cyanidation plant. The San Francisco del Oro, Minas Tecolotes y Anexas, El Rayo, and Moctezuma Lead are other important concerns of that district that have worked steadily through the year. The Veta Colorado and Arizona-Parral shut down early in the year. The Rio Tinto Copper Co. has suffered several interruptions, but has made a good showing. Shipments from mines in the Cusihuirischic district have been greatly have taken up a number of properties in the Parral district, and are reported to be planning the largest cyanide plant in Mexico. During the early part of the year the Rio Plata mill was out of commission, pending development. Since milling was resumed, it has been operating steadily. Despite difficulties, the Republica company has continued to operate profitably during the year.

The year's production of the Dos Estrellas at El Oro will average nearly a million pesos per month, and during the year the company has continued to pay dividends of ₱500,000 per month. At the beginning of the year a more favorable contract for smelting ores was made. In the year ended June 30 last, the El Oro Mining & Railway Co. had a production of £454,582, and a net profit of £182,149. The company's railway and lumber department yielded a profit of $120,220. During the year the company has been treating 20,000 tons of ore and 15,000 tons of tailing per month. Bullion worth $1,555,095 was produced from 142,884

tons milled by the Mexico Mines of El Oro in the year ended June 30. The production was maintained during the last half of 1912. The Esperanza costs have continued high during the year, with consequently small profits. At the company's annual meeting in May, it was shown that £40,000 had been taken from the reserve fund to pay dividends of £138,000 during the preceding year, and it was decided to readjust disbursements. Negotiations for a property in Zacatecas have been in progress during the year. The 1912 net earnings of the Real del Monte y Pachuca, in the Pachuca district of Hidalgo, will be double those of the preceding year. In addition, ₱1,000,000 of deferred charges from the cost of doubling capacities two years ago have been charged off. The company commenced the year milling 32,000 tons per month, and in November last the amount milled was 39,200 tons. The December record is expected to show 41,000 tons milled. The gross earnings of the Santa Gertrudis, Ltd., for the year ended in June were £631,432, and the net earnings £276,648. The dividend disbursement amounted to £205,200. The capacity of the Santa Gertrudis plant has been increased from 650 to 850 tons per day, the work being completed late in the year. The San Rafael y Anexas and La Blanca, at Pachuca, have had a successful year.

In the state of Jalisco the Amparo Mining Co. has been averaging ₱140,000 per month, with operating expenses of about half that amount. The company has continued to pay dividends of $60,000 quarterly. El Favor has been a heavy shipper of high-grade ore during the year, and in December the company declared its first dividend, 1c. per share. Mololoa has been shipping high-grade ore from development and has been milling extensively at the El Favor plant. An option to buy the Casados mines for ₱4,500,000, held by American and French interests, was surrendered late in the year because of generally unsettled conditions. During the year important and satisfactory development has been conducted. Extensive work has been in progress for several months at the old Cinco Minas, and orders have been placed for a 250-ton cyanide plant. During the year the Espada Mines Co. has been milling at the Virginia & Mexico plant, and some time ago reached a capacity of 100 tons per day. Late in the year arrangements were made for the construction of a branch of the National Railways from Ameca to the Magistral copper camp, and the coming year should see great activity in the Ameca district. El Tajo, in the San Sebastian district, has been working steadily. The Mexicana bought a 50-ton copper smelter for its mines in the Tapalpa district, but because of general conditions little work has been done during the year. The Mexican Mines Co. recently resumed at the old Bolaños mines, having stopped work early in the year. The Guanajuato district of Guanajuato continued to produce over ₱1,000,000 per month during 1912 and the enterprises there have suffered no direct interference. Recently financial reasons caused the Oro Grande practically to abandon work at the old La Luz and the Jesus Maria properties. American capital has been secured for extensive operations at the San Gregorio and Dolores properties of the Dwight-Furness interests. In October the Cia. Beneficiadora de Pozos completed a 250-ton cyanide plant, which will treat the ores of the Angustias, Dolores y Anexas, and other mines of the Pozos district of Guanajuata. The year's operations of the La Fe y Anexas Co., controlled by the A. Goerz interests of London and operating in the Zacatecas district of Zacatecas, have been very extensive. The company has put in additional pumping equipment to handle the water in the old mines and has ordered a 30-stamp concentrating and cyaniding plant. The important Mazapil Copper Co. has operated its mines and smelters uninterruptedly. The 100-ton plant of the Santa Rosa Mining Co., in the Concepcion del Oro district, started near the end of 1911, has been in successful operation the past year, and good profits have been earned. The mines and 50-stamp mill of the San Carlos Gold Mines, Ltd., of London, at Mezquital del Oro, Zacatecas, were taken over by Philadelphia interests, and the Mezquital Mining Co. formed.

The Velardeña smelter of the American Smelters Securities Co., in Durango, has been able to continue operation practically throughout the year, notwithstaning the fact that for months there was much rebel activity in that part of Durango. To maintain a fuel supply has been difficult. For some time the smelter has been averaging 1600 tons of ore per day, the greater part from the company's Velardeña mines. The production of all the mines in the Velardeña district has been almost normal. A new sintering plant is being built at the smelter, and when completed it is expected to handle a big tonnage of fine. The Peñoles Mining Co., owning the smelter and the principal mines at Mapimi, has been operating steadily. The company bought the Paloma lead-silver mines in Coahuila for ₱1,000,000, and has been negotiating for the Cabrilla mines in the same camp at a price said to be double that of the Paloma. A decision to use oil for fuel was reached during the year by the Peñoles management, and a contract made with the Doheny interests. Rebel activity checked operations in the Inde district of Durango, but the Guadalupe and the Inde Gold, the two most important concerns of the district, have resumed work. The Tominil company, an English concern operating near the Sinaloa line, was forced to abandon operations several months ago. Apparently disturbed conditions have served only to delay the plans of the promoters of the Nazas Valley & Pacific railway, projected from Tepehuanes to Guanacevi, Durango, as it is announced that grading will be commenced immediately. The Torreon smelter has been in operation throughout the year, but at reduced capacity during much of the time. The smelters at Monterey, Aguascalientes, San Luis Potosi, and Matehuala also have been operating uninterruptedly. The Central Potosi railway, giving the Tiro General mines, in San Luis Potosi, connection with the National Railways, was widened to standard gauge during the year, making possible heavier shipments to the Aguascalientes smelter. The Tiro General mines were bought by the American Smelting & Refining Co. in 1911. El Barreno started its new reduction plant in the San Pedro district of San Luis Potosi early in the year, but later some remodeling was found necessary. The Wadley antimony smelter of Cookson & Co. has had a successful year. German interests having under lease the Cerritos sulphur deposits of the Virginia-Carolina Chemical Co. have been producing heavily during the year. The Teziutlan Copper Co., of Puebla, has been producing heavily at its mines and smelter. An order for four 8-ft. Hardinge mills was recently placed. The Puebla Smelting & Refining Co. has been organized by American interests, with a capital of $5,000,000, to work a group of copper mines in the San Juan district of Puebla. The plants include a 1000-ton smelter. The Mexican Light & Power Co., the Canadian concern owning the big Necaxa plant in Puebla and supplying power to the El Oro and Pachuca districts as well as to Mexico City, had gross earnings in the first 11 months of the year of ₱8,109,306 and net earnings of ₱5,862,157. The increase in net earnings over the same period of 1911 was ₱833,995. The holdings of C. A. Hamilton in the San Juan Mining Co., owning the rich San Juan mine in the Taviche district of Oaxaca, were sold to L. R. Wiifley for ₱1,000,000, but recently a legal controversy has arisen over alleged nonconformity with the terms of payment. The San Juan has continued a heavy shipper of rich ore. Machinery for a complete 150-ton cyanide plant was bought by the Cubilete y Anexas Co. for its mines in Oaxaca.

The old Huicicila mines in Tepic were taken over by W. R. Ramsdell and associates, and the Miravalles Mining Co. organized. The reopening of the old mines is in progress. The Mexican Searchers, Ltd., has been steadily at work at the old San Jose de Ventanas mines in the Pinavete camp of Tepic, which are under option, and the purchase probably will be made soon. The Minas del Tajo, the Los Angeles concern operating the Tajo properties in the Rosario district of Sinaloa, has leased the adjoining Guadalupano mine and is working it. The Boleo Copper Co., of Lower California, has averaged over 2,000,000 lb. of copper monthly during the past year, and the total will not be much below 30,000,000 pounds.

Special Correspondence

BUTTE, MONTANA

WORK OF THE ANACONDA COMPANY.—PHOSPHATE DEPOSITS.—RADERSBURG NEWS.

The Pilot-Butte Mining Co. has found several feet of good copper ore in its shaft a few feet below the 1600-ft. level. The shaft is to be continued to the 1900-ft. level before any extensive lateral development is attempted. The ore was found in a northwest fault vein north of the Badger State mine, and angurs well for an extension of the copper zone into this territory. It is rumored that the Tuolumne Copper Co. will pay a dividend in January. The cross-cut on the 2000-ft. level has still about 200 ft. to go before reaching the vein, but earnings from recent ore shipments have been gradually increasing, and the company's treasury now contains about $200,000. The Krao Silver-Lead Mining Co., with property near Ainsworth, British Columbia, but largely owned by Butte stockholders, is considering reorganization. Henry J. Pierce, of Spokane, proposes to organize the Krao Mines, Ltd., and exchange old stock for new on an option basis extending for a year.

The State Mine Inspector's report for 1912 summarizes the operation of the Anaconda Copper Mining Co. as follows: Miners employed, 7339; surface men, 1699; miscellaneous employees, 3175; total 12,314. The mines operated during 1912 were the Anaconda, Mountain Consolidated, J. 1. C., Original, Pauline, Gagnon, Silver Bow, Tramway, Leonard, Badger State, Never Sweat, Belmont, Stewart, Parrot, West Gray Rock, Berkeley, Mountain View, West Colusa, Diamond, St. Lawrence, High Ore, Right Bower, Moonlight, Little Mina, Pennsylvania, and East Colusa. The following men are named as the operating force: C. F. Kelley, general manager; John Gillie, general superintendent; C. W. Goodale, B. H. Dunshee, and J. C. Adams, superintendents.

PART OF BUTTE.

Recent announcements show that the U. S. Geological Survey has been actively investigating the rock phosphate possibilities in Montana. The Government geologists claim to have made important finds in the following four places: (1) Beaverhead county, near Melrose; (2) Powell county, near Garrison; (3) Powell county, near Elliston; (4) Jefferson county, near Cardwell. The completion of the railroad from Anaconda is reviving Georgetown and its vicinity. The Southern Cross mine, owned by the Anaconda company, is erecting new surface buildings and preparing for the installation of a new compressor. Considerable building and other improvements are under way in Georgetown.

The Souvenir Gold Mining Co., in Lewis and Clark county, with property adjacent to the Whitlatch-Union at Unionville, is considering the sale of its property to Eastern capitalists. The North Star Mining Co. expects to erect a 50-ton concentrator on its property near Stemple. A 4-ft. vein of workable silver-copper ore has recently been developed.

The Ohio-Keating Gold Mining Co. has recently made a promising find on the 300-ft. level north in its Ohio mine at Radersburg. Details of the find have not been given out. Owners of the Robert E. Lee mine, at Radersburg, have brought suit against the Black Friday Gold Mining Co. to recover the value of ore claimed to have been unlawfully extracted from their property by the Black Friday company. The Rena mine is closed down, having been unable to handle a big flow of water developed in one of the drifts. The Butte & Radersburg Mining Co. is planning to resume operations. It is claimed that financial arrangements have been made for the completion of the railroad from Three Forks to Radersburg.

The Barnes-King cyanide mill at Kendall started on December 14, treating 100 tons of ore per day from the newly acquired Santiago orebody. The ore assays about $8 in gold per ton. The mill will run full capacity, 200 tons per day, as soon as the mine stopes have been opened up sufficiently to deliver that amount.

NEW YORK

COPPER OUTLOOK.—MARKET NOTES.—NEW ENTERPRISES.—AHMEEK AND MOHAWK.

The copper outlook for the coming year is the principal centre of interest in mining matters in the East. The deadlock which has existed between the copper producers and the manufacturers has shown some signs of giving way before the necessity of current business, and some very satisfactory and substantial orders for copper have been booked. The principal feature during 1912 was the possible amount of new copper which would have to be taken care of. A year ago estimates as to this item ranged around 200,000,000 lb., and, while the development in this direction has not been quite so rapid as was anticipated, all things considered this figure was not very far out of the way. December figures are not yet available, but the product can be reckoned within a small percentage, so that it is safe to say that the total output for the year will figure very close to 1,600,000,000 lb., an increase of nearly 145,000,000 lb. over 1911. Not all of this added output is by any means due to new properties. The Anaconda produced more than 30,000,000 lb. in excess of 1911 production; the Phelps-Dodge company averaged approximately 1,000,000 lb. per month above the figures of a year ago. Utah Copper and Nevada Consolidated can hardly be fairly compared with last year owing to labor disturbances, and similar comparisons would be out of place for the Granby and the British Columbia as these properties suffered enforced shut-downs.

As regards the copper surplus it stands somewhat above what it did one year ago, the increase being about 15,000,000 lb. as compared with the surplus at the close of 1911. Next year will see new copper possibly more of a problem than it was in 1912, some of the mines that were expected to become factors in production during the past 12 months having developed somewhat more slowly than was expected, but such developments have been wholly favorable and in order to maintain the balance between production and consumption there will have to be a reasonable increase in the latter if accumulation of surplus stock is to be avoided. This is especially true in view of the fact that there still remains as a hidden factor in the situation such copper as may be held up in the refinery yards.

The dividend resumptions and increases have come a little more slowly than might have been expected. Tennessee Copper Co. has declared a dividend of $1.50 per share, an increase of 50c. over the last disbursement, paid in August 1912. The Mohawk Mining Co. made a similar increase in its dividend and will pay $3 per share February 1, against $2.50 paid in mid-summer of last year. The Tuolumne Mining Co. has declared a dividend of 10c. per share as a quarterly payment, the first dividend which has been paid for a year or more, when 15c. per share was paid quarterly. The possibility of a resumption of dividends by the Granby is being used as market ammunition, and there is evidently some pressure on the part of some of the stockholders, who insist that it is unfair to ask that the holders forego all income while earnings are diverted to the equipment of the Hidden Creek property. The stub-

born attitude of the public in regard to the entire copper situation has been many times a matter of comment. In this regard it is interesting to note that 20 leading copper stocks have been shown during the recent slump a decline of 18.6% as compared with a drop of 7% for 20 active railroad stocks, and a drop of 9% for 12 active industrial issues. This attitude is somewhat more remarkable considering the progress made by Utah Copper, which in 1912 reached the 100,000,000 lb. mark and produced its copper at approximately 7.5c. per pound.

The United States Steel Corporation on December 30, 1912, bought 7,000,000 lb. of electrolytic copper for the bulk of which the producers' full price of 17.75c. for 30 days, delivered, was paid, although outside lots helping to make the total amount, were picked up at 17.62½c., 30 days, delivered. December deliveries of tin into U. S. consumption were large, amounting to 4050 tons, which exceeded all estimates. Total deliveries for 1912 were 49,500 tons, or 5200 tons over those of 1911. The total visible supply of tin (Europe and United States), December 31, 1912, was 10,977 tons, or 5537 tons less than the total visible December 31, 1911.

The Penn-Wyoming Copper Co. is about to go through another one of its periodical revolutions, the Federal court having just handed down a decree of foreclosure for the sum of $2,500,000, under deeds of trust given to the Continental & Commercial Trust & Savings Bank of Chicago. The various organizations and re-organizations of the Penn-Wyoming Copper Co. and its various subsidiaries, mergers, and absorptions form one of the undesirable chapters in the history of mining finance in America.

There are a few new enterprises being launched. The Bessie Gold Dredging Co. has been admitted to quotation privileges on the New York Curb. The Chile Copper Co. has been organized under the laws of the state of Maine with a capital of $20,000,000. Probably of more importance is a despatch to the effect that an Anglo-American Russian syndicate is about to undertake the development of a big placer gold property on the Patoum river in Siberia. The syndicate is said to be acting under the advice of John Hays Hammond, while an American engineer, W. E. Thorn, is to be in charge of operations. Despatches from Arizona to some of the larger shareholders in the East state that the drills on the South Live Oak property near Miami have cut a most encouraging body of porphyry ore, and the management is hoping to develop another big low-grade milling copper mine. The Tuolumne shareholders throughout the East are largely interested in Pilot Butte, the neighboring property to the Tuolumne, which is being developed under the same management, and are very much interested in the news of a recent find in the Pilot Butte of some 4 ft. of ore, carrying good copper and silver content. It is believed that the vein is the Berlin, from which vein the North Butte has taken some of its richest ore. No attempt is to be made at this time as to production, but the Pilot Butte shaft will be sunk some 300 ft. farther and another cross-cut driven to open a vein on that level.

The Boston market was somewhat exercised during holiday week by rumors of a consolidation of the Ahmeek and Mohawk. The Ahmeek has been very much in the limelight since its bitter fight against the Calumet & Hecla consolidation. The property is managed by Calumet & Hecla interests, but the big company does not hold control. The Mohawk is one of the Smith-Stanton properties and has just completed its most successful year. It is quite safe to say that the Ahmeek people who refused to be absorbed into the Calumet & Hecla would be equally strenuous in their opposition to a merger with the Mohawk, and it would undoubtedly be quite impossible to arrive at appraisals satisfactory to both companies so that a basis of exchange could be formed. Ahmeek is selling for approximately $330 per share, and as this figure makes the issue somewhat unwieldy for market purposes, it is intended to increase the capital stock from 50,000 to 100,000 shares. The Houghton Copper Co., which lies between the Isle Royale and the Section 16 mine of the Atlantic has been recently making some developments that border on the sensational. The Houghton is controlled by the St. Mary's Mineral Land Co., and on its present showing may be counted as one of the coming important producers of the Lake country.

The attitude of the Western mining man toward the somewhat aggravating condition of affairs in Mexico is shown by a letter just at hand from one of the leading figures in Colorado mining circles, who has representatives in nearly all of the important districts in Mexico. He writes: "As far as the Mexican situation is concerned, I am under the impression that the situation is about as bad as ever it was. If we had an aggressive President in the executive chair of this great United States, I think 10,000 cowboys with a first-class general in charge could sweep the whole country from Cape California to Vera Cruz."

BOSTON

CALUMET & HECLA IMPROVEMENTS.—EAST BUTTE.—SMELTER FUME LEGISLATION.—LAWSON'S ACTIVITIES.

Mild weather so far this winter in the Lake Superior region has been very welcome to the copper mining operators, as it has helped out where work has been hindered by labor shortage. Nearly all the mines have taken advantage of the mild weather to push operations, especially the Calumet & Hecla which has made additions to its surface equipment, enlarged the power plant, and built a re-grinding plant and electrolytic works. It is estimated that the re-grinding plant will treat tailing at a cost of about 6c. per pound of copper, including freight and expense of marketing. This will develop a big reserve for Calumet & Hecla and will greatly prolong the life of the property.

East Butte has been holding steady in the market, which is taken as the best evidence that it has its finances well in hand. On the first of the year the company retired $100,000 of the $500,000 notes which were issued a month earlier to meet the full payment for the Pittsmont property. The remaining four notes of $100,000 each mature February 1, March 1, April 1, and May 1 of this year. The company is at present earning over $125,000 per month, the earnings coming from the production from the Pittsmont mines and the revenue from custom smelting. The company has all the materials ready to increase the size of the two furnaces in its smelter 75%, which will give that plant a capacity of turning out around 20,000,000 lb. of copper annually. Making these additions will enforce the closing down of the furnace for 30 to 60 days, but the other furnace will continue work while reconstruction is in progress. The work will be completed during the spring and East Butte will have the advantage of increased capacity during the closing months of 1913.

Boston is greatly interested in the work which the Los Angeles Chamber of Mines and Oil has volunteered to assume in asking legislation looking to the settlement of the smelter fume troubles in the Shasta county, California district. The two Lawson companies, First National and Trinity, are most directly affected by the decree which forbids the operation of a smelter in that section. The Mammoth smelter of the United States Smelting, Refining & Mining Co. has also been affected in being required at heavy outlay to construct a bag-house which, while it has successfully met the difficulties, has materially cut down capacity. As these companies are native to Boston, the initiative of the Los Angeles body is being watched with great interest. Inasmuch as small fruit farm interests for as much as 30 to 40 miles around have been able to keep the First National mines and smelter, working 500 men and producing millions of value annually, closed down, it seems that some solution should be reached and an end placed to a vexatious situation.

T. W. Lawson in *Everybody's Magazine* explains his advertised stock operations, taking up Nevada-Utah first, calling it a closed book and disclaiming responsibility for it. Yet "Buy Nevada Now" headlines were prominent in Boston newspapers five years ago. He claims, of course, full credit for pointing the public to Chino, with its $40,000,000 of profit. But the point should be made also that had Chino (or Santa Rita) remained in the hands of Lawson and his crowd it would undoubtedly have been a much

longer time getting to production, if it ever reached it. Lawson's development and management of copper properties has been disappointing, though he has picked some winners, such as Chino.

TORONTO, CANADA

PROGRESS OF THE PORCUPINE STRIKE.—NEW MILLS.—LIFE EXTENSION OF THE COBALT DISTRICT.

Anticipations of a speedy termination of the Porcupine strike by an influx of strike-breakers from outside have been verified, and it is now apparent that the earlier reports to the effect that the backbone of the strike had been broken, and that the leading mines had all the labor they required, were altogether too optimistic. It is true that large numbers of men have been brought in, but the statement of the Western Federation of Miners that these are nearly all inexperienced men who, for some time at least, will be of little use in the mines appears to be substantially correct. The Dome management maintains its habitual policy of silence, beyond intimating that the full quota of men is now at work, but there is a significant absence of any official or other statements as to output. The monthly statement of the Hollinger frankly admits the difficulties under which operations are conducted owing to the lack of skilled labor. While the mill has been kept running, and is prepared at any time to resume crushing to its full capacity, the production has been limited to an amount sufficient to provide for the payment of dividends. The output for November was curtailed by nearly one-half, that month showing a profit from milling of $94,613. The provisional balance-sheet submitted showed a surplus on December 1 of $763,385, out of which the second dividend was payable. Allowing $83,000 for reinvestment in plant, the available balance in reserve for dividends was $339,752. The financial position at the end of the year is estimated at about the same. Allowing a somewhat smaller output for December than that of November, estimated at $125,000, the total gold production to date is in the neighborhood of $825,000.

The Pearl Lake shaft has nearly reached the 600-ft. level, at which a cross-cut will be driven to cut the rich vein found at the 400-ft. level. An order has been placed for a 30-stamp mill which it is hoped to have in operation early in the spring. The Rea mine has been leased to John Redington for five years, with option of renewal, for a payment of $6000 cash and 25% of the profits. Mr. Redington agrees to erect a 25-ton mill, which is to become the property of the company when the lease expires. A new company, to be known as the Mines Leasing & Development Co., is being organized to operate the mine, capitalized at $200,000. The 10-ton mill at the Hughes has been running on high-grade ore since the middle of December. The ore broken from the 156-ft. level, where the vein is 8 ft. wide, is reported to average $150 per ton. A large body of ore is being blocked out in preparation for the installation of a big mill next summer. Twenty tons of ore from the Tough property, in the Kirkland Lake district, stated to be very high grade, has been shipped for smelting. A previous consignment of two tons averaged $369 per ton.

The discoveries of the last few months pointing to the extension of the life of the Cobalt district with deep mining, and the announcement of some big dividends in January, have maintained an active market for Cobalt shares even during the usually dull holiday season. The Buffalo has declared its regular 5% dividend and 18% extra, and the McKinley-Darragh gives a bonus of 17% with its usual 3% dividend. The financial statement of the Beaver shows an available balance of $141,873 on December 1. The company is working in 2700-oz. ore on the 600-ft. level, and has cut a station and started cross-cutting at the 700-ft. level, where a strong vein 2 in. wide has been found. An addition which will increase the daily capacity of the mill to 100 tons will shortly be in operation. The Conlagas showed net profits for the year ended October 31 of $1,701,553, and had a balance on hand of $1,278,988. The silver shipments were 3,508,377 oz., which was mined and concentrated at 8.51c. per ounce. The ore reserves were conservatively estimated at 13,953,000 oz. The position of La Rose has been improved by development work during the year. Cross-cutting is being done to reach a vein yielding 2000-oz. ore, which comes into the property from the Right of Way at the 62-ft. level. No. 4 vein on the adit-level is showing ore on the face of the drift, and a promising new vein has been found on the north side of the Lawson shaft. Net profits for the year ended December 31 are estimated at approximately $1,000,000.

JOPLIN, MISSOURI

OPEN-PIT MINING.—PROTECTING MINES FROM FLOOD-WATERS.

Open-cut work is growing more common in the Joplin district, the high prices that have prevailed for zinc ores having made it possible to handle much leaner dirt than could be handled at a profit in former years. Improved milling conditions, thus making possible a better recovery of the contained mineral, likewise play a part in enabling operators to develop properties that had either been worked extensively and abandoned, or to go into virgin regions where the ore is thin. In the former case much open-cut mining has resulted, a common practice being to equip a property with large milling capacity and to handle an enormous tonnage of ore. It has been found possible to so treat, at a profit, ores carrying less than 1½% blende. A number of large open-cut mines are now being operated, one of the latest being that of the Minor-Heir Vantage Co., operated by the Sheridan-Adams Royalty Syndicate, in the sheet-ore district north of Webb City, Missouri. The ground was worked originally by gougers who sought only the shallow lead found a few feet beneath the surface. Development was carried to greater depths later, and eventually, as the result of high driving, the ground caved in, leaving a big open pit, more than 100 ft. in diameter and 130 ft. deep. In the sheer sides of this pit are exposed the door-like openings of the shallow drifts, near the surface, barely large enough to accommodate the body of a large man, while the high arched openings of the larger drifts are seen toward the bottom of the cave. At one time Center creek, which now flows several hundred yards to the north, passed over this land, leaving a stratum of gravel in which free galena is found. On top of the gravel is a layer of 'made' ground, representing the accumulation from an old concentrating plant formerly operating on the lease. The Minor-Heir company has increased the capacity of the mill, run an inclined tramway into the pit, purchased a steam-shovel, and is now caving all the dirt from the surface to the bottom of the pit, the entire volume thus procured being milled.

A concrete collar, constructed around the opening of the shaft of the Yellow Jacket mine, northwest of Joplin, and extending 6 ft. above the ground, protects the mine workings from flood-waters from Spring river and Center creek, two streams which flow nearby and which frequently overflow their banks. The mine, operated by O. W. Sparks, of Galena, Kansas, is situated in the low flat river bottoms, and as a rule this part of the country is inundated in the spring of the year. Mines in the one-time rich Badger-Peacock district, a short distance to the north, formerly suffered greatly from the flood-waters. The new district which is just being opened is similarly situated, and Mr. Sparks has taken this method of protecting his property. Development at the Yellow Jacket mine, which showed an extensive body of high-grade zinc, caused an extension of the zone of prospecting to the south, and as a result new discoveries were made which resulted in the building of a second and larger mill by the same company, the new plant being known as the Yellow Pup, while across Spring river, to the west, the Lynas Mining Co. is constructing a large concentrating plant. The ore occurs in large bodies in all the mines mentioned, while the concentrate averages higher than 60% zinc. Picking out waste rock from the ore after having passed through the grizzly and before going to the shaking screen has been practised at the Schoenherr-Walton mine, north of Webb City, and gives an increased milling capacity.

General Mining News

ALASKA

Cordova

A proposal was recently submitted to the Cordova Chamber of Commerce in which a company offered to erect a 50-ton daily capacity oil-blast copper smelter in the town, provided the local business men furnish 10 acres of land on the waterfront with good dock facilities, not too far from the railroad, supply the buildings for the plant, to cost $15,000, and furnish up to $50,000 cash. The stock of the Copper Reduction Co., capital $200,000, was to be given at par for the full amount of cash provided and the cost of the buildings erected. Cordova decided that some other town should be permitted to supply the above necessaries.

Fairbanks

On December 9, J. Letterman sold to Ronan & Cunningham a half interest in what is known as the Spalding property, on Lane creek, for $30,000. This also included the 3-stamp mill which was destroyed on the previous day, and other small interests.

Juneau

During November the Ready Bullion and 700-Ft. Claim mills crushed 36,773 tons of ore, yielding $45,629 by amalgamation, and $44,478 from cyanide treatment of 983 tons of concentrate. The estimated net profit was $40,752. Development covered 349 and 109 ft., and the stock of broken ore decreased 1880 and increased 4239 tons, respectively. The Alaska Mexican 120-stamp mill crushed 18,564 tons, yielding $17,801 from free gold and $19,944 from 401 tons of concentrate. The net profit is estimated as $11,922. Development covered 327 ft., and the stock of broken ore increased 2327 tons.

ARIZONA

All producing mining companies in Arizona have been notified by the State Tax Commission to present reports showing their net and gross production for 1912. The figures are to be submitted as soon after the first of the year as possible. No details are required. The Commissioners merely want to know what each mine produced and what that production netted after the costs of mining, transportation, and treatment had been paid.

Gila County

From the Inspiration mine about 20,000 tons of ore per month is being saved during development and is put on the stock pile until the mill is ready. Good progress is being made with the construction of the Arizona & Eastern railroad from the Miami to the Live Oak terminal. The Inspiration Consolidated has made a contract with the Reclamation Service for surplus power at the Roosevelt dam which assures the company the cheapest power of any mine in the Southwest. At the site for the concentrating plant, a steam-shovel is now working, and 250,000 cu. yd. of ground will have to be moved.

Mohave County

(Special Correspondence.)—The United States Smelting, Rfg. & Min. Co., owner of the Gold Road mine, will be the first corporation in northern Arizona to obey the new semi-monthly pay-day law, which goes into effect at the Gold Road property in January. This mine employs 200 men and is producing from $70,000 to $80,000 per month. The Gold Road has a body of pay-ore 3000 ft. long, and ore is still being mined in the 700-ft. level, driving east. The output of the Tom Reed for December is estimated at $125,000, the dividend disbursement for the month being 7%, or about $65,000. The largest production for any one month was October, when the total was $132,145. With a production for 1912 of nearly $1,100,000, the Tom Reed at the present time is the premier gold property of Arizona. The reported find in the Olla Oatman west 450-ft. drift, at a distance of 400 ft. from the shaft, is confirmed in so far as having a large body of low-grade ore, not, however, up to the standard value of the average ore of the mine. Additional depth is needed on this new orebody, which may eventually be larger than the three ore-shoots now being mined.

The Vivian Mining Co., and the Boundary Cone M. & M. Co., operating extensively in the Tom Reed area, have ore in and below the older andesite contrary to the opinions of probabilities given by F. C. Schrader in his report of the U. S. Geological survey, Bulletin 340-A. The Vivian company, owner of the Leland-Mitchell, has sunk to a depth of 390 ft., the vein being a contact between the newer and older andesites. A new plant has been erected and two Fairbanks-Morse 40-hp. oil-burning engines placed in commission. Sinking will be resumed about January 1 to 600-ft. depth. Harold Banning, of Los Angeles, Mr. Ross, and other capitalists of southern California are backing the new development. The Boundary Cone company passed into the older andesite at 200 ft. At 450 ft. the richest ore in the camp was found in a 14-ft. winze, after driving a short distance east of the shaft. The bottom of the winze shows a 2-ft. vein returning 12.75 oz. gold, and the average of 6 ft. is $67.90. This company is down 510 ft., and at 550 ft. will cross-cut to the vein. The principal owners of this property are prominent mining men of Los Angeles and vicinity, and their work justifies the opinion of W. H. Weed, in his article of June 1910, upon the Tom Reed district, that pay-ore in the lower and older andesites is not only possible, but certain with properly planned development. Many new properties are being started, and the year 1912 has been the most prosperous period of the goldfields of Mohave county.

Oatman, December 26.

Pinal County

In the Superior district of this county the Magma Copper Co. is shipping 100 tons of high-grade copper ore per week to the El Paso smelter. The ore is a chalcocite and bornite, containing gold and silver. Fifty men are employed, and the power-plant is finished. This property was originally called the Silver Queen, being first opened in 1874. The Gunn-Thompson company secured control about two years ago and has been successful in opening rich ore on the 650 and 800-ft. levels. The Calumet & Arizona, situated 3½ miles southeast from Superior, has 80 men at work. A 3-compartment shaft is down to 75-ft. depth, and a good head-frame is being erected. The Guggenheim Exploration Co. has a few men at the Black Diamond mine. The ore occurrs in heavily mineralized iron-manganese gossan.

Santa Cruz County

It is stated that a good offer has been made for the Ramsdale properties, situated between Harshaw and Duquesne. They contain large quantities of low-grade copper ore. T. B. Anderson, of Tucson, representing the United States Smelting, Refining & Mining Co., is visiting Patagonia and examining mining properties. This company held an option on the R. R. R. mine, but allowed it to lapse.

Yavapai County

The property of the Harris Copper Co., on the Agua Fria river, 50 miles north of Phoenix, in the Tip Top mining district, consists of 550 acres and a water-right. About 800 ft. of development has been done, and in the Casadilla claim 1000 tons of copper ore, worth $15 per ton, has been opened. Hand drills have been used so far, but it is intended to sink a shaft, cross-cut, and erect machinery to cost $11,000.

The syndicate which recently acquired the United Verde Extension mine has also taken a bond on the Jerome Verde, and the two options will run together, on the same conditions. If these properties prove worth buying, this syndicate will go in for extensive development and plant. A large vein carrying copper and gold has been opened on the Ratcliff claims. The Puntenney lime quarries are employing 100 men and producing a high-grade lime from the kilns. From the old United States mine in Copper

basin a carload of lead-zinc ore is being shipped. The Senator adit is about 3200 ft. long, and at 3000 ft. in, a drift is being driven on the Cashier vein.

CALIFORNIA

Amador County

It was recently decided by those owning a majority of the stock of the Lincoln Consolidated company to close it down, notwithstanding that the minority holders were willing to go ahead with prospecting. The trouble is in connection with assessments on stock and that certain holders had reserved non-assessable stock. All kinds of rumors are afloat regarding the company, which is headed by W. J. McGee, and nothing is definite as to future plans, although it is stated that the owners have tried to sell the property for some time past. The *Amador Record* of January 2 gives details of the present state of the property.

Calaveras County

It is stated that the smelter at the Calaveras property, at Copperopolis, was to have been blown in early in January. Over 400,000 gal. of oil is now stored in tanks near the smelter, which will ensure a full fuel supply during the rainy season, the daily consumption being 4000 gal. The concentrating plant is treating 100 tons of ore per day, although its capacity is 600 tons, but the Kennett smelter does not receive concentrate, so this is being stored. Over 150 men are employed, and two shifts are working underground in breaking ore for the Kennett smelter. In December about 30 cars were shipped, the average net value per car being $1000.

Inyo County

During November the mill at the Skidoo mine treated 1096 tons of ore, yielding bullion worth $13,562. Operating costs were $5042, and development $1748, leaving a profit of $6772.

Plumas County

(Special Correspondence.)—Copper-bearing ore is being developed in the Five Bears mine, Genesee district. The main lode ranges from 14 to 20 ft. wide and has been proved to a depth of 900 ft. The company is using electric concentrators, and is preparing to send three cars of concrete per month to custom smelters. The property is credited with a gold output exceeding $20,000 from the surface deposits. Allison & Bluett, of Los Angeles, are working the property under lease and bond. Los Angeles people, headed by Thomas J. Steel, have merged the scattered holdings in the Copper Mountain district into one company. It is planned to drive a cross-cut adit to open the veins at an approximate depth of 1500 ft. Work will commence in the spring. The Engels Copper Co. is reported to have a large reserve of ore blocked out. A small smelter has been erected at Light's canyon. Walker Bros., of Salt Lake City, are actively developing the Walker copper mine. The vein is said to be over 30 ft. wide. The property lies four miles southeast of the Five Bears group. Several other companies are active in the Genesee district, and indications point to a busy season in 1913.

Greenville, December 26.

The Genesee district is well watered by the Indian, Clover, Ward, and Little Grizzly creeks, which are capable of furnishing a total of 3000 to 4000 hp. for mining purposes. The Genesee mine, on Ward's creek, has produced $800,000 in gold from 100-ft. depth.

Sierra County

At the Tightner mine a winze will be sunk about 1000 ft. deep before any lateral development is started. P. Rohrig and Wright Bros. have taken a lease on the gravel section of the Red Star mine, and are preparing to cut the lead from the Cumberland adit. H. J. Langdon has assumed the management of the Sixteen to One mine, and shaft-sinking has been started. The old Arcade property, on Lafayette ridge, which was formerly worked as a gravel mine, has been leased to two Goldfield men.

Shasta County

Seventy mining claim notices were filed on January 1 with the County Recorder. In the Jawbone district 42 claims were located, this being property abandoned by the Kennett Con. Copper Company.

The Railroad Commission has directed that the rate of $11 per short ton of blister copper worth $300 per ton from Kennett to San Francisco by the Southern Pacific Co. is unjust, and reduced it to $6.90 on copper worth $400 per ton.

When driving a tunnel for water-supply near the Big Bend of Pit river, the Northern California Power Co. cut an 8-in. seam of good bituminous coal at 290-ft. depth. This is the first coal found in the district. The seam has been followed 22 ft. and is proving thicker as work progresses. The coal is used in the blacksmith-shop and gives satisfaction.

Tuolumne County

(Special Correspondence.)—Pasadena capitalists have taken a bond on the Omega mine and will visit the property shortly to arrange for its extensive development. It is understood that $50,000 will be expended in exploration. A complete equipment is on the property, including a 20-stamp mill. A 10-stamp mill is being erected at the Atlas mine, near Tuttletown, and the erection of a new hoist and other contemplated structural improvements will soon be under way. John L. Witney is superintendent, and has directed the development of the property ever since work was commenced by the present operators, two or more years ago. The Harvard, near Jamestown, which has been operated continuously for a number of years, holds out promise of producing steadily for a long time to come. About 75 men are at present employed, and the 60-stamp mill is in operation full time. A modern residence for H. W. Gould, the superintendent, is in course of erection at the property. The Gold Ship gravel mine, near Groveland, is being unwatered preparatory to resumption of operations, which ceased a few months ago, owing to the temporary shut-down of the electric plant supplying the power. Gravel was uncovered in the face of the main drift just prior to the recent suspension of operations. It is reported that work may soon be resumed at the Crystalline mine. The Mexican mine, northeast of Jamestown, from which early-day miners took out much gold, has been purchased by H. Cavil, who intends to reopen and develop the property. The Hardtack and Hunter mines, situated a few miles southeast of Tuolumne, and owned by W. T. Carter, are being unwatered for inspection by prospective buyers. Development of the Mangante mine, near Jamestown, is progressing steadily. It is reported that the working force will be increased after a few more weeks of work sinking the shaft. It is reported that a small vein, rich with free gold, has been uncovered in a cross-cut at the Driesam mine, at Arastraville. The 2-stamp mill at the Morning Glory mine, near Confidence, has been started. A drift is being driven from the bottom of the shaft, 100 ft. deep, where the vein is 3 ft. wide. An interest in the property has been purchased by E. W. Burley from Bingham and Layman.

Sonora, December 29.

COLORADO

Clear Creek County

The main cross-cut at the Bard Creek mine is being driven steadily and is in 1100 ft., and within 100 ft. the main lode is expected to be cut. Lessees at the La Plata mine, Democrat mountain, have broken into workings from the Silver Glance shaft. They have been mining ore from a small vein which is yielding 240 oz. of silver per ton. A good year is expected from the Capital mine, and lessees are all doing well.

Shipments of ores by the Colorado & Southern railroad from Black Hawk during the past year were 52,550 tons, to which should be added those sent from mines of Russell gulch through the Newhouse tunnel, and over the Moffat road from the northern portion of the country, making 84,350 tons, as against 76,745 tons in 1911. This

does not include the large tonnage treated in the local stamp-mills. The concentrating plant of the Frontenac-Aduddell syndicate has been in constant operation and treated about 150 tons per day, the ratio of concentration being 4 to 1. The Iron City mill has been busy with custom work. The old Hidden Treasure mill, at Black Hawk, has been purchased by Eastern capitalists, who are overhauling it for custom ore. The U. P. R. and Polar Star mills have had a busy year, and gave satisfactory results. The new shaft of the Square Deal company is down 650 ft., and shipments in December yielded high returns in gold, silver, and copper.

Lake County (Leadville)

Everything points to the past year being a record one for this county, while for the current year it is expected that the downtown section will be unwatered, also that of upper Fryer hill, and several large properties on Carbonate hill. The adit being driven by the Sugar Loaf Consolidated company is now in 4500 ft. The breast is heading northwest, and at this point work is being done on the Emmett claims, and 200 tons of ore per month, averaging 50 oz. of silver and 7% lead, is being shipped.

Mineral County

Fire broke out in the Nelson adit of the Happy Thought mine on December 24, and in order to save the lives of 40 men, rescue parties had to remove 50 tons of ore from an abandoned shaft. They met great difficulties, but all the men were saved.

Teller County (Cripple Creek)

Production of this district for December was as follows:

	Tons.	Av. Val.	Total. Val.
Golden Cycle	31,000	$20.00	$ 620,000
Portland	10,000	22.00	220,000
Smelters	4,000	65.00	260,000
Portland (Victor)	15,000	3.00	45,000
Stratton's Independence	10,000	3.00	30,000
Ajax	3,000	3.25	9,750
Blue Flag	1,000	5.50	5,500
Dante	1,500	3.00	4,500
Wild Horse	1,000	3.80	3,800
Jo Dandy	1,700	2.00	3,400
Isabella	1,000	1.50	1,500
Total	79,200	$15.20	$1,203,450

The Elkton M. & M. Co. produced 2400 tons, averaging $19 per ton. In its interesting special issue of January 1, the Cripple Creek *Times* publishes a great deal of valuable information regarding the district from which the following data are abstracted.

Production by mills in 1912:

	Tons.	Value.
Golden Cycle	381,450	$ 7,663,100
Portland (Colorado City)	119,169	2,617,518
Smelters	46,379	2,989,935
Local plants	350,453	1,086,188
Total	897,451	$14,356,741
Deducted for concentrate re-treated		350,000
Actual production		$14,006,741
Average value of all ore treated		$16.00

Total production to date is $310,354,227.

Output of local mills in 1912:

	Tons.	Av. Val.	Total. Val.
Portland (Victor)	173,079	$ 3.17	$ 548,947
Stratton's Independence	117,429	3.04	356,739
Colburn (Ajax	16,445	3.38	55,527
Kavanaugh (Jo Dandy)	14,450	2.28	33,060
Wild Horse	12,200	3.51	42,860
Gaylord (Dante)	6,400	3.31	21,180
Isabella	5,750	1.45	8,325
Blue Flag	4,700	4.16	19,550
Total	350,453	$ 3.10	$1,086,188

Due largely to the construction of the Golden Cycle mill at Colorado Springs, which handles 75% of the ore shipped from Cripple Creek, the operator and lessee gets a high return from his ore.

Dividends paid during the year were as under:

Cresson Con. G. M. & M. Co. (est.)	$ 500,000
Golden Cycle Mining Co	360,000
Portland G. M. Co	240,000
Vindicator Con. G. M. Co	180,000
Strong G. M. Co. (est.)	150,000
El Paso Con. G. M. Co	123,500
Stratton's Independence, Ltd	120,000
Elkton Con. M. & M. Co	112,500
Mary McKinney M. Co	78,555
Aurarla G. M. Co. and other owners Forest Queen	35,000
Stratton's C. C. M. & D. Co	25,000
Jerry Johnson M. Co	24,979
Gold Dollar Con. G. M. Co	17,500
Little Bessie G. M. Co. (from sale of property)	16,625
Granite Gold Mining Co	16,500
Gold King Mining Co	15,000
Acacia G. M. Co	14,390
Blue Bird G. M. & M. Co	10,000
Maggie Gold Mining Co	9,000
Gold Sovereign M. & T. Co	5,000
	$2,053,549
Lessees' profits (est.)	450,000
Total	$2,503,549

These figures include the dividends of close corporations,

PORTLAND MINE AT CRIPPLE CREEK.

closely estimated; also lessees' profits, as to which the credited total is conservative. The total to date is now $38,128,584.

Hoisting ore has been started at the Nichols shaft of the El Paso mine, which is the new shaft sunk at the east end of the property. Because of the quantity of water flowing through the 1000-ft. level, it will be impossible to clear the shaft below that point of the waste which was left in it after the shaft was raised.

IDAHO

Shoshone County

Over 16 inches of snow fell during the past week, and slides are feared in the Coeur d'Alene. On January 4 the Bunker Hill & Sullivan company paid dividend No. 184, amounting to $65,000, making a total of $13,977,150 to date. The Highland-Surprise Mining Co. has let another contract for driving the adit a further 200 ft. At 3000 ft. from the portal, a 5-ft. vein was cut in the Highland Chief claim. The Palisades company has suspended work for the winter, owing to there being 5 ft. of snow in the district. An adit 3500 ft. long is to be driven when supplies can be obtained next spring. At the Alice mine the 600-ft. level is almost unwatered. About 30 men are employed at present. The Federal Mining & Smelting Co. declared a dividend of $180,000 on December 14, the total for 1912 being $720,000, and $7,361,000 to date. It is stated that the Star mine, adjoining the Morning, has been acquired by the Federal company for $750,000.

MICHIGAN

HOUGHTON COUNTY

The Ahmeek company will send an experimental shipment of mohawkite ore to the Dollar Bay smelter, where a furnace is being specially constructed to treat this ore. It has never been smelted in the Lake Superior region before, but satisfactory results are expected. The Ahmeek mine can supply a large tonnage of mohawkite which carries a high percentage of arsenic. When first found it was treated at a smelter in New Jersey, but freight consumed most of the profit.

MISSOURI

JASPER COUNTY

The mineral output from the Joplin district for the year 1912 was valued at $18,149,777, being about $5,000,000 greater than 1911, and was due to the heavy production of zinc ores. The following is a detailed statement of production.

	Missouri.	Kansas.	Oklahoma.	Total.
Blende, lb.	494,430,190	45,119,460	21,054,084	560,603,734
Calamine, lb.	39,382,840	225,040	4,260	39,612,140
Lead, lb.	78,011,390	6,598,570	7,992,240	92,612,300
Value	$15,021,415	$586,113	$2,542,249	$18,149,777

An idea of the present effort to prospect the district may be gained from the fact that one operator has 30 separate rigs in operation.

MONTANA

LEWIS AND CLARK COUNTY

Development at the North Moccasin property of the Barnes-King company has exceeded expectations, and the Santiago orebody has been opened through the old Barnes-King workings. At the Piegan-Gloster property the Ophir adit has been driven on the vein and has produced some low-grade ore, but before the end of January the adit should cut the vein which has been opened in the Piegan district, 125 ft. above. The latest report states that it is 6 ft. wide and payable. On December 14 the Barnes-King mill was started, and is treating 100 tons per day, but will be brought up to its 200-ton capacity as soon as the mine stopes are ready. Assays so far return $7.60 to $8.80 per ton. It is not expected that the orebody will average as high as this, as the average of 25,000 tons mined by the former management was $5.60 per ton.

NEVADA

ESMERALDA COUNTY

On the 1300-ft. level, and below this point, in the Grizzly Bear workings of the Goldfield Consolidated, ore containing silver and copper has been opened. This is not amenable to ordinary treatment, and the matter is under discussion. For some time past, certain ore has been shipped to the Tooele smelter in Utah. Apart from the condition of the Consolidated mines, the current year is expected to be satisfactory at the other mines in the Goldfield district.

LYON COUNTY

Steam-shovels are to be used at the Mason Valley mine and preparations are being made for them. It is believed that when the capping of the orebodies is removed, the ore can be mined for a considerable depth by this method. The McConnell mines have given up using the auto truck, as it cost $100 per week for tires alone. The truck was a 50-ton automatic dumping type. The Nevada-Douglas Copper Co. produced about 11,000,000 lb. of copper in 1912.

NYE COUNTY

Competition in milling at Manhattan has resulted in a reduction in charges on custom ores, which makes it possible to have low-grade ore treated at a profit. There are three 50-ton custom mills in the market for ore, and rates at present are from $3.75 to $4.50 per ton for hauling and treatment, against $10 to $12 per ton charged over two years ago, with only one mill at work. During 1912 the following was the production of Manhattan as compiled by the Manhattan *Post:*

	Tons.	Value.
War Eagle	10,800	$196,109
Associated	9,825	158,000
Priest (Poak lease)	4,500	55,000
Manhattan M. & O. Co.	2,140	19,122
Total from ore treated	27,265	$428,231
Output of placers		200,000
Total from all sources		$628,231

With the starting of the Big Four mill in a short time, the current year will show a much greater output and rapid progress is expected.

The Tonopah *Miner*, with its usual promptness, publishes

TONOPAH.

the output of the Tonopah district for the past year as follows:

	1911. Tons.	1911. Value.	1912. Tons.	1912. Value.
Tonopah Mining	173,600	$3,572,000	173,809	$ 3,215,460
Belmont	114,500	3,091,500	123,847	3,149,580
Tonopah Ex.	51,000	663,000	53,201	731,513
Montana	52,500	761,250	51,875	1,023,500
West End	13,350	318,750	41,081	824,820
MacNamara	1,000	27,250	20,195	252,437
Midway	2,100	52,500	1,001	46,792
North Star	....	.....	500	19,375
Jim Butler	....	.....	6,088	133,900
Tonopah Merger	....	.....	1,485	33,005
Mizpah Ex.	....	.....	30	1,221
Total	408,140	$8,486,250	473,112	$ 9,431,603
Increase	....	.....	64,972	945,353
Total to date				58,144,490

Dividends:

	1911.	1912.	Increase.
Tonopah Mining	$1,600,000	$1,600,000	.....
Tonopah Belmont	1,350,000	1,500,000	$150,000
Montana Tonopah	110,623	199,786	89,163
Tonopah Extension	.....	47,500	47,500
Total	$3,060,623	$3,347,286	$286,663
Total to date		$15,503,559	

Dividends to be paid in January amount to $798,750 and will swell the total.

UTAH

Dividends paid by Utah mines in 1912 were: Bingham-New Haven, $68,607; Cliff, $30,000; Colorado, $90,000; Consolidated Mercur, $30,000; Daly-Judge, $225,000; Daly West, $216,000; Gemini, $30,000; Gold Chain, $70,000; Grand Central, $50,000; Iron Blossom, $370,000; Mammoth, $60,000; Opohonga, $57,396; Silver King, $312,500; Utah Copper, $4,933,282; Utah Consolidated, $450,000; and United States Smelting, $2,490,926.

SALT LAKE COUNTY

During the past year the mines at Bingham produced 6,650,345 tons of copper ore, and only for the miners' strike the total would have been over 7,000,000 tons. The total tonnage to date is 27,016,998 tons.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

A. K. Beatson is in San Francisco.

F. L. Sizer has returned to Arizona.

C. S. Herzig is in Western Australia.

C. F. Spaulding is here from Denver.

J. W. Abbott was here during the week.

Z. Cushing has returned from Honolulu.

F. B. Weeks has gone to Shasta county.

Edmund Juessen is in southern California.

C. T. Durell was in San Francisco this week.

P. B. McDonald is now at Gouverneur, New York.

Ralph Arnold was in San Francisco New Year's day.

William A. Paine has gone to Bermuda for a few weeks.

George H. Garrey has returned to New York from Arizona.

C. B. Lakenan was married recently to Mrs. Floribel White.

Harry R. Johnson has returned from London to Los Angeles.

H. F. M. Crookshanks has gone to Oaxaca on professional business.

M. P. O'Brien is at the Nonesuch mine, Ontonagon county, Michigan.

A. J. Robin has taken over the business of Herr & Herbert, at Durango.

M. K. Shaler is visiting Italy, but will be in Brussels for the next year.

E. J. Collins has returned to Duluth from professional work in Colorado.

F. G. Lasier, of Detroit, will be in the Cripple Creek district during January.

Desaix B. Myers is returning to Los Angeles from Butte, stopping at Nelson, Nevada.

Brayton P. Campbell is now superintendent for the Potrero Mining Co., Mocorito, Sinaloa.

H. C. Hoover has gone to London, expecting to return to San Francisco in three or four months.

H. P. Gordon has returned to Oakland after a year spent in hydraulic mining in eastern Canada.

W. T. Perkins has been elected chairman of the Alaska bureau of the Seattle Chamber of Commerce.

Henry E. Wood is visiting Pittsburg, New York, and Boston, returning to Denver about January 20.

A. L. Wilcox is in charge of the hydro-electric power development at Oroya, Peru, for the Cerro de Pasco Mining Company.

Myron L. Fuller has completed an investigation of the water resources of the Livermore valley for the city of San Francisco.

Howland Bancroft is engaged in examination work in western Nevada and expects to return to Denver at the end of the month.

Robert E. Cranston sailed from New York on December 28 for Brazil. His address there will be Caixa Postal 834, Rio de Janiero.

Robeat Scott is at Beatty, Nevada, where he is building a quicksilver plant for the Telluride Consolidated Gold Mines, Limited.

Kosaku Asano, metallurgist for the Ashio smelter, who is visiting metallurgical plants in America, was in San Francisco during the week.

Teisaburo Hori, formerly general manager of the Ikuno mine of the Mitsu Bishi company, has been at Goldfield and has gone to Salt Lake City.

Market Reports

LOCAL METAL PRICES

San Francisco January 9.

Antimony	12—12½c	Quicksilver (flask)	.40
Electrolytic Copper	18—18½c	Tin	.52—53½c
Pig Lead	4.60—5.55c	Spelter	.8½—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, January 9.—Copper is somewhat easier due to weaker European market. As to lead, sellers having withdrawn, the market is somewhat better. Spelter remains unchanged. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are giving below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 2	17.45	4.18	7.08	63½
" 3	17.45	4.18	7.08	63½
" 4	17.45	4.18	7.08	63⅝
" 5	Sunday.	No market.		
" 6	17.40	4.18	7.08	63⅝
" 7	17.40	4.18	7.08	63⅝
" 8	17.40	4.18	7.08	63½

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	January 9.
Camp Bird Ltd	£0 5½
El Oro	4½
Esperanza	9½
Oroville Dredging	1⅝
Santa Gertrudis	7½
Tomboy	6¾

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices, January 9.		Closing Prices January 9.
Adventure	$ 5½	Mohawk	$ 63
Allouez	40	North Butte	3⅜
Calumet & Arizona	70	Old Dominion	53
Calumet & Hecla	520	Osceola	102
Centennial	17½	Quincy	76
Copper Range	49½	Shannon	13
Daly West	3½	Superior & Boston	2½
Franklin	8¾	Tamarack	35
Granby	69½	Trinity	5¼
Greene Cananea, ctf.	9	Utah Con	10⅝
Isle-Royale	32	Victoria	1¾
La Salle	5	Winona	3½
Mass Copper	5	Wolverine	71¾

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 9.

Atlanta	$ .19	Montana-Tonopah	$1.90
Belmont	8.25	Nevada Hills	1.47
Big Four	.77	North Star	.18
Buckhorn	.75	Ophir	.14
Con. Virginia	.22	Pittsburg Silver Peak	.75
Crown Point	.20	Round Mountain	.25
Florence	.53	Sierra Nevada	.17
Goldfield Con.	2.00	Tonopah Extension	2.46
Halifax	1.22	Tonopah Merger	.87
Jim Butler	.65	Tonopah of Nevada	6.25
Jumbo Extension	.33	Union	.22
MacNamara	.22	Vernal	.07
Mexican	.98	West End	1.35
Midway	.32	Yellow Jacket	.21

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. January 9.		Closing Prices. January 9
Alaska Mexican	$ 13½	McKinley-Darragh	$ 1½
Alaska Treadwell	43	Miami Copper	26
Alaska United	23½	Mines Co. of America	3½
Amalgamated Copper	78⅝	Nevada Con	19⅜
A. S. & R. Co	73½	Nipissing	9
Braden Copper	10½	Ohio Copper	1½
B. C. Copper Co	4½	Ray Con	21⅜
Chino	46⅝	Tenn. Copper	37¾
First National	2½	Tonopah Belmont	8½
Giroux	3¾	Tonopah Ex	2½
Goldfield Con	2	Tonopah Mining	6½
Greene-Cananea	9½	Trinity	6½
Hollinger	15½	Tuolumne Copper	3½
Inspiration	19	Utah Copper	57¾
Kerr Lake	2¾	West End	1⅜
La Rose	2¾	Yukon Gold	3
Mason Valley	10½		

New York Metal Prices, December, 1912

In the course of December spelter dropped from 7.50c. New York to 7.30c. per lb., and at the latter price was weak. The market was dull during the entire month, and the decline started in early. In view of the dullness it is considered that the prices of spelter have held very well indeed. About the middle of the month a few cars of good brass mill spelter were sold at a price approximating that of prime western, the producers preferring to sell at what seemed a sacrifice rather than carry the metal over 1913. The prices in the closing days of the month were 7.30c. N. Y. and 7.15c. E. St. Louis, and these prices subject to shading.

The price of lead was cut again on December 3 from 4.50c. to 4.35c. lb. by the American S. & R. Co. Outside sellers met the cut and offered lead at 4.35c. N. Y. and 4.22½c. E. St. Louis. The market continues weak and three reasons are given for the situation—light demand, sharp competition, and fear of tariff changes. A development of importance to the trade and to all concerned is an organization formed by lead consumers who propose to secure, if possible, a lower tariff on pig lead and other metals. Those active in the new organization are working quietly but energetically to interest other consumers. Just before Christmas it was evident that consumers were taking a greater interest in lead, but their inquiries had not developed into any substantial buying. On December 24 prices were 4.27½c. per lb. N. Y. and 4.12½c. E. St. Louis, these prices of course, being quoted by 'outsiders.'

In December the tin market was featureless at first, and the activity exhibited was of the spasmodic kind. About December 12 a more or less steady buying set in and while good, it was curtailed by the high prices. December 17 tin sales were made at 50c. per lb., on December 23 at 50.25c., and December 24 at 50.15c., despite the fact that consumers do not take kindly to the 50c. level. The lowest price of the month was 49.25c. per lb., which ruled on several days. The latter part of the month there was something of a shortage of spot tin which in part caused the high prices, but the arrival of steamers in the early part of January will bring the pinch to an end. December 27, arrivals were 3549 tons, with about 200 more tons to be landed in the month. On that day there was afloat 1096 tons.

Record Year in Zinc

The valuation of zinc and lead ores from the Missouri-Kansas-Oklahoma area for 1912 is $18,043,379, or more than $2,500,000 greater than the record of 1907. High prices for zincblende, which at times brought as much as $67 per ton on an assay basis of $64 for grades carrying 60% metallic zinc, were responsible for the good showing. Almost every district in the area showed a big increase over the previous year and several new districts made their appearance. Prices for calamine were exceptionally high throughout the year. Lead was the only ore to be in weak demand. Prices were low and as a result shipments were lighter than might otherwise have been expected. The new year dawned with conditions more auspicious than they have ever been at the opening of a year. The above table shows the production, in pounds, of blende, calamine, and lead, from the various districts of the area, together with the valuations.

PRODUCTION OF LEAD AND ZINC ORES, MISSOURI-KANSAS-OKLAHOMA.

Districts	Blende		Calamine		Lead		
	Lb.	Value.	Lb.	Value.	Lb.	Value.	Total Value.
Webb City-Carterville, Mo.	214,534,546	$ 5,709,852	163,400	$ 2,888	50,695,456	$1,451,620	$ 7,164,360
Joplin, Mo.	136,976,746	3,587,532	4,874,360	80,605	10,952,941	310,477	3,978,614
Duenweg, Mo.	40,490,256	1,114,533	3,174,240	47,455	5,649,630	160,752	1,322,740
Galena, Kan.	42,526,264	1,078,005	125,120	1,960	6,577,990	183,193	1,263,158
Alba-Neck City-Purcell, Mo.	34,150,820	922,756	.....	.....	1,185,690	33,150	955,906
Miami, Okla	18,679,301	430,508	.....	.....	7,723,370	207,738	638,246
Oronogo, Mo.	21,812,320	491,741	.....	.....	3,216,820	89,452	581,193
Granby, Mo.	6,227,400	146,582	19,079,145	321,156	761,940	19,864	487,602
Carl Junction, Mo.	14,768,970	395,006	.....	.....	625,370	18,348	413,354
Cave Springs, Mo.	11,834,110	312,344	.....	.....	625,370	18,348	330,692
Spring City-Spurgeon-Saginaw, Mo.	5,600,380	141,149	3,585,660	54,535	2,345,034	65,977	261,661
Carthage, Mo.	5,733,780	141,081	61,750	1,044	19,930	603	142,728
Aurora, Mo.	3,699,510	92,196	2,062,095	30,676	56,210	1,575	124,447
Springfield, Mo.	3,186,530	91,793	.....	.....	447,405	12,597	104,390
Lawton, Kan.	3,629,280	90,693	.....	.....	248,950	6,302	96,995
Wentworth, Mo.	2,873,820	73,489	181,070	3,222	.....	.....	76,711
Sarcoxie, Mo.	1,072,970	29,400	.....	.....	186,190	2,639	32,039
Quapaw, Okla.	892,980	21,630	62,180	775	390	9	22,414
Stotts City, Mo.	615,200	13,518	.....	.....	15,980	464	13,982
Badger-Peacock, Kan.	507,220	12,670	.....	.....	9,520	244	12,914
Senaca, Mo.	.....	.....	.....	.....	350,000	8,750	8,750
Fairview, Mo.	188,900	4,888	.....	.....	.....	.....	4,888
Reeds, Mo.	.....	.....	220,830	3,615	.....	.....	3,615
Peoria, Okla.	.....	.....	180,000	1,980	.....	.....	1,980
Total shipments	570,001,303	$14,901,386	33,769,850	$549,911	91,694,186	$2,592,102	$18,043,379

Spelter Production in 1912

Production.—The production of primary spelter from domestic ore in 1912 is estimated by C. E. Siebenthal of the U. S. Geological Survey, at 323,961 short tons, and from foreign ore at 14,669 tons, a total of 338,630 tons, worth, at the average St. Louis price, $46,731,000, compared to a total of 286,526 tons in 1911, worth $32,663,964, and made up of 271,621 tons of domestic origin and 14,905 tons of foreign origin. The production of spelter from both domestic and foreign ores, apportioned according to the states in which it was smelted, by six-month periods, was:

SPELTER PRODUCTION, 1911-1912, BY STATES

State.	1911. First half.	1911. Second half.	1912. First half.	1912. Second half.
Illinois	41,255	41,875	44,224	44,065
Kansas	50,574	47,839	52,485	48,376
Oklahoma	19,997	26,318	36,010	41,584
Other states	28,370	30,298	33,777	38,109
Totals	140,196	146,330	166,496	172,134
Yearly totals	286,526		338,630	

The total production of spelter is equivalent to the output of 79,678 average retorts operating continuously through the year on 60% zinc concentrate. The retort capacity, available for ore, of the plants active in 1912 was, at the beginning of the year, 80,200 retorts. Many of them, of course, were used on low-grade ores, lessening their capacity. To these were added during the year 19,848 retorts, of which 2880 were in Pennsylvania, 3456 in West Virginia, 2476 in Illinois, 10,796 in Oklahoma, and 240 in Colorado. Meanwhile there were slight reductions in capacity at certain plants, so that the total number of retorts at the close of 1912 was 99,400. In Illinois there are now nearing completion 2400 retorts at the new Hillsboro smelter of the American Zinc Co. of Illinois, which started with 1600 retorts in November; 1600 retorts at the plant of the R. H. Lanyon Zinc & Acid Co., also at Hillsboro, which will start early in 1913; 1800 retorts at the plant of Hegeler Bros., at Danville; and 4560 retorts at the Mineral Point Zinc Co.'s smelter at Depue. In Kansas 576 retorts will be added to the La Harpe plant of the Kansas Zinc Co. Oklahoma now holds first place in active smelting capacity, with 27,416 retorts; Kansas is second, with 27,092 retorts; and Illinois third, with 25,148 retorts. The largest smelter is the Collinsville (Oklahoma) plant of the Bartlesville Zinc Co., with 8064 retorts; the next largest is the Meadowbrook (West Virginia) plant of the Grasselli Chemical Co., with 6912 retorts; and the third is the Collinsville (Oklahoma) plant of the Tulsa Fuel & Manufacturing Co., with 6232 retorts. The Mineral Point Zinc Co.'s plant at Depue, Illinois, will have 9080 retorts when completed in 1913.

At the close of the year the National Zinc Co. took over the United Zinc & Chemical Co.'s plants, consisting of a zinc smelter with 3680 retorts and an acid plant at Springfield, Illinois, and roasting furnaces and an acid plant at Argentine, Kansas.

Imports and Exports.—Imports of zinc ore were approximately 78,000 short tons, containing about 31,500 tons of zinc, compared with 78,341 tons of ore containing 31,640 tons of zinc, imported in 1911. The figures for 1912 are exclusive of 18,245 short tons of lead ore from South America, containing 2431 tons of zinc, an average of a little more than 13%, all of which was lost in smelting the lead and thus does not properly enter into the figures of imports of zinc. Of the zinc ore imported, 72,000 tons, about 92%, came from Mexico, compared with 75,982 tons imported from Mexico in 1911. The exports of domestic zinc ore were 19,953 short tons, valued at $704,207, compared with 18,281 tons in 1911.

The imports of spelter were the largest for many years, being estimated at 10,700 short tons, valued at about $1,202,000, compared with 609 tons in 1911. The imports of zinc dust were 2350 short tons, valued at $262,700, against 1713 tons in 1911. Exports of domestic spelter are estimated at 6673 short tons, worth $871,479, compared with 6872 tons in 1911. The exports of foreign zinc increased from 4758 short tons in 1910 to 11,276 tons in 1911, and to approximately 6779 short tons in 1912. During the first nine months of the year there were also exported under drawback articles manufactured from 938 tons of foreign zinc on which duty had been paid, compared to 3079 tons in 1911. The exports of zinc dross amounted to 203 short tons, valued at $17,803, compared with 4246 tons in 1911.

Consumption.—The apparent domestic consumption of spelter in 1912 may be computed as follows: The sum of stock on hand at smelters at the beginning of the year, 9081 tons, plus the imports, 10,700 tons, and the production, 338,630 tons, gives the total available supply, 358,411 tons. From this there are to be subtracted the exports of domestic spelter, 6673 tons; the exports of foreign spelter, 6799 tons; and the stock on hand at smelters at the close of the year (to be exact, on December 15), 4208 tons; a total of 18,618 tons; leaving a balance of 339,793 tons as the apparent domestic consumption. This calculation takes no account of the stocks of spelter held by dealers or consumers. On comparing the consumption in 1912 with the 280,059 tons consumed in 1911, the 245,884 tons in 1910, the 270,730 tons in 1909, the 214,167 tons in 1908, and the 226,969 tons in 1907, it is seen that the consumption is phenomenally large.

Lead Production in 1912

Production.—The total production of refined lead, desilverized and soft, from domestic and foreign ores in 1912, according to an estimate compiled by C. E. Siebenthal of the U. S. Geological Survey, was approximately 480,965 short tons, worth at the average New York price $43,286,850, compared to 486,976 tons in 1911 and 470,380 tons in 1910. These figures do not include an estimated output of 13,384 tons of antimonial lead, against 14,078 tons in 1911 and 14,069 tons in 1910. Of the total production, desilverized lead of domestic origin, exclusive of desilverized soft lead, is estimated at 229,765 tons, against 201,223 tons in 1911; and desilverized lead of foreign origin comprised 81,649 tons, compared to 94,143 tons in 1911. The production of soft lead, mainly from Mississippi Valley ores, is estimated at 169,551 tons, compared to 191,619 tons in 1911. Despite the reduced output of soft lead, there is no doubt that Missouri retains first place among the lead-producing states. The final figures of production of soft lead are likely to show an increase of a few thousand tons over those given above, because the argentiferous lead smelters and refineries undoubtedly treated more or less soft-lead ore from the Mississippi Valley which is not taken into account in their preliminiary estimates.

Imports and Exports.—The imports of lead are estimated at 10,969 short tons of lead in ore, valued at $452,650; 76,468 tons of lead in base bullion, valued at $3,452,750; and 266 tons of refined lead, having a value of $20,000; a total of 87,703 tons, compared to 89,952 tons in 1911. Of the 1912 imports, 85,000 tons, or about 97%, came from Mexico. The exports of foreign lead (lead of foreign origin smelted or refined in the United States) show a decrease of more than a third, being estimated at 65,253 tons, against 101,227 tons in 1911. The imports of type metal (antimonial lead) were 757,375 lb., containing 485,596 lb. of lead and valued at $18,516, compared with 8,390,470 lb. in 1911, containing 6,936,711 lb. of lead and worth $310,658. These imports of type metal are withdrawn from bond and therefore should not be added to the general imports of lead given above, as that would involve duplication.

Consumption.—The amount of lead available for consumption during 1912 may be estimated by adding to the stock of foreign lead in bonded warehouses at the beginning of the year (4481 short tons) the imports (87,703 tons) and the domestic production (399,316 tons), making an apparent supply of 491,500 tons. From this is to be subtracted the foreign lead exported in manufactures under drawback (estimated at 9848 tons), the deduction by liquidation (5814 tons), and the stock in bonded warehouses at the close of the year (assumed to be the same as at the close of November, 9497 tons), leaving as available for consumption 401,088 tons, which by comparison with 399,472 tons in 1911, 376,021 tons in 1910, and 370,013 tons in 1909, seems to be a normal figure.

The foreign lead remaining in warehouse at the close of November 1912 was distributed principally as follows: At Chicago, 161 short tons, compared with 477 tons at the close of 1911; at Newark, 591 tons, against 1389 tons at the end of 1911; at Perth Amboy, 8353 tons in 1912 and 1154 tons in 1911; and at El Paso, 343 tons, compared with 1278 tons at the close of the preceding year.

The past year has been marked by steady progress in the mining industries of eastern Canada, and a large increase in the value of the output. There have been great advances made in the introduction of improved machinery and more economical processes. The speculative feature, so prominent in the earlier history of the Cobalt and Porcupine districts, has been largely eliminated, and while many of the weaker companies have discontinued operations, the really substantial and well managed enterprises have had a highly prosperous year, and paid good returns to their shoreholders.

Metal Production of Western States

ARIZONA experienced in 1912 an exceptionally good year in mining, especially in the mining of copper ore, and the preliminary total value of all metals is estimated by members of the staff of the U. S. Geological Survey at more than $65,000,000, an increase of more than $20,000,000, or 49% above the production for 1911. Of this total value, the copper output represented over $58,000,000, gold $3,500,000, and silver $2,000,000. Gold production increased 3%, the total being over 17,000 oz. Silver production increased to 3,300,000 oz., or 2%. Copper production reached 359,000,000 lb., an increase of 17% over 1911. The lead output was 7,000,000 lb., a decrease of 32%. Spelter production was 8,500,000 lb., an increase of 89% over 1911.

CALIFORNIA shows an increase in output of both gold and silver in 1912 compared with 1911, according to preliminary figures by Charles G. Yale. The difference is not very marked, but is sufficient to show that the precious-metal output of the state is advancing somewhat. California retains first rank in gold output, regained from Colorado in 1911. The mine figures of the Survey for 1911 were: gold valued at $19,738,908 and 1,270,445 oz. of silver, while estimates for 1912 indicate an output of gold valued at $19,950,000, and 1,270,000 oz. of silver. Moreover, it is highly probable that when complete detailed returns are available, the 1912 figures will be somewhat enhanced. Copper production shows an increase over 1911, though figures are not yet available. Lead shows a decrease, preliminary returns indicating 1,032,000 lb., as compared with 1,398,111 in 1911. Zinc shipments have been at about the same rate as in 1911, when 2,800,000 lb. was produced.

COLORADO mines for eleven months of 1912 and an estimate for December, according to preliminary figures by Charles W. Henderson, show a decrease of $300,000 for gold, an increase of 750,000 oz. for silver, a decrease of 1,000,000 lb. for copper, an increase of 5,000,000 lb. for lead, and an increase of 27,000,000 lb. for zinc. With increased market prices for silver, copper, and zinc, the value of the output in 1912 was over $4,000,000 greater than in 1911—$3,000,000 in zinc and $1,000,000 in silver, the increased value for lead and copper about balancing the decrease for gold. The output for 1912 is therefore estimated at approximately $18,700,000 in gold, 8,080,000 oz. of silver, 7,025,000 lb. of copper, 74,680,000 lb. of lead, and 121,600,000 lb. of zinc, valued in all at nearly $36,500,000.

IDAHO metal output in 1912, according to preliminary estimates by C. N. Gerry, was valued at nearly $21,000,000, an increase of about 10% over the value for 1911. Increases were made in the production of copper, lead, and zinc, while the output of gold and silver slightly decreased. The added value was due partly to the better prices for silver, copper, and zinc prevailing in 1912. There was a slight decrease of about 4% in gold production, lowering the output for 1912 to about $1,300,000.

MONTANA metal output, as a result of the increased prices of metals and the greater production of copper particularly, was worth close to $64,000,000 in 1912, according to preliminary estimates by V. C. Heikes. This represents an increase of nearly 36% in value over the 1911 output and is the most valuable production since that of 1906. About 79% of this value came from copper alone, about 12% from silver, nearly 6% from gold, and nearly 3% from zinc. An estimated decrease of over 3% in gold production brought the output of 1912 down to about $3,500,000. This was probably due to a diminished yield of mill bullion, especially in the Little Rockies district, formerly in Chouteau county but now in Blaine county. The gold-output from placer bullion slightly increased, being sustained by six operating dredges. The four boats at Ruby had a successful season, and the Kansas City plant in Missoula county, and the Magpie in Lewis and Clark county were active. There was also an increase of about 5% in silver, from nearly 12,000,000 oz. in 1911 to about 12,500,000 oz. in 1912. This was creditable to Butte copper ore. The increase of 7.5c. per oz. in the average price of silver meant a difference of nearly a million dollars in the value of the production, while the increased price of copper swells the total.

NEVADA ores, according to preliminary figures by V. C. Heikes, produced metal valued at nearly $36,500,000, which is a little over 7% greater than the value for 1911. The gold output forms the largest part, or 37½% of the total value; copper nearly 34½%, silver slightly in excess of 23%, and lead and zinc each over 2%. The Goldfield mines produced more ore but less gold in 1912, and this with decreased output from the National and Seven Troughs districts was the principal cause of a decrease in total gold production of about 25% from the yield of $18,193,397 in 1911. There has been a steady increase in the annual silver output of Nevada since 1901, when production began at the Tonopah mines. In 1912 the producers of Tonopah increased the yield of ore from about 8000 to nearly 12,000 tons per week, but the average silver content per ton decreased. An increase estimated at 17% in the production of copper, from 67,377,518 lb. in 1911 to about 79,000,000 lb. in 1912, is due to the new smelter which started operations early in 1912 at Thompson on copper ores produced chiefly from the Mason Valley and Nevada Douglas properties in the Yerington district.

NEW MEXICO mine production of gold in 1912, according to preliminary estimates by Charles W. Henderson, showed a small increase over the output of $762,808 in 1911; the output of silver an increase of about 150,000 oz. over the production of 1,354,540 oz. in 1911; lead an increase of about 1,700,000 lb. from the yield of nearly 3,000,000 lb. in 1911; and copper an increase from 4,057,040 lb. in 1911 to about 28,000,000 lb. in 1912. The output of zinc made little change in 1912 from the output of 10,237,176 lb. in 1911. The increase in the value of copper alone adds over $4,000,000 to the value of the output of New Mexico.

OREGON metal output has been declining for several years, more especially in gold and silver, but preliminary returns for 1912 show that this has now been checked, according to Charles G. Yale. The mine report of the Survey for 1911 showed an output of gold valued at $633,407 and 45,221 oz. of silver. The preliminary returns for 1912 indicate that the Oregon yield was about $657,000 in gold and 86,951 oz. of silver, a marked advance in the silver output. Moreover, the smelters received about 100,000 lb. of copper, compared with 93,196 lb. in 1911, and 38,000 lb. of lead, whereas there was no yield of lead in 1911. More placers are being worked than formerly in Oregon, mainly by hydraulic methods. The grade of ore in the deep mines has been much lower than formerly, although more of it is treated. The lowering of the average tonnage value is due to the large quantities of old tailing handled, their average yield being taken with that of the new ore in making up the totals and average values.

SOUTH DAKOTA mine production of gold in 1912, according to preliminary estimates by Charles W. Henderson, was the largest ever produced in any one year, the output being $150,000 above the previous maximum mine yield of $7,657,376 in 1908, or about $7,807,000 in 1912. The yield of silver showed little change. Both lead and copper were produced in 1912, the output for each metal being close to 20,000 pounds.

UTAH ore production in 1912 aggregated close to 7,500,000 tons, valued at about $44,000,000 for its gold, silver, copper, lead, and zinc content, or an increase of 19%, according to preliminary figures by V. C. Heikes. The strike of miners at Bingham, lasting 40 days, during which nearly all the mines there were closed or operating with decreased forces, caused a decrease of about 500,000 tons in the total ore production. The smelters, however, were not seriously affected, as they operated for a time on the stock reserves and at nearly full capacity the entire year. Owing to the higher price paid for the metals, considerable old mine-dump material on various properties, the accumulation of many years operations, was almost entirely disposed of to the smelters, and likewise large dumps of old slags were shipped for re-treatment without sorting.

WASHINGTON gold production decreased to about $679,000 in 1912, according to preliminary figures by C. N. Gerry. The total value of all metals produced in the state was greater by nearly 7% than that of 1911. This was due to

the increased production and better market price of both silver and copper. There were no shipments of zinc ore, and only a few cars of lead ore was marketed, against a nominal output of zinc and a production of 848,584 lb. of lead in 1911.

Review of Lake Superior Copper Mining Industry, 1912

By R. H. Maurer

Mining for copper in the Lake Superior district antedates the earliest visits of European explorers to this region, and begins with production on a commercial basis in 1845, since when the district has been a steady producer. Always an important factor in the copper-mining industry of the world, the Lake Superior field for many years subsequent to 1845 was the most important copper-producing district in the United States. In total production, the Lake Superior district ranks second, and in output for 1912 it ranks third. The total production of fine copper to the close of 1912 is estimated at approximately 5,200,000,000 lb.—30% of the output from the United States since 1845.

Although an English company made an attempt at mining along the Ontonagon river, in the southern part of this district, as early as 1770, the history of copper-mining in historic times may be said to begin with the organization, in 1844, of the Pittsburgh & Montana Mining Co., the first producer and also the first dividend-payer of the district. This company operated the famous Cliff mine of early days. The first dividend of which there is any record was paid by the Old Cliff in 1849, the amount being $60,000. Dividend payments during 1912, with eight companies contributing, reached a grand total of $9,069,257, an increase of nearly $3,000,000 over the preceding year.

In the value of metal output, and in the resulting profits, the district takes high rank among the great mining fields of the world. The gross value of production to date will closely approximate $800,000,000, and the total dividend disbursements by all companies now stands at above $200,000,000. Though primarily a producer of copper, the Lake Superior district has at various times yielded considerable quantities of silver, and in 1911 ranked eighth among the silver-producing states of the Union with a production of 497,281 fine ounces of silver, against 330,500 oz. in 1910. Production in 1912 will probably exceed 500,000 oz. This production is secured mainly from the electrolytic refining of the copper produced, and, as a rule, increases or decreases as the quantity of copper refined is increased or reduced.

Dividend disbursements by Lake Superior companies during the past year, and total payments of all companies for all years of which there is any record are shown in the appended table.

Company.	1912.	Total.
Ahmeek	$ 900,000	$ 1,000,000
Atlantic	.....	990,000
Calumet & Hecla	4,200,000	119,100,000
Central	.....	2,130,000
Cliff	.....	2,518,620
Copper Falls	.....	100,000
Copper Range Con	787,382	12,901,048
Franklin	.....	1,242,000
Kearsarge	.....	160,000
Minesota	.....	1,820,000
Mohawk	350,000	2,650,000
National	.....	320,000
Osceola	1,201,875	11,266,250
Pewabic	.....	1,000,000
Phoenix	.....	20,000
Quincy	550,000	20,292,500
Ridge	.....	100,000
Tamarack	.....	9,420,000
St. Mary's	480,000	5,560,000
Wolverine	600,000	7,440,000
Total	$9,069,257	$200,030,418

The growth of the industry has been remarkable, and, although the district has been an active producer for more than 65 years, none of the mines are threatened with immediate exhaustion. Less than 30% of the copper-bearing area has been touched, and the productive limit of the district appears nowhere to have been reached. Production, which in 1845 amounted to only 25,000 lb., increased by leaps and bounds to more than 200,000,000 lb. in 1904, and reached its high mark in 1905, the total output in that year amounting to 230,288,000 lb. fine copper. The annual rate of production since 1907 has held steadily around 220,000,000 lb., and at no time declined more than 5% from the high mark set in 1905.

Much attention was paid during 1912 to the exploitation of new territory, and this work has added much to the known mineral resources of the district. Nearly $1,000,000 was required to meet the cost of this exploratory work by companies still in the development stage. More than 30 companies were actively engaged on both ranges seeking workable copper deposits or developing deposits disclosed in previous years. Of the several new disclosures of copper deposits made at various points along the contact of the Lake Superior mineral belt with the great Eastern Sandstone, those in the area under development by the Mayflower and Old Colony companies are easily the most important. The south range, which was quite thoroughly explored in the preceding year, continues to receive full attention.

The number of workers employed in the various branches of the industry was again smaller than during the preceding year and is now around 17,000, compared with 18,000 a year ago and 21,000 employed in the three counties in 1909. Fully 15,000 find employment in Houghton county. The payroll of the district will closely approximate $15,000,000 per year. A brief résumé of what the several Lake Superior companies accomplished during the year, and what may be expected in the future, follows:

The Calumet & Hecla Mining Co., with probably less than 20 years of life remaining in the conglomerate lode, is concerned chiefly with the development of the Osceola lode on its own property, and with the development of a number of mines on other formations, in which the company is interested through its shareholdings in other companies. The conglomerate bed has been a most profitable source of production, and will continue to be so to the end of its life, though declining copper content has materially affected profits. The mine in the conglomerate lode is supplying about three-fourths of the Calumet production, about 2,000,000 tons of ore per year, averaging around 30 lb. fine copper per ton. There remains approximately 30,000,000 tons unmined. The mine on the Osceola lode, easily capable of supplying 1,000,000 tons per year, is low grade, with a copper content of about 15 lb. per ton of rock. The reserve of the mine on this formation is estimated at 40,000,000 tons. The combined output of these mines during the year closely approximated 2,700,000 tons, resulting in a production of slightly more than 69,000,000 lb. fine copper, indicating an average yield of about 26 lb. fine copper per ton of rock milled. In addition to the output secured from the Calumet and Osceola lodes, the company controls the sale of upward of 60,000,000 lb. fine copper produced by the so-called Calumet & Hecla subsidiary companies, giving the parent company a total output well over 130,000,000 lb. fine copper annually, or approximately 60% of the total output of the Lake Superior district.

The Copper Range Consolidated Mining Co. is not directly engaged in mining, but is a securities-holding company controlling and directing the operations of the Baltic, Champion, Trimountain, and Atlantic mines, and the Copper Range railroad. These mines during the year yielded approximately 37,300,000 lb. fine copper. In this production the St. Mary's Mineral Land Co. has an equity equal to about 8,000,000 lb., being one-half of the output of the Champion mine, owned jointly by these companies, leaving the consolidated company a net production of about 29,000,000 lb. This production was taken from the Champion, Baltic, and Trimountain mines. The Atlantic mine is idle. The Baltic and Champion mines are the mainstay of the combination and show no appreciable changes

from the previous year, physical conditions being entirely satisfactory. The Trimountain mine has improved wonderfully during the year and promises to take equal footing with its big neighbors. Production has increased materially within recent years and was fully 20% greater than in the preceding year.

The Quincy Mining Co. will, when final figures are in, report a production smaller by about 5% than that of the preceding year. Dividend disbursements were greater by nearly $500,000. The mine is old and deep in the south end. Air blasts are of frequent occurrence, but are not proving so troublesome as in the past and do not greatly hinder operations. The Quincy is no longer the rich mine it once was and the content, as in all other Lake Superior mines, has declined materially with depth. The present yield will range between 14 and 16 lb. fine copper per ton of ore mined, averaging 15 lb. Development work is confined almost entirely to the so-called Pontiac tract in the extreme north, in which a shaft has been sunk to a depth of 3000 ft. Despite the long life spent on the Pewabic lode the company has in the north territory, embraced by the Mesnard, Pontiac, and St. Mary's tracts, an area fully as great as that already worked out in past years.

The Osceola Consolidated Mining Co. operated with much the same results obtained in past years and is keeping ore reserves well ahead of immediate requirements. Production was smaller by about 300,000 lb. Striving for 'dollar rock,' the company has probably come closer to attaining this object than has any other mine in the district. The cost of mining, transporting, and milling a ton of ore during the past year will probably average less than $1.25. Its ability to show such remarkably low operating costs is in part due to the favorable physical condition of the property, but is withal an achievement that evidences good management. The Osceola branch was reopened during the year and is now yielding a regular production. The Ahmeek Mining Co. continues to establish new records. Production increased fully 1,000,000 lb., with costs reduced to about 7½c. per pound, making the mine the champion low-cost producer of the district. A total of $900,000 in dividends was disbursed during the year.

The Wolverine Copper Mining Co. reports a normal production, with dividend disbursements slightly increased. The company has an estimated life of 7 to 9 years on the Kearsarge lode. Considerable attention was paid to exploratory work in the horizons of the Osceola and Old Colony lodes. This work offered some promise, but is generally without encouragement. The Mohawk Mining Co. in strengthening its position among the dividend-payers, and its ability to wring profits from the treatment of the low-grade copper ore reflects great credit on the management. Production holds steadily around 12,000,000 lb. annually. The physical condition of the property is excellent and a larger production is predicted for the new year.

Isle Royale, Allouez, Superior, and Tamarack are profitable producers, with productions ranging from 8,000,000 lb. down to 4,000,000 lb. annually. The Isle Royale will probably declare its first dividend early in the new year. The others may be expected to follow a year or two later in the order named. Isle Royale, the largest producer of the quartette, is sinking a new shaft and will shortly be in position to increase production to around 12,000,000 lb. annually. Allouez is operating through two shafts with an annual production of 10,000,000 lb. fine copper in sight. Superior is developing an area of exceptional richness in the west bed of the Baltic formation, but is still a one-shaft mine. Development work in the south shaft continues rather discouraging. Tamarack is centring activity in the Calumet conglomerate, and is also giving some attention to the underlying Osceola lode. The mine is seemingly hopeless. It is a deep mine and the cost of production is very high. The mine is practically on probation and will never again be the Tamarack of old.

In quite another class are the Lake, Hancock, Franklin, Centennial, Mass, Winona, and Victoria. All are yielding small productions and all are still in the development stage. Years will be required to place even the most likely on a dividend basis. The worth of the Lake with respect to the Lake lode has been fairly demonstrated. The possibilities on the several other formations in its territory are unknown. Hancock has developed several copper deposits of commercial value and will be yielding a regular production early in the present year. Franklin has one shaft in operation and a second under way. Production increased fully 100% during the year and promises to reach a total of 3,000,000 lb. during 1913. The corner has been turned after years of discouraging work and the mine is going to be one of the largest in this district. The Winona is making slow progress. Two shafts are in commission. A large tonnage of low-grade material has been developed and the mine is easily capable of doubling the present rate of production. Centennial, Mass, and Victoria are obtaining just enough encouragement to induce further work. The Laurium, Houghton, Objibway, St. Louis, Oneco, Wyandot, and White Pine are engaged in development work with varying degrees of success. The Indiana, Adventure, New Baltic, Algomah, New Arcadian, and South Lake are sinking shafts and otherwise opening ground for the purpose of determining the value of copper deposits previously disclosed in diamond-drilling. Mayflower, Old Colony, Naumkeag, Onondaga, La Salle, Keweenaw, and Contact confined all activity to diamond-drilling, work that resulted most favorably for Mayflower and Old Colony. The Gratiot, Michigan, North Lake, and Bohemia, all active in 1911, spent the greater part of 1912 in idleness.

Copper Production in 1912

The figures showing smelter production from domestic ores, which have been collected by B. S. Butler, of the U. S. Geological Survey, represent the actual production of most of the companies for eleven months and an estimate of the December output. The November figures for a few companies were not available and these companies furnished estimates for the last two months of the year. According to the statistics and estimates received, the output of blister and Lake copper was 1,249,000,000 lb. in 1912, against 1,097,232,749 lb. in 1911, at an average price of 16c. per pound the 1912 output has a value of nearly $200,000,000, against $137,154,092 for the 1911 output. Statistics for December appear elsewhere.

Statistics published by the Copper Producers' Association show an output of 1,429,147,150 lb. for the first 11 months of 1912 and indicate that the production of marketable copper by the regular refining plants from all sources, domestic and foreign, will amount to about 1,560,000,000 lb. for 1912, against 1,433,875,026 lb. in 1911.

According to the Bureau of Statistics imports of pigs, bars, ingots, plates, and old copper for the first 11 months amounted to 276,508,505 lb., and the copper content of ore, matte, and regulus imported amounted to 94,486,041 lb. If the imports for December were equal to the average monthly imports for the first 11 months the amount of copper entering the United States for the year was about 404,721,323 lb., against 334,607,538 lb. for 1911. Considerable of the copper imported had been exported as ore.

The average quoted price of electrolytic copper for the year showed a marked increase over that for 1911. The average for 1912 was about 16c. per lb., as compared with 12.5c. per lb. for 1911. The year opened with copper at 14c. per lb., but since June the monthly average has not been below 17 cents.

There will be no new large producing mines added during 1913. Several of those that began production in 1911 and 1912 will, however, turn out larger quantities than in 1912. At the prices for copper prevailing during the latter part of 1912 the industry is highly profitable, and if the output can be marketed and the price maintained the producers will be in a position to make a still further large increase in 1913.

PIG IRON made in Canada during 1911 amounted to 917,535 tons from 97,732 tons of Canadian iron ore, and 1,628,368 tons of imported ore. Of steel rails, 399,760 tons was manufactured, and 543,933 tons of Canadian coke used.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

GOLD MINE ACCOUNTS AND COSTING. By G. W. Tait. 85 pp.; chart. Isaac Pitman & Sons, London, England, 1912. For sale by the *Mining and Scientific Press.* Price $2.

There are many forms of mine bookkeeping, and this volume presents the method of accounting as applied to gold mines in South Africa, where the calculation of costs has at times seemed supreme to other important departments. The material in the book originally appeared as a series of articles in the *South African Mining Journal.* It is a valuable discussion of English methods, but these differ so greatly from American that the American reader is likely to find the book suggestive rather than useful. The absence of any index detracts greatly from its serviceableness.

MINERALOGY OF THE RARER METALS. By Edward Cahen and W. O. Wootton. 211 pp.; index. Charles Griffin & Co., Ltd., London, 1912. For sale by the *Mining and Scientific Press.* Price $2.50.

Greater interest is being taken each year in prospecting for rare minerals and in their technology. The growing use of rare metals and alkaline earths in the manufacture of electric and gas incandescent lamps, production of special steels, and other industries, has created a demand for minerals that are comparatively unfamiliar even to the scientific prospector. It must be remembered that these metals are only used in limited amount, and immediately there is an overproduction prices fall rapidly. Each mineral is discussed under the usual heads of detection, properties, metallurgy, industrial application, annual production, and value, and the little book, which is well bound and of pocket size, will prove very useful.

ENGINEERING AND METALLURGICAL BOOKS, 1907 TO 1911. By R. A. Peddie. 206 pp. D. Van Nostrand Co., New York, 1912. For sale by the *Mining and Scientific Press.* Price $1.50.

Of the making of books there is no end, and a perusal of this volume will give a good idea of the great number issued during the past five years. New editions of works which have appeared during the quinquennium are also included. The whole field of engineering is covered, and metallurgy as well, but only certain phases of chemical technology and a few books on mining geology. Books are arranged chronologically under a list of subheads. Unfortunately, these are badly chosen and are not sufficiently comprehensive; for example, Thompson's 'Applied Electrochemistry' is not listed under electrometallurgy, and numbers of other omissions might be cited. An incomplete check-list is a blind guide, and the including of those old books as have appeared in new edition during the period, while omitting the others, is likely to be confusing to anyone who attempts to use it as a finding list.

BIBLIOGRAPHY OF THE MINERAL WEALTH AND GEOLOGY OF CHINA. By C. Y. Wang. 63 pp. Chas. Griffin & Co., London, 1912. For sale by the *Mining and Scientific Press.* Price $1.25.

The author of this little volume, who is now provincial geologist of Kuangsi, is well known to many Americans, he having studied both at California and Columbia universities after graduation from the Pei Yang University. His earlier volume, 'Metallurgy of Antimony,' reflected great credit upon its author, and it is greatly to be deplored that it has been followed by a volume which is likely to have the reverse effect. The preparation of a bibliography is an ungrateful task, for the amount of work required to make it anything like complete is enormous, and an item which occupies two lines may require two weeks of effort for authentication. China presents even greater difficulties than other topics, for the literature is scattered through obscure and often inaccessible publications. The preparation of such a general bibliography of China as that of Cordier is therefore almost a life work; one prepared with less care is almost valueless. The inconvenient form of this one is doubtless to be laid at the door of the publishers, since the system of dividing a work into sections and omitting an index is characteristically European. The reader is, for example, scarcely able to perceive from the volume that one of the most important papers on gold and silver in North China is that by H. C. Hoover, since it is omitted in the section on gold and silver and placed under 'Metals in General.' But the compiler is also at fault, making remarkable blunders. Thus N. F. Drake's important paper on the coalfields near Tze-chou, Shansi, is given as 'anonymous', though references to abstracts of the same paper appear elsewhere under Drake's name. In other cases references are given to abstracts, but none to the original paper. Many of the most important papers, such as those by Lorenz, Garnier, and Coldre, are entirely omitted. Most of the work on the book was evidently done previous to 1905, since only a few of the recent papers are mentioned. In the introduction the author admits the incomplete state of his work, and it is too bad that the aid of skilled assistants was not invoked, for a half-done bibliography is of little more value than a half-baked cake. Mr. Wang's many friends will regret that his second volume does not maintain the standard set by the first.

Recent Publications

CITY SMOKE ORDINANCES AND SMOKE ABATEMENT. By S. B. Flagg. 55 pp. Bureau of Mines, Bulletin 49. Washington. 1912.

PLEISTOCENE RODENTS OF CALIFORNIA. By Louise Kellogg. University of California Publications. 17 pp. Berkeley, December 1912.

IGNITION OF GAS BY STANDARD INCANDESCENT LAMPS. By H. H. Clark. 6 pp. Technical Paper 28, Bureau of Mines. Washington, 1912.

PRODUCTION OF IRON AND STEEL IN CANADA IN 1911. By J. McLeish. Publication No. 182, Canada Department of Mines. 32 pp. Ottawa, 1912.

SOUTHERN VANCOUVER ISLAND. By C. H. Clapp. Memoir No. 13, Canada Department of Mines. 208 pp.; ill., map. index. Ottawa, 1912.

MINING ACCIDENTS IN ONTARIO FOR JULY, AUGUST, AND SEPTEMBER 1912. By E. T. Corkill. Bulletin No. 12, Ontario Bureau of Mines. 16 pp. Toronto, 1912.

FAUNA FROM THE TYPE LOCALITY OF THE MONTEREY SERIES IN CALIFORNIA. By B. Martin. University of California Publications. 7 pp. Berkeley, December 1912.

METHODS FOR THE DETERMINATION OF WATER IN PETROLEUM AND ITS PRODUCTS. By I. C. Allen and W. A. Jacobs. Paper No. 25, Bureau of Mines. 13 pp.; ill. Washington, 1912.

PRODUCTION OF CEMENT, LIME, CLAY PRODUCTS, STONE, AND OTHER STRUCTURAL MATERIALS IN CANADA, 1911. By J. McLeish. Department of Mines Publication. 55 pp. Ottawa. 1912.

GEOLOGY AND NATURAL RESOURCES OF THE BASINS OF HARRICANAW AND NOTTAWAY RIVERS, NORTHWESTERN QUEBEC. By J. A. Bancroft. 16 pp., map. State Department of Mines Publication. Quebec, 1912.

SEA FISHERIES OF EASTERN CANADA. Report of the meeting of the Committee on Fisheries, etc., of the Commission of Conservation, held at Ottawa, June 4 and 5, 1912. 212 pp.; map, chart, index. Ottawa, 1912.

WATER RESOURCES OF CALIFORNIA. Part II. Stream Measurements in San Joaquin River Basin. By H. D. McGlashan and H. J. Dean. 439 pp.; ill., index. Water Supply Paper 299, U. S. G. S. Washington, 1912.

A RECONNAISSANCE REPORT OF THE GEOLOGY OF THE OIL AND GAS FIELDS OF WICHITA AND CLAY COUNTIES, TEXAS. By J. A. Udden and D. McN. Phillips. 308 pp.; ill., maps, plans, tables, index. Bulletin No. 23, University of Texas. Austin, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

SPEED at which rock can be drilled does not indicate how it will break, as it often happens that rock easily drilled is hard to blast.

SODIUM NITRATE imports for consumption in manufacture of fertilizers and other chemical products amounted in value in 1911 to $16,814,268.

SULPHUR production in the United States in 1911 totaled 265,664 long tons, valued at $4,787,049. Pyrite production was 301,458 tons, worth $1,164,871.

LITHIUM minerals were not produced in the United States in 1911; neither was there any production of potash salts, imports of which were valued at $9,892,324.

CANNEL COAL was mined to the extent of 170,010 tons in 1911, according to the U. S. Geological Survey, Kentucky producing 90,275 and Pennsylvania about 40,000 tons.

SULPHURIC ACID amounting to 438,300 short tons of 60°B., and valued at $2,733,696, was produced from the fume of copper and zinc smelters in the United States in 1911.

GRAVEL used in concrete work should be washed. This costs little more, and insures the absolute dependability of the concrete. Unwashed and untested gravel is a doubtful material to employ.

WATER from streams in California in its progress from the mountains to the sea, a distance of about 100 miles, has been diverted for power, irrigation, and municipal water-supply as many as eight times.

MANGANESE mining has never been a very important industry in the United States, owing to the small extent and the irregularity of the deposits. It is obtained commercially from manganese ores, manganese iron, and silver ores, and manganiferous residuum from zinc roasting.

ACETIC ACID used in Government laboratories for certain analyses must pass the following test: 10 c.c. of acid mixed with 10 c.c. of H_2SO_4, and 2 mg. of $K_2Cr_2O_7$, must not show a green color after standing half an hour, and must have a strength of 99.9%. This test indicates the absence of empyreuma.

COAL-MINING requires, according to investigations by the American Mining Congress, an average investment of $1.41 for every ton of coal mined per year, so that a mine producing 300 to 400 tons per day, or say 100,000 tons per year, requires, on the average, an investment of $150,000. Large plants sometimes involve investments of several million dollars.

SALES of private coal lands in the United States during the past year, omitting sales in Pennsylvania and others of a speculative character, involved 102,464 acres, which realized $18,813,179, an average of $180 per acre. During the past five years, public coal lands covering 133,948 acres were sold at an average price of $18.30 per acre, or about one-tenth that received from private lands, which in some cases brought from $400 to $800 per acre.

THE use of clearance water, to keep the glands free from grit, is essential in all pumps of the plunger or centrifugal type which handle sand or slime. The pressure of the clearance water should exceed the maximum pressure under which the pump delivers; and the water from the gland service should be admitted by the operation of an arrangement which connects the belt clutch with a valve on the water service, so that the clearance water is necessarily admitted as soon as the pump is in action; and automatically turned off as soon as the pump is stopped.

PERFORMANCE of annual labor required upon mining claims can be proved in the same way as any other overt act. In some jurisdictions the filing of an affidavit within a given time is *prima facie* evidence of the performance of labor, and in some jurisdictions the failure to record is evidence that the work has not been done. In any case, it may be proved by other evidence that work has or has not been done. The California act of 1891 providing that failure to file an affidavit of labor rendered the claim open to re-location was held unconstitutional in Harris *v.* Kellogg, 117 California, 490, and was repealed in the act of 1909 which enacted section 1426 of the Civil Code, which provides that the filing of an affidavit is *prima facie* evidence which may be controverted by other evidence.

ELECTAIC incandescent lamps are used in a large number of mines. When properly installed they offer ordinarily only a small fire risk. The presence of explosive mixtures of gases, however, increases this risk. When a lamp bulb is broken in an explosive mixture of gas, this mixture is brought into violent contact with a wire having a temperature of 1800 to 2000°C., or two to three times the ignition temperature of methane. The Bureau of Mines made a number of practical tests, and 1219 lamps, made by eight manufacturers, were used, on natural gas from the Pittsburg city mains, which contains 82% of methane, 16.4% of ethane, 1.5% of nitrogen, and a trace of CO_2. The most explosive mixture of this natural gas and air contains 8.6% of gas. Out of the tests made under various conditions of voltage, and breakage, there were 96 ignitions of gas, the percentage being 100 in many cases.

STEEL BELTS have been used in some of the large manufacturing establishments of Huddersfield, England, during the past year and have been most satisfactory. At a local mill a steel belt 7⅞ in. wide, weighing 119 lb., performs the work formerly done by a leather belt 22 in. wide, weighing 814 lb., transmitting 300 hp. In another mill a steel belt 3½ in. wide, weighing 12 lb., does work in driving 40 hp. that formerly required a leather belt 12 in. wide, weighing 64 lb. These are concrete instances of the success of this German invention. It is especially appreciated for use in the woolen industry, where steadiness and uniform speed are essential to the best results. The steel belt is also an economizer of space, does not slip or stretch, and gives the greatest efficiency of power delivery. A Government test has shown a saving of 61 hp. on a drive of 640 hp. in using the steel belt. Serviceable wood pulleys need not be discarded in changing to the metal belts, for the former can easily and cheaply be adapted for steel belts by stretching a steel band over the top of the grooves, thus obtaining a flat pulley.

DRESSING of zinc-boxes should be timed by the appearance of the first compartment, and should not entirely depend on the question of the efficiency of precipitation. The maximum action of the solution of the zinc occurs at first contact, and it is therefore essential that there be no channeling in the first compartment. As soon as this is noticeable the box should be dressed. The moving and rearrangement of the zinc frees it from much of the adhering gold or silver slime; and the repacking of the box so that the solution comes into first contact with the shortest zinc, ensures the handling of the minimum amount of base metal for the maximum amount of bullion when cleaning up. The use of long zinc-boxes and the exposure of an abnormal amount of zinc, which permits the breaking up of some of the zinc in each compartment, is, however, a method often adopted. In this case the boxes may be left for a considerable time without attention, but the gold is ultimately found distributed over a large area of filament zinc, and is not concentrated on the 'shorts' in the first compartment, as it is when sufficient attention is paid to dressing.

Commercial Paragraphs

THE HENDRYX CYANIDE MACHINERY Co. reports the sale through its English agents, Head-Wrightson & Co., of five 18-ft. agitators. These machines are for South Africa. Another sale through the same agents is announced of two 13-ft. agitators for Siberia.

THE BRITANNIA MINING & SMELTING Co., of Britannia Beach, British Columbia, has placed orders for five 8-ft. Hardinge conical mills of latest design, and one 6-ft. Hardinge conical ball mill, which are to be used in connection with the Minerals Separation, Ltd., flotation process.

The H. W. JOHNS-MANVILLE Co. announces the appointment of C. S. Berry as manager of its Atlanta, Georgia, office, at 31½ South Broad street. To facilitate delivery in the South a stock of roofing, packing, pipe covering, and other J-M asbestos, magnesia, and electrical products is carried at this address. This office also employs a force of workmen experienced in the application of J-M products.

THE JOSEPH DIXON CRUCIBLE Co., of Jersey City, makes the announcement that the selling price of its silicagraphite 'One Quality Only' paint is reduced. This reduction is made because the decrease in the price of linseed oil, which is used as the vehicle, makes it possible, and because it is the aim of the company at all times to give its customers any benefit possible in reduction of price of materials.

Roy D. Hunter has resigned as general sales manager of the SULLIVAN MACHINERY Co. Howard T. Walsh, who has been the European agent of the company, with headquarters in London, is appointed general sales manager, with headquarters in Chicago. Austin Y. Hoy, representative of the company in Spokane, Washington, succeeds Mr. Walsh in London. Louis R. Chadwick, of the St. Louis office, succeeds Mr. Hoy as local manager in Spokane.

It is reported that new equipment to the amount of $700,000 is to be provided for the Hidden Creek property of the Granby Consolidated Mining, Smelting & Power Co. The furnaces, converters, sampling machinery, ore crushers, and settlers are to be installed by the Traylor Engineering & Manufacturing Co. The Pelton Water Wheel Co. is to furnish a water-wheel. The compressor plant is furnished by the Nordberg people, while the Westinghouse Electric Co. is to furnish two 43-ton, six 12-ton, and eight 6-ton electric locomotives and twenty-five 25-ton steel ore cars.

William B. Dickson was elected president of the INTERNATIONAL STEAM PUMP Co., November 19, 1912. He succeeds the late Benjamin Guggenheim, who went down on the *Titanic*. Mr. Dickson has been connected with the steel industry for some time. After several years passed at manual labor in the mills he was transferred to the office, acting at first in a clerical capacity and subsequently receiving rapid promotion through various grades up to that of assistant to the president and managing director of the Carnegie Steel Co. He became a junior partner in the Carnegie Steel Co., Ltd., in 1899. On the formation of the United States Steel Corporation in 1901 he accompanied C. M. Schwab to New York as assistant to the president of the United States Steel Corporation, and later was elected a vice-president of that corporation, which position he held until May 1, 1911.

Charles E. Rogers, general manager for FRASER & CHALMERS, LTD., at Johannesburg, South Africa, who has been in this country several weeks and will return early this month, in speaking of South African development called attention to the fact that copper is found in large quantities in that section of the world. He mentioned in particular the Cape Copper Co. on the south coast, which has a large output, and the Messina Copper Co. on the Transvaal, both of which are backed by British capital. The last mentioned company is comparatively new and is just about to be reached by rails. Copper, Mr. Rogers said, is also found in what is known as the Katanga concession in the Congo, which is Belgian territory. These Congo deposits are believed to be enormous, but production is hampered because of the mineral being found in the form of carbonate, and fluxes are not easily obtainable, and only a small plant is in operation. Mr. Rogers pointed out that zinc properties are being developed at Zeerust, the Transvaal, and that the outlook there is promising. A little tin is found in the Transvaal and prospectors are continually looking for more. Mr. Rogers, who is an American graduate of Cornell University, handles mining machinery and represents several firms. American manufacturers send to South Africa over 60% of the drilling and cutting apparatus used there.

The annual convention of the MEESE & GOTTFRIED Co. was held at the home office in San Francisco December 30-31-1912. There were present besides the officers, the branch managers, salesmen, engineers, and department heads from Seattle, Portland, Spokane, Los Angeles, and San Francisco. Constant Meese, president, made the opening address on December 30, and F. Gottfried, secretary and treasurer, opened the second session on December 31. Many letters were discussed and important papers read, the following being of especial interest: 'Speed Reducers,' W. C. Constant, manager, San Francisco; 'Silent Chain Drives,' H. T. Hesselmeyer, chief engineer; 'Washing and Screening Plants,' F. J. Bodinson, sales engineer; 'The Factory,' W. A. Goeliner, superintendent; 'The Draughting Room,' G. E. Taylor, chief draughtsman; 'Screw Conveyors,' W. C. Conant, manager, San Francisco; 'Rope Drives,' H. T. Hesselmeyer, chief engineer; 'Elevating and Conveying Machinery,' J. F. Bodinson, sales engineer; 'Purchasing for a Manufacturing Plant,' Dave Young, purchasing agent; 'Advertising,' J. A. Bried, advertising manager; 'Salesmanship and Marketing of Our Products,' M. A. Zan, general sales manager. The annual dinner was held at the Commercial Club. The genial sales manager, Mano A. Zan, contributed greatly to the jollity of the occasion by forcing extemporaneous speeches on many who would rather have spent a month at their chosen work. At the conclusion of the dinner, H. T. Hesselmeyer, chief engineer, in behalf of his co-workers and as a slight mark of their esteem, presented handsomely engraved solid gold pocket-knives to both Constant Meese and Fritz Gottfried, the founders of the institution.

Catalogues Received

AMERICAN WELL WORKS, Aurora, Illinois. Bulletin No. 127, 'Economical Irrigation by Pumping.' 72 pages. Illustrated. 8 by 10 inches.

DEANE STEAM PUMP Co., 115 Broadway, New York. Bulletin D-225, 'Triple Plunger Artesian Well Pumps.' 16 pages. Illustrated. 6 by 9 inches.

JEFFREY MFG. Co., Columbus, Ohio. Bulletin No. 46. 'Jeffrey Swing Hammer Pulverizer for Laboratory Use.' 4 pages. Illustrated. 6 by 9 inches.

POWER & MINING MACHINERY Co., Cudahy, Wisconsin. Spanish catalog on mining and smelting machinery, etc. 112 pages. Illustrated. 6 by 9 inches.

EDGAR ALLEN AM. MANGANESE STEEL Co., McCormick building, Chicago. Bulletin No. 54, 'Renewable Point Dipper Teeth.' 12 pages. Illustrated. 6 by 9 inches.

THE HAYWARD COMPANY, 50 Church street, New York. Catalog No. 40, 'Orange Peel, Clam Shell, Drag Scraper Buckets, and Other Digging Machinery.' 94 pages. Illustrated. 9 by 12 inches.

CHICAGO PNEUMATIC TOOL Co., Fisher building, Chicago. Bulletins No. E-22. 'Heavy Duty Electric Drills for Alternating Current.' E-26. 'Universal Electric Drills Operating on Direct or Alternating Current,' E-27, 'Heavy Duty Electric Drills.' 34-G, 'Receivers.' All illustrated. 6 by 9 inches.

NATURAL GAS produced in Ohio in 1911 amounted to 49,449,749,000 cu. ft., valued at $9,367,347, and obtained from 450 wells. The consumption was 112,123,029,000 cu. ft., valued at $22,792,270. The difference between production and consumption represents the quantity piped from West Virginia and Pennsylvania.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

NO country subscriber has yet taken advantage of the much advertised opportunities afforded by the parcel post to send this editor a basket of fruit or a chicken—we just mention the matter.

SPOKANE is preparing for the second annual meeting of the Northwest Mining Congress, to be held February 19, 20, and 21. Visitors may be sure of a hearty welcome and an excellent time.

COPPER production at the Braden mine in December amounted to 910,000 pounds and the property has become the most important producer in Chile, one of the notable copper-producing countries of the world.

HORTICULTURE as an adjunct to gold mining is one of the signs of the times. The Natomas Consolidated has just established a large nursery, which is a reminder that this dredging company is as busy reclaiming as destroying land.

INCREASE in ship-building in the United States during the past year was remarkable, the tonnage built in the last six months of 1912 being 43 per cent larger than in the same period of 1911. Evidently the influence of the Panama canal is already being manifested.

GRANT by the Federal Government of permission to the Great Falls Power Company to extend its transmission lines over public lands clears the way for the electrification of parts of the main line of the Chicago, Milwaukee & Puget Sound railway and is an important move in the development of the natural resources of Montana that is a direct outgrowth from the development of copper mining in that state.

"WE lead, others follow," was once proudly announced by one of our contemporaries which has since adopted the 'By the Way' department first established in the *Mining and Scientific Press*, our convenient two-column measure and large faced type, and now plans to send its editors into the field and 'squirt some human interest into' its editorials. Apparently the policy of the *Press* commends itself to rivals as well as readers.

DIAMOND-DRILLING from the deep levels of the Goldfield Consolidated mine is to be done. The core-drill has been of great service in discovery of other minerals, and while in gold mines the irregularities of deposition prevent the drill being used to find ore, there is no reason why it should not be of great service in the preliminary task of finding

the veins, determining the formation, and working out the geological structure.

WASHINGTON and Idaho are among the states in which efforts are being made this winter to secure appropriations for geological surveys. Both states have large resources that wait development and both can well afford to spend the small sum necessary to secure expert aid in problems relating to mineral production.

ROCHESTER is the district of the hour in Nevada. It lies at the head of Rochester canyon, on the flanks of Crown Point, or Nenzel, as the newcomers are calling one of the peaks in the Humboldt range. The district is reached from Lovelocks and Oreana on the main line of the Southern Pacific. At present most of the traffic is by way of Lovelocks, from which point the journey may be made by automobile, though over a poor road leading first 18 miles up the valley parallel to the railroad, and thence up the canyon to the new town. The latter has telephones, boarding houses, assay offices, saloons, and all the usual hodge-podge of a new mining district. It also has at least one good property and abundant prospects of more. It is receiving the serious attention of experienced engineers and investors. The deposit which attracted attention to the district outcrops boldly at the head of the canyon. From this outcrop Mr. J. F. Nenzel shipped two carloads of ore early in December, that was said to be worth nearly $100 per ton, mainly in silver. The lode has been known to a few men for nearly a dozen years and has been repeatedly located and the claims allowed to lapse. Secrecy was maintained in part to avoid litigation growing out of conflicting claims and work was only begun in earnest when it was thought that these had been successfully harmonized. How important and how extensive the discovery may prove remains to be seen, but prospects now are excellent.

ADOPTION of small drills, which can be handled by one man, for mining in the Calumet & Hecla properties is being imitated by the other companies in the Lake Superior district and it is prophesied that within a short time their use will there be almost universal. Eastern market journals acclaim the change as "revolutionizing ground breaking," quite oblivious to the fact that a similar revolution has been in progress in Western mining districts for many years, without producing any startling upheavals. Whether large or small drills give better results depends largely on the use to which they are to be put. That small drills cannot do as much work as large in shaft-sinking or tunnel-driving, for example, is as evident as that small drills are better than large for stoping, especially in narrow veins. Striking the best balance between mechanical horsepower and human energy required is a problem of management. Where it is desirable to use a rather light drill it is obviously better to make it light enough for one man to handle, rather than employ two men for work which is but little beyond the power of one. It will be remembered that the long strike at Reefton, in New Zealand, was the result of the refusal of the miners' union to allow a single man to handle a drill, but the demand of the men was so obviously unreasonable that they were unable to enforce it. Considerable economy in mining costs has resulted from the use of the 'one-man' drill elsewhere, and there is every reason to believe that equally good results will accrue in the copper mines of Lake Superior.

California's State Mining Bureau

The State Board of Control, an excellent feature of the financial administration of California recently established, has been pointing out places where better methods would lead to more economical transaction of the business of the state. The efforts of the Board deserve the support of all good citizens, and it is a pity that other states do not maintain similar central business committees. It is in part because we do approve so heartily of the general purpose and work of the Board, that we regret to see that it has been led into making unfair criticisms of the State Mining Bureau. That the latter is not accomplishing all that it should for the benefit of the state is frankly recognized by its best friends, and by no one more frankly than Mr. W. H. Storms, the present State Mineralogist. In a recent editorial we pointed out that the state was keeping up an expensive establishment without making adequate use of the organization. The heavy overhead expense that must be met in some form is being paid; but no active study of the state's resources is being made, nor has any been attempted for some years. It avails little to pay the salary of a mineralogist or geologist, if no allowance be made for field expenses; and that is the situation in California. The museum, the library, the determinative laboratory, all these are good and all are necessary. Possibly the present expense of maintaining them is a trifle high, but, if so, no adequate analysis of the figures to prove it has been published. It is to be remembered that the money paid by the Bureau for rent goes back to another state department, and if the janitor and the stenographer receive a few dollars more per month than in a commercial office, the same is true of practically all minor state employees.

It is a well recognized rule that in government service less important positions are over-paid and high-grade men receive smaller salaries than those paid in private employment. Granting that there is room for a trifle of economy in the work now being conducted, no one can fairly maintain that any such amount could be saved from the present appropriation as would be needed if the Bureau took up the serious field studies that the times demand. The place to study the geology and resources of the state is in the field, and if the Bureau has any public function to serve at all, it would seem to be in promoting the economical development of the state's mineral resources. Mr. Storms has been given no money with which to do this work, and it is unfair to blame him for the lack of results. Such money as remained unexpended when he was appointed was needed to complete work undertaken by his prede-

cessor, and to realize as much as possible from expenditures, perhaps not well advised, but already made or contracted. The fact that the Board of Control criticises the making of trips to the mines, and evidently regards such studies as private work, shows a total lack of comprehension of the real field of usefulness of the Bureau. For the information of those who do not know, we may state that since Mr. Storms went into the office he has made no examinations for fees. He has taken the only proper attitude for a state officer, that if the examination was of public use he should make it for nothing, and if not, he should not make it at all.

As to the charges of financial irregularities, the answer is simple; it is merely a matter of bookkeeping. Those who have never worked for an American state or for the United States, may be interested to know that employees when on official journeys must usually advance their own money and await reimbursement at the later convenience of auditing officers. This often becomes a serious burden, for red tape is abundant and long, and auditors' hours are often shorter than are those of field assistants. We have known young men employed by the United States Geological Survey and earning less than $100 per month, who had several months' salary tied up in expense accounts. We have also known whole parties to be held at hotels on expense because money for traveling had not been advanced and personal funds were exhausted. Under these conditions a state officer who finds a petty cash account that can be used as a revolving fund, guards it zealously and considers himself fortunate. It happens that the California State Mining Bureau has such a fund, originating through gifts, and that the trustees, acting on the advice of counsel, refused to turn this into the general state treasury when demand was made by the Board of Control. Whether they were right in this is a nice legal question. In the meantime it has long been customary to advance from this fund money for traveling and other expenses requiring immediate cash outlay, and to accept a due bill from the employee receiving the money. Later the amount was refunded when the bills had been finally audited and state warrant issued. Since freight, express, and telephone bills for small amounts came in regularly, there was a standing due bill in favor of one clerk, to the amount of $50. This is the small basis of the big mountain of condemnation. In all the years no money was ever lost, and upon objection by the Board of Control the practice itself stopped several months ago. To state the case in such terms as to make it appear that employees of the department had been 'grafting,' is entirely unfair.

We have frequently criticised the State Mining Bureau. We have been frank in stating our belief that under Mr. Storms' predecessor the institution was of small benefit to the state. With the appointment of Mr. Storms to the position we had hopes that a better day had come. He is an honest able official who has greatly improved the work of the Bureau and has made the best of a bad situation. The organization, however, is wrong and the funds are inadequate. It will be remembered that in 1908 Messrs. F. W. Bradley, Curtis H. Lindley, and E. A. Stent, finding in a critical case that the trustees of the Bureau had no real control of its affairs, emphasized their disapproval by resigning. It is certainly an anomalous condition to have trustees and then leave appointments to a Governor at the same time that a Board of Control, acting for the state in general matters, presumes to decide whether or not individual field trips made by the State Mineralogist are proper. A fundamental change in the organization is necessary if efficient work is to be done. A free hand is needed if good work is to be accomplished even by the best appointee. In the meantime we urge candor and fairness in discussion of the situation.

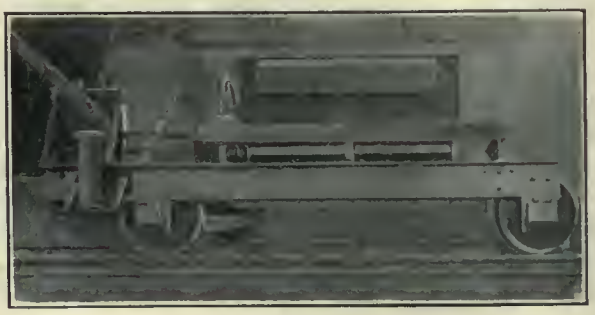
New Copper Production

Taken as a whole, the conditions at the close of the year, as shown by the report of the Copper Producers' Association, make the amount of new copper to come from the developments under way a more serious question for the coming twelve months than it has been during the past year. The Miami Copper Company is now producing at the rate of approximately 3,000,000 pounds per month; Greene-Cananea is producing more than 4,500,000 pounds; the Braden, which has only been in operation about one year, produced during 1912 something over 9,000,000 pounds, and is expected to yield something more than 40,000,000 during the coming twelve months; the Anaconda output for 1912 totaled, in round numbers, 294,700,000 pounds, as compared with 260,600,000 pounds for 1911 and 267,872,000 pounds for 1910, and so long as the present copper market holds may reasonably be expected to show further increases; the Guggenheim and affiliated properties, including Utah Copper, Nevada Consolidated, Ray Consolidated, and Chino, showed an increase in 1912 over the previous year's figures of 68,000,000 pounds, of which the greater part came from the two last named. Students of the situation anticipate that Ray Consolidated and Chino will probably more than double their present rate of output during the year to come. There are several important properties of less magnitude that must be taken into consideration in estimating the volume of new copper seeking a market in the near future. Among these may be mentioned the Hidden Creek mine, which is being rapidly equipped by the Granby, the Giroux, now making regular shipments to Steptoe, the Shattuck-Arizona, now sending its ore to the Calumet & Arizona smelter, and several Butte producers that are rapidly growing in importance. The Tuolumne has just opened a body of ore on the 2000-foot level: the Pilot Butte, which is a neighbor of the Tuolumne, is now in ore, and, taken as a whole, the Butte district is now prepared to play as large a part in the country's copper production as at any time in the past. It is easy to see that notwithstanding the enormous financial strength that is supporting the present copper metal market, the men in control will have their work cut out for them during the next twelve months unless recourse be again had to a policy of curtailment.

Lead Plant of the International Smelter

By L. S. Austin

The plant of the International Smelting & Refining Co., situated at the mouth of Pine canyon, four miles from Tooele, Utah, was originally built for treating the copper-bearing sulphide ore of the Highland Boy mine of the Utah Consolidated Mining Co. The smelter was arranged for five reverberatory furnaces of 200 to 250 tons' capacity each. It was intended that the supply from the mine should be supplemented by copper ores from other sources. The amount of Highland Boy ore fell off however, and it was felt that to operate the plant profitably, the tonnage should be increased by smelting silver-lead ores. The smoke from the plant is carried up the canyon, but this advantage is in part offset by the necessity of transporting custom ores up a grade with 500-ft. rise from Tooele Junction on the main line of the San Pedro, Los Angeles

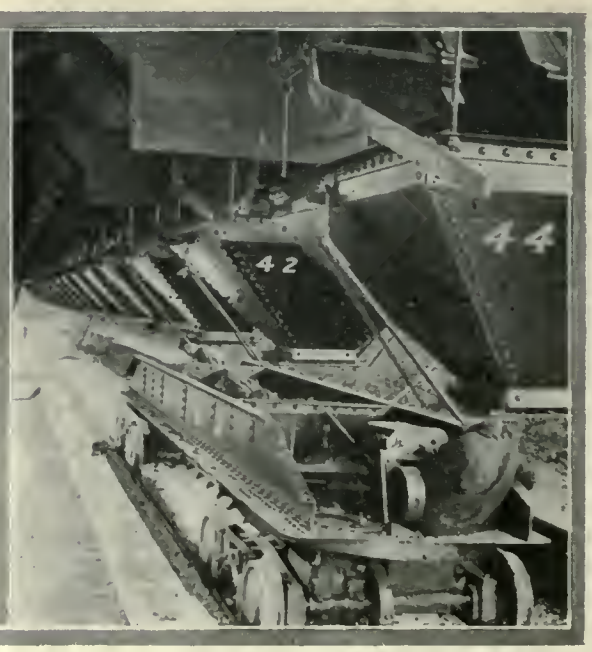


SINTER CHARGE CAR.

STACK OF LEAD PLANT.

SINTER MACHINE BUILDING, LOOKING NORTHWEST.

UPPER FLOOR OF FEED-BIN BUILDING.



FEED-BINS AND WEIGHING HOPPERS.

& Salt Lake railroad, 7 miles distant; this branch being a subsidiary enterprise of the company.

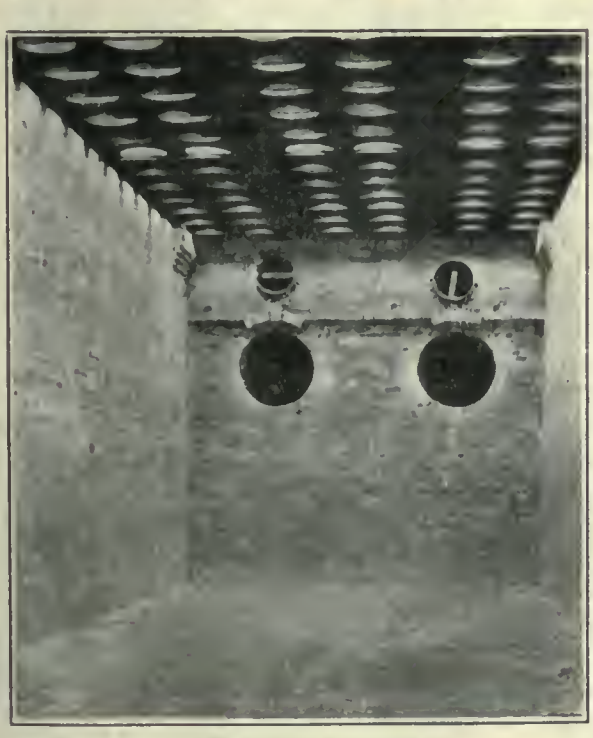
For the new lead-smelting department there was available the already existing trackage, receiving-bins, sampling-mill, crushing machinery, and a power plant, which obtained its steam supply from the waste-heat boilers of the reverberatories.

The transportation of ores and supplies at and within the plant is in the main effected by steam or electric locomotives and a terraced site is consequently satisfactory. The ores are dropped or shoveled from the railroad cars into the receiving bins, and as fast as sampled and crushed, sent by belt-conveyors to the feed-bins. There is little shoveling done except from cars which are not self-discharging. Before the beginning of lead-smelting, however, a large stock of ore was accumulated and this had to be put in stock-piles adjoining the yard-tracks. This ore had to be expensively handled and when sent to the furnace had to be picked up with the aid of a track-derrick and grab-bucket.

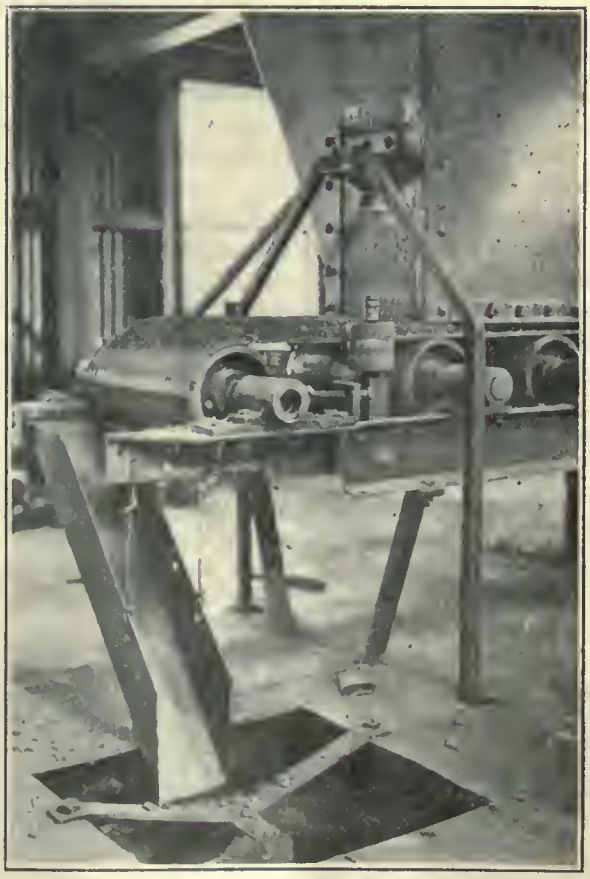
BLAST-FURNACE, SHOWING SLAG CAR.

LEAD KETTLE AND HOWARD PRESS.

It was planned to crush the lead-bearing ores and to mix them with flue-dust and sinter. This product was to be smelted in the blast-furnace, with the addition of some silicious ore and fluxes. The flue-dust, both from the blast-furnaces and from the sinter plant, was to be caught in flues and in a bag-house, the slag was to be wasted, the matte was to be treated in a converter (using the existing equipment and catching the converter fume in another bag-house), while the base bullion was to be remelted, skimmed, and molded into bars for shipment to the refinery of the company at East Chicago, Indiana.



LOWER CHAMBER OF BAG-HOUSE.



SINTER MACHINE FEEDER.

The ore, fluxes, and fuel coming in railroad cars

from the main line, arrive over the scales at the highest level, and after weighing are sorted upon any one of the six storage tracks. When they are discharged the materials are placed as follows: (1) The coke is dropped into one of the feed bins or is unloaded on a stock pile; (2) the coal goes to one of the western receiving-bins; (3) the ore and limestone go to the eastern row of receiving-bins. The building for the receiving-bins, 30 by 296 ft., contains a double row of sloping-bottom bins marked from 'A' to 'N,' and of different capacities. These have chutes at 10-ft. intervals, 28 to each row. The building extends north and south, while west of it, 30 ft. away, is the four-story sampling mill, in area 30 by 34 ft. Imagine a transverse plane at the middle of the bin-building; it will divide both mill and bins into duplicate sections, north and south, each taking from 14 chutes of the eastern row of storage bins. At the centre of the bin-building are four additional bins having hopper bottoms. The western row of receiving bins is devoted to supplying the copper department of the works, while the eastern row and the four centre bins receive ore and fluxes for the lead-smelting. Considering now either section devoted to lead-smelting; ore from any of the 14 chutes can be withdrawn upon an endless-apron feeder capable of being set by any desired chute. From the feeder the ore falls upon a 20-in. conveying-belt, which delivers it upon a transverse 20-in. conveying-belt taking it to the shaking-feeders of the first Blake ore-breaker in the mill. Beneath the four central bins is another troughed conveying-belt, which may be run in either direction and so may deliver upon the 20-in. transverse belt of either section as desired. The transverse belts are 25 ft. centre to centre.

At the mill, the transverse belt, as already stated, delivers to the perforated shaking-feeder where the fine ore is removed, the coarse going to the first crusher, set with a jaw-opening of two to three inches. The combined crusher product and the fine material are unitedly elevated to the top or fourth floor of the mill. The elevator discharge descends upon four Brunton samplers in sucession, one-fifth of the ore-stream being cut out each time or 1-625th in all, being 3.2 lb. per ton. The successive fifths as fast as they are cut out go through a crusher or through rolls before the next following cut is made. The rejected portions (or principal) drop into the boot of elevator No. 2 to be delivered to the crushing system of machines and trommels where all is crushed to pass a revolving trommel having ⅝-in. round holes. The crushed product is finally delivered upon a transverse 20-in. conveying-belt which drops it at the west side of the mill upon longitudinal 20-in. conveying-belts, these latter leading in three sections in series to the north end of the feeding-bin building, that building being 350 ft. directly north and in line with the receiving-bin building. The continuation of the high-line track through the latter building is carried through the feed-bin building. This building 30 by 250 ft. has 26 hopper-bins, which receive crushed ore not only from the movable tripper of the 20-in. conveying-belt, but from cars on the track alongside and parallel to it. The south feed bins are reserved for the crushed ore intended for the sinter plant; the north bins receive sintered ore, limestone, iron ore, and silicious ore intended for the blast-furnaces. Coke is stored in the north-end bins, but when the supply in them runs short, it is taken from the stock-piles.

At a distance of 125 ft. west of the south end of the feed bins is the sintering plant or building, 64 by 42 ft., which contains four 100-ton capacity Dwight-Lloyd sintering machines with grates 42 in. wide. The building is being extended northward to contain six additional machines. At the south end of the feed-bin building is a pit beneath the charge-track to contain the lower or feed-end of a belt-conveyor of an inclination of 18 degrees which leads to the fifth floor of the sinter-building.

Referring again to the feed-bins; each one may be regarded as in two, the upper or main bin capable of holding four carloads, while below it is suspended the weighing hopper equipped with Fairbanks scales which may hold a ton. From the bin, ore is withdrawn into the weighing hopper. Beneath the weighing hopper runs the charge-car track. There are two motor-propelled blast-furnace charge-cars and one sinter-furnace charge-car. Ore and coke having been drawn off into the several weighing hoppers, the charge-car is run under them successively and receives first the coke then the various items of the charge. As the material is dropped from the hopper the car is slowly and skillfully moved beneath the falling stream, so that it is distributed in the car to suit the running of the furnace. Thus it may be largely distributed at the ends, evenly throughout, or more to the centre of the car. The car is approximately as long as the furnace. When charged it is run to the furnace. To charge the furnace the car is run over it, the hinged shutters at the top of the furnace are opened, the bottom doors of the charge-car open and the charge drops a distance of nearly 12 ft. into the furnace. As the result of experience for a sinter charge the smelting column is carried at 10 to 12 feet.

The blast-furnace building, 30 by 75 ft., is on a side-hill site, and is 90 ft. north of the feed-bin building, its feed-floor being at the feed-track level The crucible floor of the furnace is 5 ft. above the slag-dump level. In this way the fore-hearth set upon the slag floor has plenty of height beneath the slag spout of the furnace. The distance from the crucible floor to the feed floor of the furnace is 30 ft. The building contains two furnaces 45 by 180 in. at the tuyere level and set 30 ft. centre to centre, set transversely to the building, so that there is a separate feed-floor track to each furnace. There are three wrought-steel jackets per side, each having four tuyeres or 24 to the furnace. The fore-hearth is 10 by 5 ft. and 5 ft. high with rounded ends. Each furnace has its own down-take, taken off below the feed floor, and leading to a cylindrical dust-catcher 20 ft. diam. by 20 ft. high. From each dust-catcher a branch 6 ft. diam. connects to the main flue 8 ft. wide by 12 ft. high, this flue having a V-shaped bottom with slides at intervals for the removal of accumulating dust. Provision is also made to withdraw the dust into a tram-car from the bottom of the

dust-catchers. The main flue, 525 ft. long, leads to the bag-house.

Herewith is given a typical blast-furnace charge. It will be seen that of the 4900 lb. of charge (not counting slag) some 70% is sintered material. The charge contains 902 lb. of lead, or 16.7%, from which should be subtracted 40 lb. contained in the slag, 60 lb. in the matte, as well as the flue-dust and volatilization loss; the latter two items being recoverable in the flues and bag-house. This charge makes slag of the composition SiO_2, 31%; FeO and MnO, 35.5%; and CaO, 17.5%. Of the total sulphur, 40 lb., or 1.5%, enters the slag, and 53 lb., or 30% of the whole, is volatilized. This leaves 84 lb. of sulphur, which should result in 380 lb. of matte, being a matte-fall of 7% computed on 5400 lb. of actual charge. Examination of the analyses of the items of the charge will reveal interesting details. A typical matte, specific gravity 4.897, is as follows:

	Per cent.
Pb	15.80
Cu	7.80
Fe	45.00
Zn	6.00
S, As, etc., by difference	26.20

Besides the above typical charge, a novel feature is the introduction, after every third to sixth of these, of a 'crude-ore charge' which contains about 1150 lb. of sinter only (23.5% in place of the usual 70). The object of doing this is to slightly modify the slag-type. This is in accord with observations already made by experienced metallurgists accustomed to the performance of the lead blast-furnace, who have noted that when a change occurred in the charge, it often resulted temporarily in a hotter corrosive slag which tended to remove accretions in the furnace and fore-hearth.

The slag, overflowing from the settler or fore-hearth, is received in conical slag-pots of five tons capacity. These are hauled to the dump by a 12-ton electric locomotive. Settling has been so well performed that both the molten slag and the shells are as a rule rejected. It has been found to be more profitable to smelt the converter slag from the copper-smelting department. A typical analysis of the rejected slag-shells contains: SiO_2, 32.5; FeO, 29; MnO, 6.0; CaO, 15.0; ZnO, 9.0; Al_2O_3, 4.0; S, 2.0; Pb, 1.2%; all by wet determination. The furnaces run rapidly; thus, on November 22, 1912, No. 2 furnace put through, on three shifts, 102 charges of 4900 lb., or 250 tons. The percentage of coke is from 12.5 to 14, or with the slag, from 12 to 13.5% of the charge. The limestone is coarsely crushed at the sampling mill, and is delivered by belt-conveyor to one of the feed-bins.

Crushed ore is weighed to the sinter-charge car, as already described for the furnace-charge cars, and from it is dropped through a hopper upon an endless-belt feeder. This delivers it to the inclined belt-elevator already mentioned. Arriving at the sinter building, it is taken by conveying belt to the hoppers of the sintering machines. The inclined conveying belt is stopped or started to supply the charge as desired. The materials are fed upon the sintering machine over a distributing apron which delivers it to the thickness of 4 in. upon the 42-in. endless slowly-moving grates. This machine is fully described by H. O. Hofman.* The discharge end of the machine is just outside the building, and the product drops from it through a grating into steel hopper-bottom railroad cars. These cars when full are switched around upon the high line and their contents dropped into the feed-bins.

The sinter charge may be quite variable, the sulphur ranging from 12 to 15%. Thus, in August 1912, a sinter charge of 4200 lb. when going to the machines was computed to carry SiO_2, 18 to 20%; Fe, 18; Pb, approximately 20; S, 14 to 16%. This was roasted until there remained 3 to 5% sulphur in the sinter. More recently leady oxidized ore with an iron excess has been added, raising the weight of the charge to 5200 lb., and it was found that the same number of charges could be put through as before, or that the capacity of the machine was increased in that proportion. The table on the following page represents this charge.

From this it is to be seen that as high as 26%

Trans. Amer. Inst. Min. Eng., Vol. XLI, p. 759.

TYPICAL BLAST-FURNACE CHARGE

	Wt.	Pb %	Pb Lb.	SiO_2 %	SiO_2 Lb.	Fe and Mn %	Fe and Mn Lb.	CaO %	CaO Lb.	S %	S Lb.
Sinter	3450	24.0	828	20.5	707	25.0	862	5.4	117	4.4	151
Siliceous ore:											
A	250	2.0	7	55.0	137	14.0	49	...	...	...	...
B	100	2.5	3	50.0	50	16.0	16	...	...	13.0	13
Baghouse fume	100	58.0	58	1.0	1	1.0	1	2.0	2	6.2	6
Iron ore	200	3.0	6	11.0	22	41.0	82	9.0	18	...	...
Limestone	800	...	...	2.8	22	0.5	4	51.0	408	...	...
Coke	700	...	...	5.0	35	2.0	14	0.5	3	1.0	7
Slag shells	500	1.0	...	...	...	...	...	...	...	...	...
	6100		902		974		1028		548		177

Weight of charge 4900 lb.

Slag—	%
SiO_2	31.0
FeO and MnO	35.5
CaO	17.5

SiO_2 974
FeO, MnO. 1107
CaO 548
2629 84% of slag
Total slag..3130 lb.

Fe for matte 168
7)860
123
9
1107

S in slag....40
S volatilized..53
— 93
S in matte... 84
2
Fe for matte. 168

$$\frac{84}{0.22} = 380 \text{ lb. matte and } \frac{380}{5400} = 7\% \text{ matte fall}$$

of lead is carried, while the silica has dropped off. Again, 10,198 tons roasted in September contained in the raw charge Pb, 19.3%; SiO_2, 19.4; Fe + Mn, 20.6; S, 15; CaO, 3.7%, while the corresponding sinter contained Pb 21.1; SiO_2, 22.8; Fe + Mn, 25.8; S. 4.7, and CaO, 4.5 per cent.

again opening the pores of the cloth. This work is performed without the necessity of anyone entering the house. The dust contains 58% lead. It is burned on the floor of the chamber, sintering and forming a product that can easily be used at the smelting plant.

SINTER CHARGE, NOVEMBER 1912

	Wt.	Pb %	Pb Lb.	SiO_2 %	SiO_2 Lb.	Fe %	Fe Lb.	CaO %	CaO Lb.	S %	S Lb.	Zn %	Zn Lb.
Ore A	700	20.0	140	26.0	182	16.0	112	...	..	22.0	154	1.0	7
" B	700	3.0	21	11.0	77	43.0	301	9.0	63	...	...	...	...
" C	800	28.0	224	7.0	56	23.0	184	3.0	24	0.8	6	1.5	12
" D	700	50.0	350	10.0	70	10.0	70	...	..	12.0	84	6.0	42
" E	400	41.0	164	10.0	40	10.0	40	...	..	12.0	48	6.0	24
" F	100	46.0	46	23.6	24	6.8	7	...	..	10.0	10	6.0	6
Flue dust	400	20.0	80	25.0	100	25.0	100	10.0	40	7.0	28	4.0	16
Concentrates G	500	32.0	160	4.0	20	14.0	70	...	..	27.5	137	15.0	75
" H	700	9.5	67	11.5	80	24.5	171	...	..	32.0	224	6.5	45
Ore I	200	50.0	100	8.0	16	16.0	32	...	..	...	...	...	...
	5200		1352		665		1087		127		669		227
			26%		13%		21%		3%		13%		4%

The base bullion is tapped from the lead-well into wheeled pots or bowls that hold 3 cu. ft., and are taken to the drossing plant, where the lead is dumped into one of the two kettles, each of which will hold 33 tons of lead. When full the kettle is skimmed, using a Howard press, the skimmings or drosses being returned to the blast-furnace while the clean base-bullion is siphoned into 100-lb. bars. For sampling the product, there is used a mold with 10 conical depressions, each holding approximately half an assay-ton. In taking the sample from the kettle, the skimmed bullion, at the temperature of 400°C., is agitated from the bottom by stirring-paddles and the sample removed from time to time as the charge is siphoned into the molds. These half assay-ton samples are subsequently assayed without trimming to the exact weight, the assay value being adjusted to the plus or minus error.

The bag-house, of brick, 56 by 111 ft., and lying east and west, is divided into seven bays and has a steel truss roof covered with tight tongued-and-grooved boards with a patent roofing. In each bay are 144 cotton bags 31 ft. long by 18 in. diameter, making a total of 1008 bags in all. The temperature of the entering gases is maintained at 150°F. On the north side of the house is a brick flue, 6 ft. wide by 13 ft. high inside, the top three feet being divided off horizontally to form a top flue. In the top compartment are openings below the thimble-floor 18 in. diam. and in the lower similar openings 36 in. diam. These openings are closed by disk-valves operated outside the flue by their stems. The top flue is the reverse-current flue, which is connected to an independent fan. Generally, the gases are passing into the bag-house by the lower flue, being driven in by a large centrifugal fan run by a 100-hp. motor. The bags of each section are shaken six times daily, the procedure being as follows: The lower valves of the section are closed, the upper ones opened. The bags are thus collapsed and the attached dust loosens and falls into the chamber beneath the thimble-floor. The valves are next changed, expanding the bags. This operation of expanding and collapsing, being repeated three or four times, frees the bags from most of the dust,

The composition of the blast-furnace matte has already been given. This is to be treated in a basic-lined converter belonging to the copper-smelting department of the works, an equipment already available for use. For the recovery of the lead in this matte, which is volatilized in the bessemerizing operation, a bag-house as large as the one just described has been provided. It will thus be seen that there is no roasting of the matte nor of its return to the blast-furnace charge, but the matte, as fast as made, is sent for treatment to the converter. The copper, the product of this operation, is yielded as blister copper available for electrolytic treatment.

Some further description of the illustrations will be of interest. The sinter-charge car is shown in position to drop its contents into a hopper. An endless-belt feeder delivers upon the feed end of the inclined belt-conveyor leading to the sinter mill. The sinter-machine building is five stories high. At the right is the feed-bin building. The inclined belt-conveyor from the south end of the bin building takes the sinter charge to the fifth floor of the sinter building. At the left is seen the sinter machine discharge. This drops into the railroad car below. The horizontal pipe in the foreground carries the fumes from the machines to the lead plant chimney. At the left of the chimney is the feed-bin house; at the right, the bag-house. In front, entering the chimney, is the sinter plant flue. The downtake from the bag-house to the stack is shown.

The illustration of the blast-furnace and accessories shows the slag-car and forehearth. The crucible floor-level is 5 ft. above the slag-floor. Matte is withdrawn at the other side of the forehearth. Base bullion is tapped into the 3-ft. wheeled bowl at the near side of the furnace. In working the lead kettle the follower is raised and the Howard press lowered into the molten lead. The mold is filled with the skimmed drosses. The press is now raised and the follower pushed into it as shown. The molten lead is squeezed out. The press is now moved over and the bottom dropped. The drosses fall out on an inclined surface, ready for removal to the blast-furnace.

Secondary Sulphide Enrichment of Ores—II

By C. F. Tolman, Jr.

Various Types of Enrichment

Gold Enrichment.—It is unnecessary to discuss further the enrichment and impoverishment of gold deposits, as W. H. Emmons' paper, already cited, is accessible to American engineers. In addition to the rearrangement of metals that takes place above and at the top of the oxidized zone, by means of ferric and manganese solutions, there has often been noted a moderate increase in the gold and decrease in silver content to considerable distances below water-level. It is not certain whether this is due to an actual enrichment in respect to gold, or is an apparent enrichment due to the decrease in the relative amount of the sulphide minerals.

Silver Enrichment.—Silver undergoes both oxide enrichment and sulphide enrichment, the first often more important on account of the insolubility of the oxidized products. C. R. Keyes[33] has emphasized the fact that the ground-water of the semi-arid regions contains a large amount of chlorine, and the formation of the little soluble haloid compounds is the result. It is known to the prospector that the pocket-like bonanzas of silver ore in the Southwest are generally superficial. (Note the term 'chlorider' is applied to the miner in the Southwest who works any rich ore pockets, especially those close to the surface.) There seems to be another factor of importance to explain the great decrease in grade of silver ore at the water-line in such famous bonanza silver mines as Tombstone, the Commonwealth, and the Jack Rabbit mines, all in Arizona. In all these cases, great flows of underground water were encountered when the attempt to pump the mines was made. It is possible that the veritable 'sea' of underground water so diluted the downward creeping silver-bearing solutions that their silver content went into solution instead of precipitating.

When the descending solutions are acid, and chlorine is not an important constituent, valuable silver sulphide enrichments may develop, especially in connection with copper deposits.

Lead and Zinc Enrichments.—It is difficult to recognize a secondary lead or zinc sulphide by mineralogical criteria, because both primary and secondary sulphides form the same minerals. I have, however, examined specimens of lead ore in which the outer portions of the galena crystal assayed over 100 oz. in silver per ton, while the centre core carried between 5 and 10 oz. Here the silver-bearing galena was a secondary sulphide. Established cases of secondary enrichment[34] have been described, but they will not be considered here, since this paper deals chiefly with the more important and interesting copper enrichment.

Enrichment of Copper Ores.—Copper enrichments fall into three distinct types, which are represented by the three well known ore deposits of Butte[35], Bisbee[36], and Ray[37].

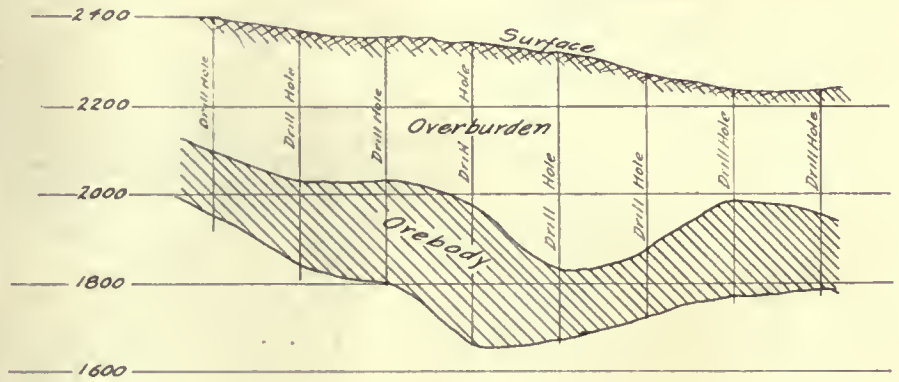


Fig. 3.

In the Butte type, the enrichment is caused by cupreous solutions, strongly acid in composition, descending to great depths along strong lines of fissuring. The granitic country rock does not neutralize the solutions to a marked degree and the secondary alteration is largely a kaolinization of the country rock.

At Bisbee the deposits are in limestone, the descending solutions reacting with the $CaCO_3$ to form carbonates of copper which migrate downward very slowly, the solutions are neutral, or even alkaline (oxidation is artificially accelerated by mine workings, and the solutions are therefore more acid than under conditions actually obtaining when the deposits were formed). And the sulphide enrichment occurs as layers around kernels of low-grade pyritic ore.

In the disseminated type represented by Ray, the solutions diffuse downward throughout the mass of fractured altered rock. The solutions remain acid wherever they are concentrated, but may be neu-

*Continued from p. 38.

[33] *Trans.* Amer. Inst. Min. Eng., Vol. 42, pp. 500-518, 1911.

[34] Spurr, J. E., and Garrey, G. H., U. S. Geol. Surv. Prof. Paper 63, pp. 143 and 190.

[35] U. S. Geol. Surv. Prof. Paper 74.

[36] U. S. Geol. Surv. Prof. Paper 21, and *Mining and Scientific Press*, Vol. 99, pp. 356-360, 1909.

[37] *Mining and Scientific Press*, Vol. 99, pp. 622-624, 1909.

tral or even alkaline (see discussion above), and then may be highly charged with silica. The deposits take the form of a wide-spread sheet at or near the water level. (Fig. 3.)

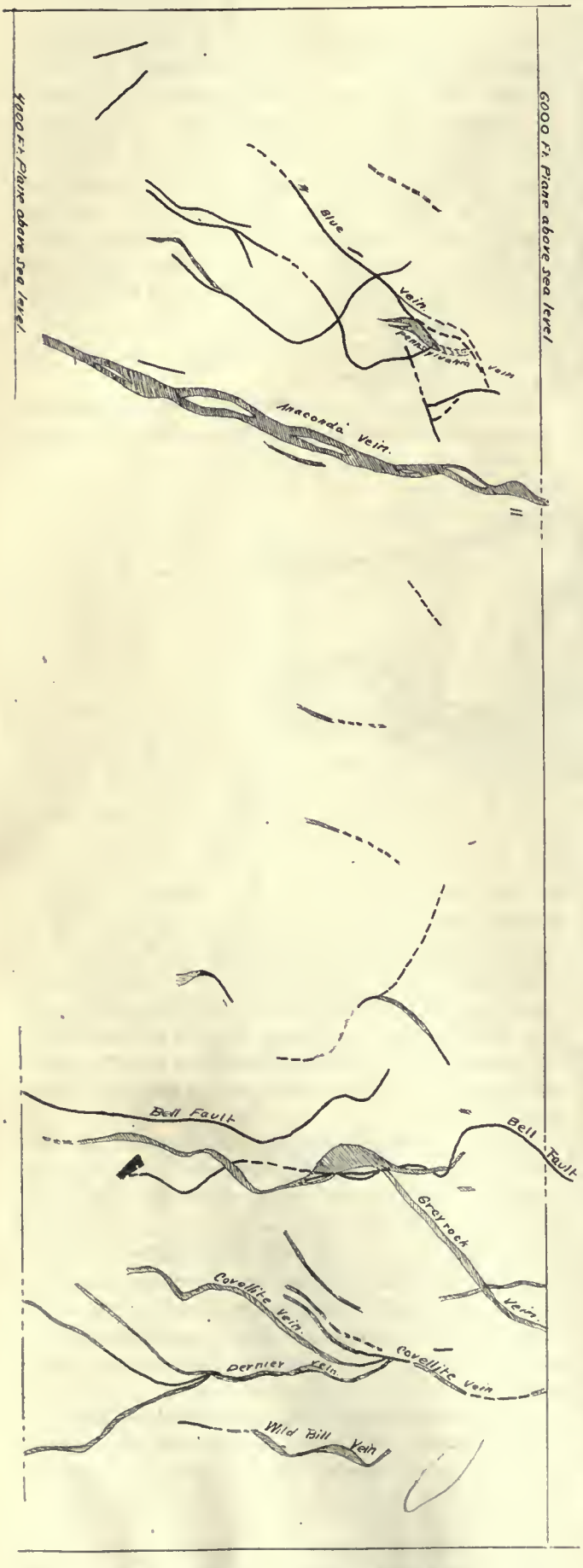


FIG. 4. CROSS-SECTION OF ANACONDA, GREY ROCK, COVELLITE, AND WILD BILL VEINS AT BUTTE.

(The shaded areas represent copper ore; the solid lines, barren fissures and faults.)

Structural Relations Governing Secondary Sulphide Deposition

1. *Strong Faults, Veins, and Reopened Fissures.*—Butte is the classic example of great secondary concentration down fissures (Fig. 4). The earliest ore deposition occurs as massive quartz pyrite veins, which have been broken and rebroken, the earlier periods of breaking being accompanied by renewed ascending metallizing solutions, but with each break secondary enrichment also penetrated from above, and the great bonanzas were formed near the water level, and lower-grade deposits to great depths.

The Old Dominion mine, Globe, Arizona (Fig. 5) is an example where a prominent break (fault) governed both primary and secondary deposition of ore. On the hanging wall of the fault underneath

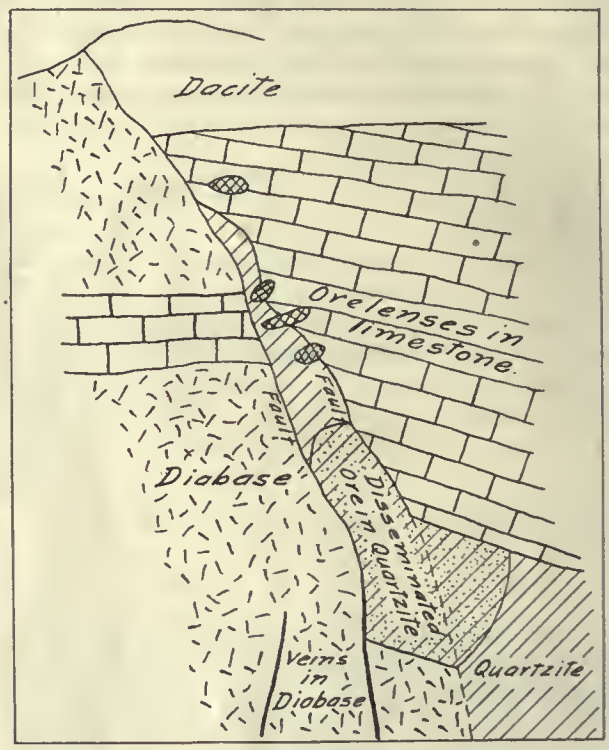


FIG. 5.

the dacite flow is first limestone, then quartzite, and then diabase. In the limestone there are great lenticular masses of iron oxides carrying oxidized copper ore, the value of which have been concentrated by oxide enrichment, but no sulphide enrichment occurs. The brittle quartzite was crushed by the fault movement and enriched disseminated sulphide ores occur in the shattered quartzite, while in the diabase the fissures are well defined and narrow enriched veins of sulphide ore are developed.

Some years ago I observed in the Capote workings at Cananea, Mexico, a curious case where structural features localized oxidation and sulphide deposition without regard to the water-level. (Fig. 6.) Here the well developed hanging wall of a vein allowed a rapid downward oxidizing circulation which developed oxidized ores from the surface down. The solutions working inward toward the foot-wall produced a secondary sulphide enrichment which developed under the oxidized ore.

2. *Ore Blankets Caused by the Leaching of a Permeable Copper-Bearing Formation.*—The great 'por-

phyry coppers' of Utah, Arizona, Nevada, and New Mexico fall under this head. The accidental structural troughs, and the relations of present and past topographies modify the form of the deposit and govern the amount of enrichment, but nevertheless they all have certain features in common:

(*a*) The primary ore in an impregnation of an extensive mass of rock by copper-bearing pyrite. Whether the original ore was a mixture of pyrite and chalcopyrite or was cupriferous pyrite, the result of leaching and concentration has been the same.

(*b*) The entire mass is permeable to descending solutions, and therefore the portion above water-

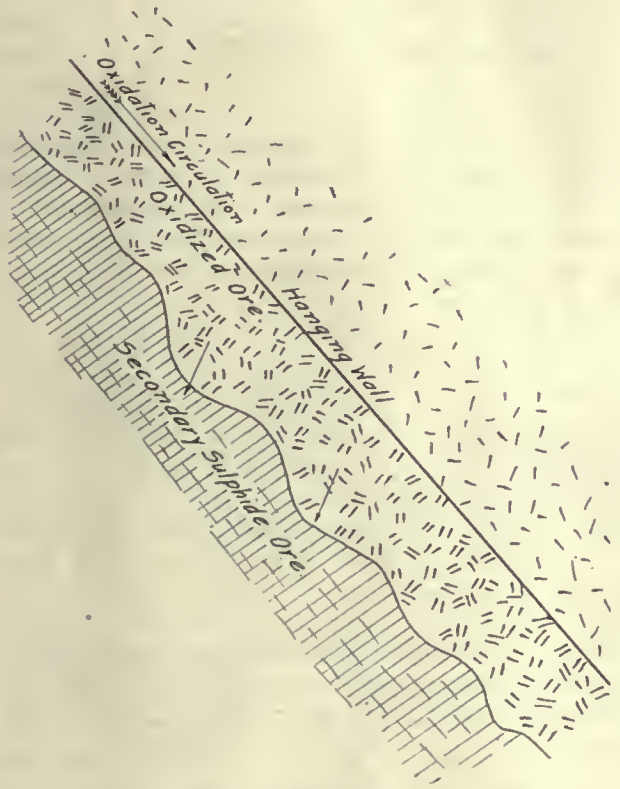


Fig. 6.

level is leached, and the metal is deposited below as an extensive sheet of ore.

(*c*) The rich ore is deposited generally at the top of the orebody, where the chalcocite may completely replace the pyrite. With depth the chalcocite decreases in amount, appearing as shells around the pyrite grains, finally completely disappearing where the primary ore is reached.

Effect of Rock Composition, Topography, Climate, and Structure on the Formation of Disseminated Ore

The composition of the rock will often be an important and at times the controlling factor governing sulphide enrichment. I have met so many instances where dense contact metamorphic ore deposits of closely intergrown garnet, epidote, quartz, pyrite, and chalcopyrite have successfully resisted the attack of oxidizing solutions, that I have come to believe that only under unusual conditions can such orebodies be leached and enriched. On the other hand, a contact deposit of coarse granular garnet readily goes to pieces in the belt of weathering. In addition to the power of resistance of the rock to physical and chemical disintegration, the question as to whether or not the underlying rock contains a precipitating agent may become important. Theoretically a case may be postulated where the descending waters are conducted out of the pyritized zone into a rock which contains no sulphides. Such a case would be more likely to occur where the enrichment has been a long continued process during which there may have been topographic changes and faulting. A number of examples are believed to have occurred in the Globe district, Arizona. When the Miami Copper Co. discovered the remarkable orebody in a schist whose surface is stained with carbonates and silicates of copper and which is now worked, it was to be expected that the still more strongly copper-stained and brecciated schist area of the lower Pinto creek would be tested. Deep drilling, however, showed that carbonates and silicates predominated to the greatest depths reached and the interesting question (especially to those who bought stock in the Cactus Copper Co.) is, why so little chalcocite was deposited from solutions that carried such large amounts of copper. As has already been suggested in the case of the Miami foot-wall, it appears that the brecciated zones down which the solution drained contained little pyrite, and hence secondary silicates and carbonates were deposited to great depth.

Topography and Enrichment

The reader who has followed the discussion so far will have obtained a general idea of the close relations of enrichment to topographic development of the region. A few of the more important relations will be stated concisely and illustrated by figures.

Case I. Youthful topography with vigorous erosion in gullies. (Fig. 7.) The result is that the secondary sulphides are concentrated under the hills.

Case II. Extreme youth and very rapid erosion in the gullies; or uplift and rejuvenation of gully cutting. (Fig. 8.) Result, the valleys have cut into primary ore, and since the migration of the copper

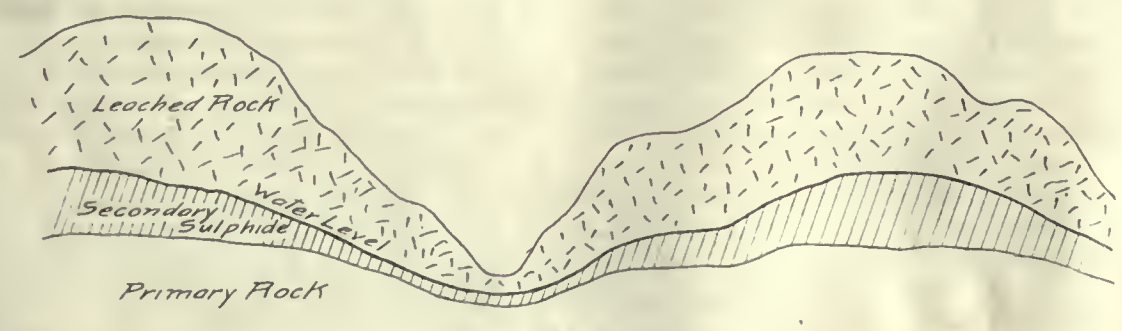


Fig. 7.

is slow the enrichment may be far above the water-level.

Case III. The country is stationary and the topography is mature. (Fig. 9.) Result is that the

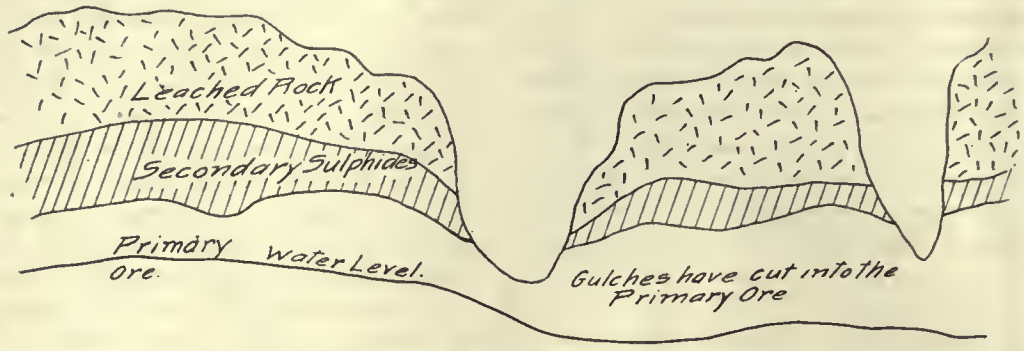


FIG. 8.

secondary sulphides have concentrated under the drainage lines, being much thicker here than under the hills.

These three cases cover most of the disseminated deposits; the Inspiration orebody, Arizona, comes under case I; Morenci, Arizona, illustrates case II, the deep gullies cutting far down into the zone of primary sulphides, and the enriched ore being far above water-level; the deposits at Ely, Nevada, probably fall in part under case III, the greatest deposits lying under Copper Flat.

The Iron Cap as an Indicator of Sulphide Enrichment

A long continued process of enrichment below, accompanied by the erosion of the surface, gradually destroys the prominent 'iron' outcrops. Many of the greatest copper mines have only insignificant outcrops (examples, Butte and Morenci), while many imposing iron caps of the Southwest overlie deposits of pyrite with only low content in copper, or develop over quartz-magnetite deposits where even the pyrite is scarce. The common practice of the prospector to judge the value of a copper deposit by the development of the iron cap is apt to lead to disappointment.

The Lava Cap Problem

A large number of the Western mining districts were flooded with lava after the primary mineralization had taken place, these flows occurring at various times. The moment that erosion exposes the primary deposit to the attack of surface waters, enrichment starts. The date of the formation of the primary ore deposits varies from the late Jurassic period through the Cretaceous and into the early Tertiary. In places where erosion has proceeded rapidly, surface waters may have been busy rearranging metals through Tertiary and Quaternary times. It is to be expected, therefore, that at the time some of the caps were formed, valuable secondary enrichment had been developed. The lava cap and the rise of the water-level necessarily accompanying the filling of the valleys, and the addition of a rock stratum, protect the deposit from further attack of surface waters until erosion has cut away a considerable portion of the lava. In several of the copper districts the problem has arisen as to whether the enriched ore extends under the remaining cap of lavas. The value of such pre-lava enrichments compared with that caused by both the earlier and later cycles may be judged to some extent by the relative amounts of pre-lava and post-lava erosion. In Fig. 10 the amount of rock attacked by post-lava processes (*b c d*) is small compared with that worked over by erosion during

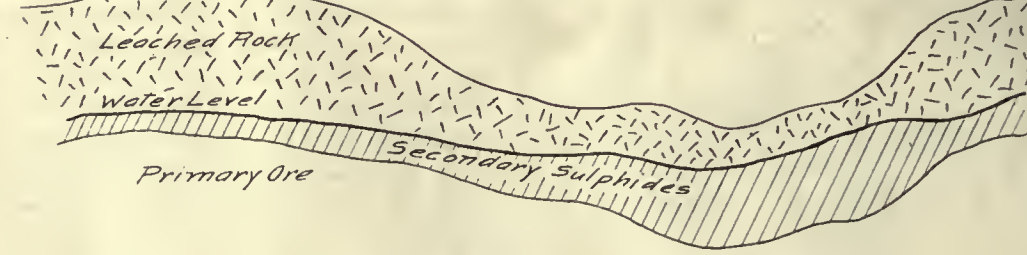


FIG. 9.

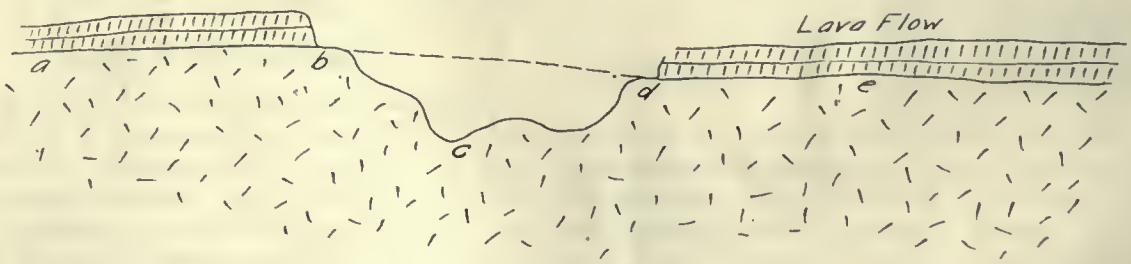


FIG. 10.

the development of the flat erosion surface *abde*. Therefore the chance of finding enrichment under the lava is good provided the primary mineralization extends out in this direction.

The Canyon and Delta of the Copper River in Alaska

By Lawrence Martin

The canyon by which the Copper river crosses the Chugach Coast range in Alaska is over 100 miles long and 4000 to 7000 ft. deep, the width varying from two and one-half to four miles. The heights specified are attained within one to three miles of the river. The Copper River canyon is, therefore, deeper in places than the Grand Canyon of the Colorado, with which it forms numerous contrasts because of profound glacial erosion. At its northern end is Wood canyon, which is apparently due to post-glacial incision following glacial diversion of the Copper river, rather than rejuvenation through warping as postulated by A. C. Spencer. The former Copper River glacier widened and deepened this canyon tremendously, as is shown by oversteepened valley walls, truncated spurs, and hanging valleys. The grade of the river in the canyon is 3½ to 5 ft. to the mile. The canyon terminates in a flaring lower section interpreted as a former fiord, now filled by the glacial sediments of the Copper River delta, whose area exceeds 500 square miles. On this delta detailed measurements of width and depth and of the rate of stream flow in the several distributaries furnish important data on the carrying power of glacial streams. Comparative studies in several show the rate of deposition and of erosion. Borings by the railway engineers show the nature of outwash material below the surface at several positions and depths on the delta. Vegetation below present sea-level in these borings proves recent sinking of the land. The existing glaciers of the Copper River canyon dominate the river in places, causing the deposition of outwash gravels in one area of over 50 square miles above a glacier dam. The distribution of present-day vegetation in the canyon suggests a recent pre-historic period of glacial expansion. (Read before the Geological Society of America, December 1912.)

Manganese mining in Russia is largely in the hands of Germans. The production has been considerably discouraged in the past by recent high freights, but when it is possible to get manganese cheaply from the Caucasus to the European markets the mines will no doubt promptly respond to the call. The production in the first half of 1912 was 120,032 tons, against 97,475 in the first half of 1911, in South Russia. Export from the Caucasus has largely increased this year.

Mercury reduction works at Bachmut, Russia, are to be reopened after having been closed for some time. Russia, once a well known producer of quicksilver, for a year or two fell out of the ranks altogether, but is coming back.

Concentration of Dissolved Metals in Slime Ponds

By M. W. von Bernewitz

A millman at Tonopah recently said to me, "When anybody states that there is no dissolved metal going out with the residue, I doubt it." And most people will agree with him. At Kalgoorlie, especially from the ponds consisting of finely ground roasted ore, the clear water floating off has at times assayed from 6 to 20c. per ton, and has been clarified, strengthened by addition of a little lump cyanide, and the metal content precipitated on zinc shavings. The water always shows cyanide by test, at one mine averaging 0.003% KCN. At another mine, lessees of the ponds did fairly well for a time; but on the whole there is little profit to be made in this way.

In *The Mining Magazine* for June 1910, G. B. Butterworth describes the sampling, erection of plant, and results of a dump of roasted ore which had been treated in the usual way at Kalgoorlie and discharged from cars. In this case, sampling was inaccurate, as "this is a case in which a portion of the gold in the residue was converted into soluble gold, in the presence of even such a small quantity of cyanide as remained after the final fresh-water washing, during the air-drying and subsequent handling, until it was buried in the dump. The rain soaking through would then be a solvent, and the sun would draw the moisture, carrying gold, to the outside crust; this would be deposited by evaporation as a soluble salt of gold."

In the Tonopah district quite a new industry has sprung up of late in recovering from the slime ponds the soluble silver salts which rise to the surface by the combined action of moisture in the dumps, heat of the sun, and capillary attraction, or in other words, evaporation of weak cyanide solution which carries dissolved metal. The salts form a crust with the top ⅛ in. of slime, and are collected by scraping with garden hoes or whisk-brooms. A great deal depends on the weather, and warm weather is most desirable. The value of the product depends on the care taken by the men in scraping it up, as digging too deep is like adding waste to ore. I was told that the *caliche*, as it may be called, varies in value from $30 to $130 per ton, and will average $40 per ton, while the cost of scraping and treatment also varies, since one man can collect 2000 lb. per day at $4, if the deposit is thick; but he will average only about 1000 lb. with the usual thin layer. Then there is the company's royalty to be paid which amounts to 35% in one instance. At the Belmont mill, at Millers, the *caliche* is sampled, fed into a tube-mill, and then mixed with the pulp, undergoing the usual treatment, while at the Extension it simply passes through with the ore after being sampled. One lessee ships his product to the Selby smelter at San Francisco. Even if the cost of collecting and treatment reaches $13 per ton (a figure given me as correct), there is a good profit in it for both the lessees and the companies.

Shaft-Sinking for the Rondout Siphon

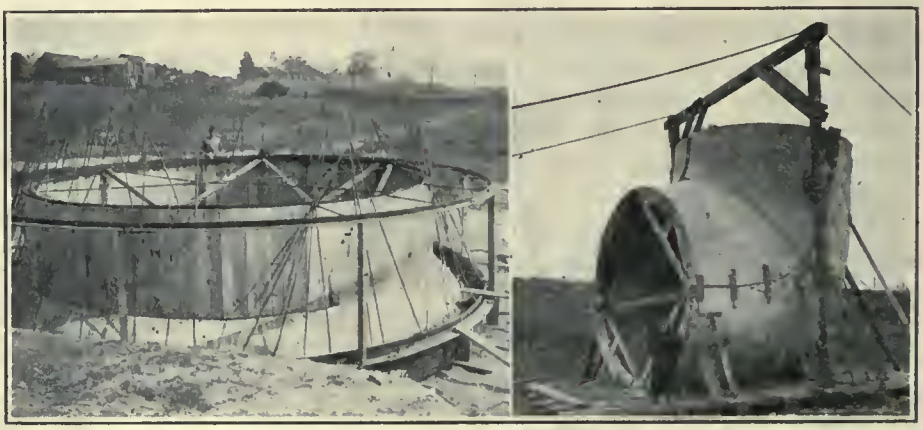
By J. F. Springer

*The sinking of shaft No. 4 for the Rondout siphon of the Catskill aqueduct has been described in detail elsewhere. It will suffice here to give only a brief account of some of the difficulties overcome. The strata which had to be penetrated were as follows:

	Feet.
Glacial drift	6
Helderberg limestone	226
Binnewater sandstone	39
High Falls shale	92
Shawangunk grit	134
Total	497

A 4-in. bore-hole had been put through the prism which the shaft would occupy. Water was to be expected in the sandstone and shale. However, long in advance of reaching the Binnewater sandstone, that is to say, at the 80-ft. level, water came in through the bore-hole, catching the contractor unprepared and flooding the shaft to the 40-ft. level. The water was pumped out to a point within a short distance of the bottom, and preparations made to fill the bore-hole with cement grout. A nipple was driven in and casing attached. Within this a 1-in. pipe was put down to about the level of the grit, 363 ft. below the surface. The water was then permitted to return, thus eliminating currents. The cement grout, made 1 to 1, was now put down the pipe, the purpose being to seal up the hole and its ramifications. As the grout was put in, the pipe was withdrawn. This hole seems to have given no further trouble. However, fears were entertained as to trouble below. These fears were abundantly realized, although no additional trouble of an especially serious character from water appears to have arisen until after the attainment of the 260-ft. level. At this moment only about 225 gal. of water per minute was coming in. However, while the sump was being drilled, there occurred a sudden inrush of 600 gal. per minute through one of the drill-holes. A second flooding now took place, apparently because of this flow through one small hole. The shaft was then unwatered, only to be flooded three times more in as many weeks. Water had now conquered five times. Large openings in the rock were ascertained to exist only a short distance below the point of excavation. One 8-in. crevice was only 1½ ft. below. If 2-in. bore-holes gave so much trouble, what would happen when larger openings were exposed? Effective preventive measures were imperative.

It was determined to attempt to seal the openings and connections with cement. Four grouting machines were set up at the surface, and 2½-in. piping with terminal 2-in. delivery tubing was put in place. When grouting was begun, trouble was experienced with back-leakage. This was overcome by mixing finely ground horse-manure with the grout. A total of 2900 bags of portland cement was used in the sealing operations. A few more holes were drilled and some additional cracks filled, 60 bags of cement being thus consumed. It was not deemed advisable to proceed with the excavation until further precautions were taken. There was still a distance of 100 ft. to the grit. Six drill-holes, three yielding 1-in. cores, and three 8-in. cores, were now put down through the intervening material, and the grouting processes again carried out. The pressure employed was 275 lb. per square inch; still only 175 bags of cement was consumed. This amount was so small comparatively that it was a question whether the problem had been an easy one, or whether it had been only imperfectly solved. Sinking was, however, resumed, and a depth of 320 ft. reached without serious mishap. A couple of collecting-rings had been arranged, and the shaft was nearly filled with sinking-pumps. It was now determined to construct a special pumping chamber to one side, and to install in it a powerful plant. Before these plans were carried out, however, the sixth and last flooding took place. The special chamber was situated at the 309-ft. level, and had a height of 10 ft. and a floor area of 17 by 24 ft. Underneath the floor a sump, 5½ ft. deep and 16 by 22 ft. in horizontal section, was provided. Its capacity was, therefore, 14,500 gal. In this chamber were installed three horizontal condensing pumps, built by the A. S. Cameron Steam Pump Works, New



STEEL SHOE FOR CONCRETE CAISSON, SHAFT No. 2. FORMS FOR DOWNTAKE SHAFT.

*From *Western Engineering*, January 1913.

York City. Each of these was of the 24 by 10 by 20-in. size, and the combined capacity was 1050 gal. per minute. Steam was supplied by three 100-hp. boilers set up at the surface. It seems that this special chamber, with large pumping plant and sump, should have been provided at an earlier stage of the sinking operations. It would appear that if this measure had been taken at or near the 200-ft. level, provided that conditions permitted, only one flooding might have taken place. That this shaft earned the descriptive adjective 'wet,' will be readily granted from the foregoing and from the fact that 86,181,000,000 foot-gallons of water was pumped therefrom during the eighteen months of its construction. The total cement consumed was 971 barrels.

CONCRETE BULKHEAD NORTH OF SHAFT No. 4.

At shaft No. 1, the overlying earth covering the rock was 83 ft. deep. It was proposed to pass through this bed, consisting of bonider clay, by means of an open cylindrical caisson of reinforced concrete. It is said that this shaft might have been sunk with the aid of timbers. The concrete caisson was employed, however, for the reason that the specifications required the removal of all timber down to the ground-water level before putting in the permanent lining. However, for a short depth timbering was employed. Then, at a point 23 ft. below the surface, a steel riveted cutting-edge was constructed, together with an interior form, the latter to give shape to a section of the concrete caisson. The external cylindrical surface was formed by the clay wall of the excavation itself. In this way a caisson 25 ft. in height was constructed. There was then considerable weight resting on the cutting-edge.

Excavation by pick and shovel was then started, a derrick taking away the spoil. This caisson sank vertically until a depth of 26 ft. was reached, when it began to deviate from the vertical. In part, the disposition to lean was corrected by increased digging beneath the high side. When it had reached the 34-ft. level, the skin friction of the concrete against the clay became so excessive that undercutting of the steel edge was insufficient to cause it to descend. It seems that the contractor was not permitted to use either air or water in sufficient quantity to soften the sides. The reason for this restriction was based on the fear that surface settlement might result, and that thus difficulty might arise in connection with founding the heavy siphon chamber which was to be constructed later on. However, permission was granted to inject a moderate amount of water through the grouting holes of the caisson. This procedure alone was insufficient, so it was determined to impose a load. Two hundred and fifty tons of earth was loaded on the caisson, using a suitable box as a retaining device. At length the 63-ft. level was reached. There was still 20 ft. between the cutting-edge and the rock below. It was now determined to concrete this section instead of attempting to force the caisson itself down to the ledge. Accordingly, the shaft was excavated to full size through this intervening region, and a central form set up, the clay wall acting as the outside form. When these preparations were completed, concrete was filled in, thus completing the lining of the lower portion of the earth shaft. The spaces between the caisson and the clay were filled with grout. It is thought that no appreciable settlement of the earth around the caisson took place. The same general method of sinking was employed in shaft No. 2.

Antimony shipments from the port of Hankow, China, increased in value from $92,692 in 1910 to $196,974 in 1911, of which $116,460 is represented by refined metal and regulus. Total shipments of antimony from Hunan province amounted to $505,645, exclusive of ore.

First Aid for Cyanide Poisoning

By W. H. Kritzer

Considering the large quantities of cyanide salt and solution handled in gold and silver-mining districts, and the poisonous nature of this useful compound, the number of deaths from its use are few. When a man has inhaled prussic acid gas, or swallowed some cyanide solution the poison acts quickly, and his life depends on prompt action. The gas, when pure, causes almost instant death; and when diluted with air, results in dizziness, faintness, and a depressing headache. Solutions also act quickly internally while with many men they act on the skin and produce eruptions which are painful.

If an employee has inhaled prussic acid gas proceed as follows: Dash water on the patient's face; start artificial respiration; make him inhale either a small quantity of ammonia, ether, or chlorine gas. The latter may be quickly made by sprinkling a small amount of chloride of lime on a flannel cloth moistened with acetic acid, and then holding the cloth to the nostrils of the patient. If poisoning is from swallowing cyanide solution, place the patient in a hot bath, if procurable, and apply cold water to the spine and neck, providing that no delays are permitted to intervene in carrying out previous instructions. Also, incite vomiting by tickling the back of the patient's throat with a finger or feather; by giving lukewarm water, or strong mustard and water; by using a stomach tube and hot water; or by physical means. Diluted solutions of ammonia, cobalt nitrate, peroxide of hydrogen, or freshly precipitated carbonate of iron may be given. The last mentioned is made by mixing equal parts of ferrous sulphate, and sodium carbonate, and then administering at once. The following may be also used, the apparatus consisting of one sealed bottle 30 c.c. of caustic potash; one sealed bottle containing 30 c.c. 33% solution of ferrous sulphate; and one sealed package containing oxide of magnesium. As quickly as possible, empty the contents of the two bottles and a package into a metal cup, and stir thoroughly with a metal spoon. If the patient is conscious, make him swallow the mixture at once, and then lie down a few minutes. If unconscious, place him on his back and pour the mixture down the throat in small quantities, if necessary pinching the nose in order to start swallowing. Then incite vomiting by one of the previous methods suggested. It is advisable to have a soft rubber stomach-tube having a funnel and exhaust bulb in a cabinet to be described, if the services of a doctor cannot be had promptly. It is advisable to have a physician prepare the solutions required, and prescribe the dose of each to be taken by a patient in an emergency; and to further assist in preventing mistakes, bottles of blue glass can be used for the acids, and of white glass for the alkalies.

In all cyanide plants it is important to have wood cabinets with compartments of suitable size in conspicuous, and easily accessible parts of the building, and preferably painted red. Have the emergency orders for the handling of patients fixed to the inside of the cabinet door, and properly label each bottle and see that the contents are kept in a fresh and pure condition. The four compartments should contain (1) one large bottle of distilled water; one large metal spoon; and a one-pint metal cup for mixing the different antidotes; (2) for external use one bottle each of ammonia, ether, acetic acid, chloride of lime (bleaching powder); and a piece of flannel cloth for administering the chlorine gas; (3) for internal use one bottle each of diluted ammonia, cobalt nitrate, ferrous sulphate, and sodium carbonate, the two latter to be fresh; and (4) one sealed bottle with 30 c.c of caustic potash, one sealed bottle with 30 c.c of 33% solution of ferrous sulphate, and one sealed package with oxide of magnesium. Another important point, now fortunately observed at most cyanide plants, is the erection of notice-boards in different parts, warning employees and others that certain tanks and pipes contain solution and others water.

Progress at the Nevada Wonder

By J. A. Burgess

The construction work which was begun by the Nevada Wonder Mining Co. late in October was finished early in December. The 70-ft. head-frame, and the double-drum hoist, with a double-deck cage, are now in operation and are working satisfactorily. At present only one cage is being used, and it is counterbalanced with a weight running in a box in the manway compartment. The head-frame is built of timber, with steel girders and posts at the top to support the sheave wheels, and is well tied with iron bolts and rods, thus forming a rigid structure, which has very little vibration when in use. The new 125-hp. double-drum hoist, made by the Joshua Hendy Iron Works, has a drum capacity for 1500 ft. of 7/8-in. rope. By operating two double-deck cages in balance at a speed of 400 ft. per minute, this will give all the hoisting capacity that the mine needs for the increased amount of work that is planned.

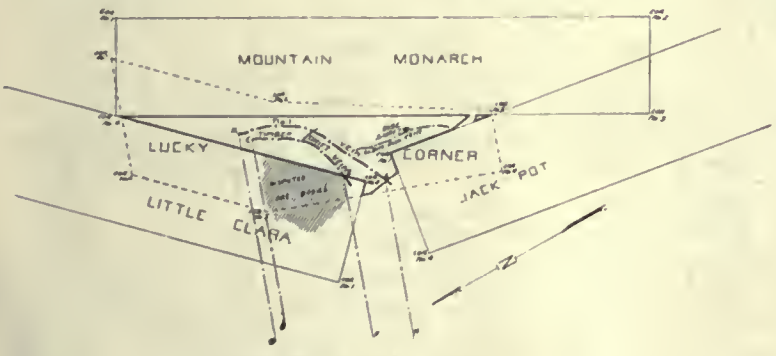
The hoist and compressor building has been moved into the excavation made for it, and has been enlarged sufficiently to contain another compressor. Five new mine-cars have been added to the equipment. A comfortable cottage has been built for the superintendent's use, and a stable has been built near the mine. With these changes and additions to the plant, the property now has first-class equipment. The work of enlarging the shaft by adding a second hoisting compartment from the 700-ft. level to the surface is now under way, and sinking the shaft from the 700-ft. level will be started in a short time. The general development work is decreased to some extent by the shaft work, but driving is now in progress on the 200, 500, and 600-ft. levels. During the month of November 3128 tons of ore was milled at a net profit of $19,466. Mining operations were stopped November 11 on account of the construction work, and for the remainder of the month the mill was run on dump ore, which accounts for the decreased earnings.

The Doctor-Jack Pot Case

The statement appearing recently in the columns of an Eastern contemporary that the devision in the case of Work M. & M. Co. *v.* Doctor-Jack Pot M. Co., recently decided in the Circuit Court of Appeals for the Eighth Circuit, had been affirmed in the United States Supreme Court, is not strictly true. The Supreme Court merely refused to issue a writ of certiorari in the case, and it has been repeatedly held that this is not to be construed as an affirmance of the opinion below. The case is of unusual interest and was discussed by H. V. Winchell in the *Mining and Scientific Press*, May 7, 1910. In view of its interest we present a further brief summary of the controversy.

The Doctor-Jack Pot M. Co. was the owner of the Lucky Corner lode claim in the Cripple Creek district. The Work M. & M. Co. owned the Little Clara lode claim. The relative positions of the two claims is shown in the figure below:

Claiming to be the owners by virtue of patent and mesne conveyances of the Lucky Corner claim, the Doctor-Jack Pot company alleged that the Work company had trespassed on an extralateral segment of the Timber Drift vein, having its apex inside the boundaries of the Lucky Corner claim. The defendants alleged: (1) that the Timber Drift vein in its course intersected the Lucky Corner side-lines, that said lines were not parallel, and that therefore plaintiff was not entitled to any extra-lateral right; (2) that no sufficient discovery had ever been made within the boundaries of the Lucky Corner claim prior to its patent, and that therefore the patent was void; and (3) that all mining done by defendants had been upon the Basalt Flat vein



PLAT OF CLAIMS.

apexing within the boundaries of the Little Clara claim and discovered long prior to any discovery within the Lucky Corner.

The principal question presented by the record was as to the right of defendants to attack the Lucky Corner patent by showing it to be unsupported by a discovery. On this point both the trial court and appellate court held that the findings of the Land Department as to a proper discovery were conclusive and could not be collaterally attacked subsequent to the issuance of a patent, stating:

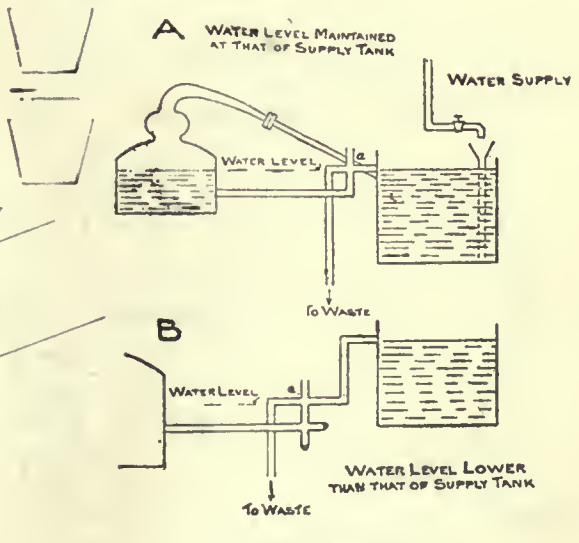
"It follows that the Land Department at the time it issued the patent necessarily passed upon the question, not only as to whether there was a discovery upon the claim, but whether such discovery was in the discovery workings, as required by the laws of Colorado, because the Land Department must take notice, not only of the requirements of the acts of Congress, but the local laws and regulations of miners as well. * * * Whatever may have been the right of the defendant to raise the question, by protest or other appropriate proceeding, of no discovery within the patented ground, prior to patent, that question was forever foreclosed when the patent issued, except by a direct proceeding to set aside the patent or to declare that the grantee therein held it in trust for some party having a better right."

With reference to the vein crossing the side-lines, it was held that this was not established by the evidence, and that in the absence of a showing to the contrary, it would be presumed that the end-lines fixed by the patent are the true end-lines, and that the vein ran lengthwise of the claim and not crosswise.

The evidence seems to have established the identity of the vein on which defendants were working with the Timber Drift vein. Judgment for the Doctor-Jack Pot company was accordingly affirmed on appeal. The decision is in line with the general policy of the courts to accept as final findings of the Department of the Interior as to fact.

Level Regulator

The device figured below was described at a recent meeting of the Chemical, Metallurgical & Mining Society of South Africa. The diagram shows the device fitted between a condenser and a still,



WATER-LEVEL REGULATOR.

and serves to keep the still filled to a constant level with hot water from the condenser. If the condenser is of ample size and the water-supply suitably regulated, the water entering the still will be nearly boiling, complete condensation will be maintained, and very little water run to waste. When hard or dirty water is in use, T or cross-pieces can be introduced at convenient points for cleaning, as illustrated in diagram *B*. The water-level within the still may be at or under that of the condenser and is regulated by that of the crosspiece *a*. The crosspiece could be connected to its supply and delivery points by flexible tubing and the water-level would then be subject to immediate control by raising or lowering the crosspiece.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Geological Mysteries

The Editor:

Sir—Isn't this a gem? It is from a report by a man signing himself "J—— G——, *Prac. M.E.*":

"The mineralized zone is the same Rhyolite, a mere composition of mother earth formation, consisting of lime Porphry and Hematite of Iron, subjeet to deeomposition and reeiproeation."

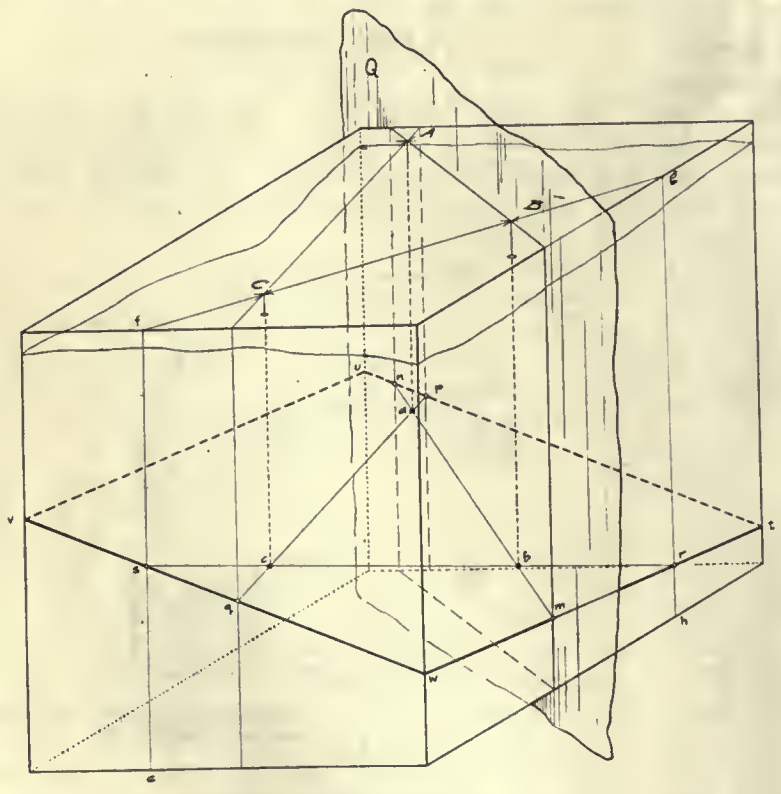
ALEXANDER LEGGAT.

Butte, Montana, January 8.

Graphic Representation of Oilfield Structure

The Editor:

Sir—In response to the request for additional details regarding graphic representation of oilfield structure, discussed in your issue of December 28, I give below a brief outline of the method that is used in plotting a formation of interest in a stereogram.



STEREOGRAM OF OILFIELD STRUCTURE.

For the sake of brevity, only three points are taken (*a*, *b*, and *c*) which might be considered as the upper limit of oil in the three wells *A*, *B*, and *C* (see figure). Imagine a vertical plane *Q* drawn through two wells, *A* and *B*. A line drawn through points *a* and *b* (oil-sand) will lie also in the plane *Q* and, prolonged, will interseet the two border planes in the points *m* and *n*, which will be on the intersection lines of the plane *Q* with the lines of the block. Similarly, two other vertieal planes (not shown on the drawing) drawn through *B* and C, and *C* and *A*, will locate the points *p*, *q*, and *r*, *s*, on the border planes. In eonnecting these points (*m*, *r*, (*t*), *p*, *u*, (*u*), (*v*), *s*, *q*, and (*w*) *s*) with straight lines we obtain the outside rim of the oil-sand, shown by a full line on the front planes and in dotted on the hack planes. Evidently, the drawing of the vertical planes is reduced to the drawing of three lines, *gh*. *fg*. and *fe*, which simplifies the whole construetion.

ALEXANDER J. HEINDL.

San Franeiseo, January 10.

Vacuum-Filter Improvements

The Editor:

Sir—I was interested to read in your Octoher 19 issue of the success attending the introduction of the method of simultaneously replaeing the pulp with wash solution in the working of the stationary type of vacuum-filter at the Concheño mill, in Mexico. H. G. Smith, who describes the innovation, takes undue credit to himself as the originator of the idea. *The Engineering & Mining Journal* of May 15, 1909, contains an article of mine explaining the system and its advantages, and outlining a scheme for continuous operation. For some time previous to this, I had worked the method with considerable sueeess in northern Mexieo. In the concluding paragraph of his article, Mr. Smith presents the idea to his co-workers. This indicates a commendable spirit of generosity, but I would like to add that the improvement in question is protected in Mexieo by Patent No. 8814, which was granted me on February 3, 1909.

A. W. ALLEN.

Lonely Reef Mine,
Rhodesia, Deeember 3, 1912.

Lubricating Oils and Warm Solutions in Cyanide Practice

The Editor:

Sir—During the hot summer months on the desert it usually requires some extra effort toward conserving the limited water supply in order to meet the requirements of a milling plant. At the King of Arizona mine an endeavor was made to meet this condition by laying drains from the boilers, engines, pumps, and hoists to convey all waste water, and incidentally a large portion of the waste oil, to a common sump. As occasion permitted, the water from this sump was added to the working solution by pumping it as a final wash upon a leaching vat, thus leaving the oil deposited on top of the sands.

The Mexiean hoist men had observed the oil floating on the vats from time to time, and seemed to me to show uncommon zeal in the matter of allowing waste oil, oily refuse, cotton waste, etc, to slide into the sump. They had evidently concluded that this was a new departure in cyaniding and presumably had something to do with lubricating the

path of the gold through the vats into the refinery. At least a protest against so much oil being thrown into the sump elicited the quick response: "*Pero aceite se necessita para sacar el oro mas pronto no?*"

Exhaust pipes from the solution and vacuum steam pumps in the refinery were laid to the weak solution sumps and arranged to exhaust beneath the surface of the solution. By this means the mill was usually abundantly supplied with steaming warm weak solution charges. In discussing the effects of warm and hot cyanide solutions, late reference books on cyanide practice seem inclined to disparage any benefits to be derived from such procedure. Clennell[1] says: "In some cases it has been found that higher extractions are obtained by the use of hot solutions at a temperature of say 100° to 130°F. and provision is

KING OF ARIZONA MILL.

sometimes made for heating solution or slime pulp by the injection of steam. In most cases it is doubtful whether the improved extraction outweighs the increased cost." H. W. MacFarren[2] adds: "In practice it has generally been impossible to note any difference between the normal extraction and that made by heating the ore and solution, or that obtained during the heat of summer or the frigid weather of winter."

I wish to state here that heating the solution was done less with the expectation of directly increasing the dissolving power of the solution, than to increase the rate of percolation, thereby facilitating more thorough drainage, hence a better aerated charge, and an increased number of solution charges within the treatment time allowed. Each vat was given a 7 days solution treatment. A marked decrease in the percolation rate was noticeable toward the close of the treatment period, due to packing of the sand. This was especially troublesome in the vats nearest the mill, but was largely compensated by using warm solutions toward the end of the treatment. As the mill was treating 200 tons daily a saving of 20 to 30c. per ton by utilizing waste heat proved a profitable innovation amounting to a considerable sum at the close of a month's run. While it is possible there may have been a slight loss of cyanide due to discharging the hot oily steam into the solution, such losses were not detected.

[1]Clennell, 'The Cyanide Hand Book,' p. 239.
[2]MacFarren, H. W., 'Cyanide Practice,' p. 15.

Regarding the effect of cyanide upon oils, Clennell[3] says: "Cyanide is also a solvent of oily and fatty matters, but probably only by virtue of the free alkali it may contain." It is of interest here to note also the effect of an electrolyzed cyanide solution upon oils as observed by J. H. Aldrich, Jr.[4]; "Grease in the ore or on the surface seems to dissolve very rapidly in the treated solution and slowly in the untreated solution. We tarred our tanks inside and coated them with black oil outside, and more or less grease was frequently floating upon the surface of the solution, where the effect was noticed."

Bottle tests were prepared as follows, and the solutions covered with oil and occasionally agitated.

	I. Cylinder oil, per cent.	II. Engine oil, per cent.
Free KCN	0.20	0.20
Total KCN	0.20	0.28
Protective alkalinity	0.08	0.05
After 24 Hours		
Free KCN	0.20	0.20
Total KCN	0.20	0.26
Protective alkalinity	0.08	0.07
After 48 Hours		
Free KCN	0.20	0.20
Total KCN	0.20	0.26
Protective alkalinity	0.10	0.08

A final titration in 96 hours gave similar results, with a still further increase in alkalinity. In two other tests from different lots of oils quite a copious white precipitate formed, but the general results did not in the main differ from those given.

J. E. Clark.

Riverside, California, December 9, 1912.

Hendryx Agitator on the Rand

The Editor:

Sir—I note in your issue of November 9, 1912, an article by H. Stadler under the head of 'Johannesburg Correspondence,' entitled 'Hendryx Agitator on the Rand.' I beg to state that from March 11, 1912, to May 2, 1912, five tests were made, of which Mr. Stadler was only in charge of two. Some of the statements in the article referred to are quite misleading and unfair. When the Mines Trials' Committee was requested by me to test the agitator, their secretary desired for the information of this committee to know what claims were made for the agitator and was informed that it would dissolve as much or more of the gold content of the Rand ore, sand and slime together, in one hour as ordinary leaching methods would dissolve in twenty-four; that the loss of cyanide during the period of agitation would be less than in percolation to dissolve the same amount of gold; that the power would not be excessive, that the agitator would start readily after a long period of settlement; that the slime contained in the ore, owing to the rapid and violent agitation, would be coagulated instead of emulsified, and would more readily settle or filter than when air agitation was used. The official report which the committee has been courteous enough to allow me to publish I hereby enclose.

[3]Clennell, 'The Cyanide Hand Book,' p. 184.
[4]*Trans.* Amer. Inst. Min. Eng., Vol. XLII, p. 746.

It is not necessary for Mr. Stadler to give the apparent reason for the non-publication of the tests by the Mines Trials' Committee, as no one is better aware of the fact than he that it is neither the custom nor the policy of the committee to publish results of its tests. It is very necessary that the committee protect itself against misrepresentations and the rule of not publishing such tests, I understand to be a policy of protection to themselves. Knowing that I had come a long distance and had expended a large amount of time and money, and that no misrepresentations would or could be made, they had the courtesy to permit me to print the tabulated report above referred to.

The comparison Mr. Stadler attempts to make of my 18-ft. agitator with the 400-ton leaching tank is not only unfair but absurd. Had the committee desired to ascertain how many tons could actually be put through the 18-ft. agitator in twenty-four hours, otherwise than by comparison after the assaying of the solutions and wash residues at different periods, it undoubtedly would have installed dewatering or thickening tanks as storage ahead of the agitator and decanting or filtering apparatus after the agitator, so the time of dewatering, filling, and discharging could be reduced to a minimum; an expense entirely unnecessary in order to ascertain what the committee desired to know. Also, it would have installed a large size 24-ft. agitator, holding 100 tons of solids and 200 tons of solution with proper arrangement for filling and discharging, and would have treated four charges per day of the coarse material, which would have been 400 tons in twenty-four hours as against 400 tons of Mr. Stadler's leaching tanks in seven days. On the slime several times that amount could have been treated.

WILBUR A. HENDRYX.

New York, December 4, 1912.

[Mr. Hendryx is in error in supposing that the article referred to is by Mr. Stadler, as it was sent us by our regular Johannesburg correspondent. In our issue of last week Alfred James speaks forcefully concerning the policy pursued by the Mines Trials Committee.—EDITOR.]

East Africa has not yet been geologically surveyed, but coal has been found near Mackinnon Road station on the Uganda railway. The outcrop, however, has not been traced, though the field is being examined by a geological expert. The enormous soda deposits lying in the bed of the 'soda lake' of Magadi will soon be shipped to market. The railway to connect the deposit with the Uganda railway is now under construction, and work is also in progress looking to the providing of deep-water facilities at Mombasa, which will be required to take care of the output when the movement to market begins. Additional equipment is also being ordered by the Uganda railway to meet the anticipated requirement for cars and engines. During 1912 the Busoga railway, from Jinja, on Lake Victoria, toward Lake Kioga, was completed. This forms a small but important link in the Cape-to-Cairo railway project, and also opens up a valuable cotton territory. It is the first piece of railway in the Uganda Protectorate, the Uganda railway being entirely in the East Africa Protectorate.

RESULTS OF ACTUAL TESTS MADE BY THE MINES TRIALS' COMMITTEE AT THE WOLHUTER G.M. CO.

ARGUS CO.—12869

TEST NO. AND DATE.	1.—MARCH 11, 1912.	2.—MARCH 20, 1912.	3.—MARCH 26, 1912.	4.—APRIL 9, 1912.	5.—MAY 2, 1912.
PRODUCT..	Sands and Slimes.	Slimes only.	Sands and Slimes.	Sands and Slimes.	Sands and Slimes.
QUANTITY AND RATIO ..	Ore: 35 tons / Soln.: 70 „ } 1 : 2	Ore: 35·03 tons / Soln.: 70·00 „ } 1 : 2	Ore: 35 tons. / Soln.: 71 „ } 1 : 2	Ore: 35 tons. / Soln.: 72·4 „ } 1 : 2·068	Ore: 35·09 tons / Soln.: 73·69 „ } 1 : 2·1
GRADING: + 60	9·4%	—	13·75%	5·93%	9·18%
+ 90	19·3%	·1%	17·74%	20.52%	21·10%
+ 120	11·3%	·4%	10·70%	12· 0%	11·39%
— 120	60·0%	99·5%	57·81%	61·45%	57·33%
AVERAGE ASSAY OF CHARGE ..	2·55 dwts.	1·65 dwts.	2·2 dwts.	1·95 dwts.	2·3 dwts.
SOLUTION STH PER TON OF ORE—					
Start	·068 × 2 = ·136	·021 × 2 = ·042	·063 × 2 = ·126	·052 × 2 = ·104	·0525 × 2 = ·105
Finish	·066 × 2 = ·132	020 × 2 = ·040	·060 × 2 = ·120	·050 × 2 = ·100	·050 × 2 = ·100
Loss	·002 × 2 = ·004	·001 × 2 = ·002	·003 × 2 = ·006	·002 × 2 = ·004	·0025 × 2 = ·005
EXTRACTION :—BY SOLUTION.	Assay × Ratio. dwts.	dwts.	dwts.	dwts.	dwts
1 hr.	·76 × 2 = 1·52	½ hr. ·5 × 2 = 1·0	1 hr. ·67 × 2 = 1·34	1 hr. ·6 × 2·068 = 1·24	·57 × 2·1 = 1·218
2 hrs.	1·00 × 2 = 2·00	½ hr. ·58 × 2 = 1·16	2 hrs. ·83 × 2 = 1·66	2 hrs. ·67 × 2·068 = 1·385	·65 × 2·1 = 1·365
3 hrs.	1·10 × 2 = 2·20	1 hr. ·69 × 2 = 1·38	3 hrs. ·84 × 2 = 1·68	3 hrs. ·68 × 2·068 = 1·406	·79 × 2·1 = 1·659
4 hrs.	1·15 × 2 = 2·30	2 hrs. ·76 × 2 = 1·52	4 hrs. ·9 × 2 = 1·80	4 hrs. ·79 × 2·068 = 1·633	·85 × 2·1 = 1·785
5 hrs.	1·15 × 2 = 2·30	3 hrs. ·76 × 2 = 1·52	5 hrs. ·92 × 2 = 1·84	5 hrs. ·84 × 2·068 = 1·737	·89 × 2·1 = 1·869
6 hrs.	1·20 × 2 = 2·40		6 hrs. ·94 × 2 = 1·88	6 hrs. ·84 × 2·068 = 1·737	·98 × 2·1 = 2·058
7 hrs.	1·20 × 2 = 2·40				
% EXTRACTION BY KCY. SOLUTION.	2·4 dwts. from 2·55 = 94·1%	1·52 dwts. from 1·65 = 92%	1·88 dwts. from 2·2 = 85·4%	1·737 dwts. from 1·95 = 89·3%	2·058 dwts. from 2·3 = 89·47%
WASHED RESIDUE ASSAY ..	·281 dwts.	·06 dwts.	·35 dwts.	25 dwts.	·55 dwts.
COMPARATIVE % EXTRACTION FROM—					
RESIDUE ASSAY	93·06%	97%	84%	87·2%	76·3%
SOLUTION ASSAY ..	94·1 %	92%	85·4%	89·3%	89·47%

The above figures represent the exact results obtained by the Mines Trials' Committee (Johannesburg Transvaal) in the Hendryx Agitator upon residues after Amalgamation.

THE FOLLOWING FIGURES SHOW THE TOTAL EXTRACTION FROM THE ORIGINAL ORE, INCLUDING AMALGAMATION IN THE MILL AND WERE FURNISHED BY THE COURTESY OF THE WOLHUTER G.M. CO.

TOTAL EXTRACTION: BY AMALGAMATION AND KCY SOLUTION—					
FIGURED FROM RESIDUES	97·6%	99·0%	94·5%	95·5%	91·6%
FIGURED FROM SOLUTIONS	97·9%	98·0%	94·89%	96·2%	96·31%

OFFICIAL REPORT, MINES TRIALS COMMITTEE.

Special Correspondence

NEW YORK

THE COPPER SITUATION. — BREITUNG MINES CORPORATION. — MIAMI DISTRICT.

The report of the Copper Producers' Association for December rather upset the calculations of those who had proclaimed that the deadlock existing in the copper-metal market had been broken. It had been anticipated that production figures would show a substantial diminution as a result of the curtailment of operations caused by the strike and the labor disturbances at the Utah Copper Co. and the Nevada Consolidated; but instead of showing a decrease, the production was nearly at a record level, amounting to 143,354,042 lb., a figure which has been exceeded only twice during 1912. The export demand took up 65,713,796 lb., which is well up to the average monthly shipments for the year, the domestic consumers taking 58,491,723 lb. These figures reflect in some degree the unwillingness of American consumers to come into the market at present prices. The resulting increase of 19,148,523 lb. somewhat more than justifies the attitude of manufacturers at home in their position that, so long as the producing and selling interests insist upon maintaining a price of 17¾c. for copper, they must carry the metal for the consumer. It is hardly worth while to try to stampede the consumer into the market as long as surplus stocks show substantial increases. There is still such an intense feeling of uneasiness abroad that it is hardly to be expected that any abnormal demand will spring up, at least such a demand as will have its source in consumption of copper other than that used by the various governments in their preparations for war, and it is undoubtedly true that so far as this particular demand is concerned it has already been provided for in large part. Consumers at home are fully justified in their continuance of the so-called hand-to-mouth policy.

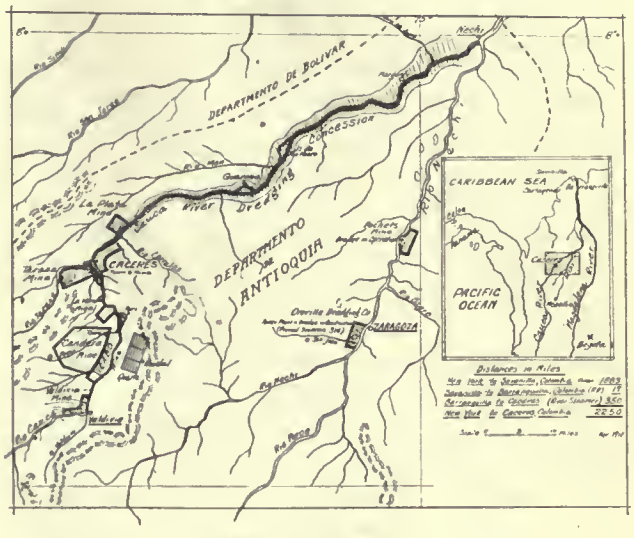
The Calumet & Hecla is almost the only large producer that shows a decrease in production for 1912 as compared with the year preceding, and with the development of the Ahmeek and the splendid work that has been going on in increasing efficiency, it is anticipated that this decrease will be turned into an increase in 1913. One of the principal items in the work of the efficiency department has been the supplanting of the old two-man drills in the Calumet & Hecla by new one-man machines. The Calumet & Hecla now has 90 drills of this type at work, each machine doing exactly the work heretofore done by the two-man machine.

The Dern interests of Salt Lake City have formed the Mines Operating Co. to work the property of the Ontario Silver Mining Co. on a royalty basis. One of the most pretentious attempts at mining finance put forth within recent months in New York is the organization of the Breitung Mines Corporation by Breitung & Co., Ltd., with a capital of $10,000,000, to operate in the Cauca and Nechi valleys in Colombia, South America. It is said that a large amount of prospecting has been done and that the new company expects to develop aggressively along the same lines pursued by the Oroville Dredging Company.

The making of another important copper producer for the Miami district seems highly probable. The South Live Oak Development Co. has two drill-holes in commercial ore, one at a depth of 535 ft.; a second drill-hole also went into the ore at 535 ft. In one hole the orebody showed a thickness of 90 and in the other of 95 ft. Assays show an average copper content of about 2%. Drill-holes are being sunk at intervals of 200 ft. with the idea of outlining the entire orebody.

The Arizona United Mining Co., operating at Johnson, in Cochise county, Arizona, and controlled by Philadelphia interests, reports the finding of a good body of sulphide ore in the bottom of a winze 50 ft. below the eighth level in the Republic mine. The Arizona United has been endeavoring to get on a basis of production, having been obliged to suspend early in 1910 when the copper-metal market was at such low level as to make any profit impossible. The property is equipped with a 125-ton smelter, and in the course of development has produced something over 500,000 lb. of copper.

The Mexican Metals Co., the corporate successor of the Arizpe Mines Co., is one of the specialties of the open market in Boston. The company controls some 6500 acres of mineral land lying about 39 miles south of the United States border and some 15 miles from Cananea, Mexico. The property is equipped with a 100-ton mill, but this capacity is to be largely increased in a few months, the company's treasury having already been provided with



PART OF COLOMBIA.

funds necessary to add the new equipment. George E. Keith, a large shoe manufacturer of Brockton, Massachusetts, together with B. P. Cheney and his associates, control the property.

BOSTON

THE BRADLEY PROCESS.—MASON VALLEY SMELTING.—FRANKLIN MINING.

Lawson's Trinity and Curb stocks, First National, and Bay State Gas, fluctuate now principally in accordance with the news received from the workings of the Bradley process at the Washoe smelter. A. C. Burrage expended something like $250,000, it is said, on an experimental plant for the Bradley process to treat the slime containing about 2% copper, at Anaconda. This was nearly a year ago, and ever since that time Boston has been receiving varying advices about the progress of the process. It is said that mining and smelter men in Butte look on the experiments askance, yet with no little interest, believing that they will not be successful. Some time ago a news bulletin was sent out stating that the thing was practically a failure. Now it is claimed by the promoters, Lawson and Burrage, that the process is running fairly satisfactorily and that the difficulties, entirely mechanical, are gradually being overcome. The news that the process was a success at Anaconda would probably add more to the market selling price of Trinity, First National, and Bay State Gas than a Lawson advertisement, even though it occupied a half page or a page, could accomplish. A successful demonstration of the Bradley process at Butte will foreshadow its installation at the Balaklala smelter in the Shasta district and the resumption of mining at First National, with the possible resuming of shipments at Trinity.

The Mason Valley smelter is now handling about 850 tons of ore and shipping out about 60 tons of copper matte per day. The operation of the smelter has encouraged mines to start shipping throughout the Mason and neighboring districts, with the result that the custom business has increased very materially during the past year. It is

expected that this increase will keep up during 1913. Before the smelter was started, the company, reported to be fearful that it did not have a sufficient supply of ore and fluxes to depend upon otherwise, took the precaution of making a contract with the Nevada-Douglas company to ship 250,000 tons of ore. When this contract expires there may be some new developments in the Mason district. The Nevada-Douglas people are understood to be dissatisfied with the cost of smelting their ore at the Thompson plant and have long been considering the building of their own smelter in Smith valley. It may turn out that by the time Nevada-Douglas has completed its contract of shipping 250,000 tons to the smelter, the smelter people will be in receipt of ample ore mixtures from other sources and the Nevada-Douglas interests may be ready to build their own smelter. At any rate, there is the very likely probability that the mining and smelter situation in Mason or Yerington will greatly expand from now on. The Mason Valley people are considering the installation of two stands of converters, and experiments will be made with the view of reducing the cost of fuel at the plant.

The adjourned special meeting of the stockholders of the Franklin Mining Co. was held on January 8, about 45 stockholders being present. This meeting followed one which failed to arrive at any agreement in December. The motion was offered that litigation should not be started against Messrs. Edwards, Tolman, Howard, Watson, or Wyman, directors, and that litigation against Dow and Bailey be deferred until the question could be taken up at the company's annual meeting. It is claimed that litigation is hardly advisable because recovery of money is neither sufficiently certain in law nor sufficiently great in amount to justify the proceedings. The motion was carried by a vote of 105,901 shares in favor to 460 shares against.

OURAY, COLORADO

Changes at Wanakah.—Customs Zinc Mill.—Ouray Club.

The Camp Bird is pushing development of the new orebody, with reported favorable results, and the mill is still operating at part capacity. At the Wanakah the mill continues to operate at full capacity and the management has been carrying on extensive development and exploration in the mine for some time. Amalgamating, re-grinding, and slime concentrating apparatus have produced such improvement in milling that considerable additions will no doubt be made to the mill this spring. The Atlas has been operating regularly on the usual basis and is now supplying a large part of the concentrate treated at the custom zinc separator. The Barstow has closed its mill for the winter, after a successful season, and is carrying out a scheme of exploration and development of greater extent than for some years past. A long raise is being driven.

The Humboldt and Mountain Top, the two most important new companies in the district, successfully transported and placed their machinery, and are now active in exploration and development; the Mountain Top has begun its 2000-ft. adit and three shifts are making good progress. The Humboldt has large ore reserve, which promises well for a new mill next year, sinking and driving is in progress. The custom zinc mill, erected and operated by David Foerster, using Huff electrostatic machines, has made a good record on Barstow and Atlas concentrate, and is operating steadily on this material. The Revenue Leasing Co., leasing the Revenue Tunnel property, was forced to close its mill on account of difficulties in milling during the winter, but announces that work will soon be resumed.

The Ouray Commercial Club, at its meeting of January 8, outlined an ambitious plan of work for the coming year. The year 1912 closed with more activity along the line of real mining than has been shown for some years past, and the year 1913 promises improvement. The bureau of mines of the club is beginning an active campaign along various lines, and will make a point of giving reliable information, or none at all, and is soliciting inquiries. John T. Roberts, Jr., is president of the club, and C. R. Wilfley, of Ouray, is chairman of the bureau of mines of the club.

PORCUPINE

Production for Year.—Changes at Dome.—New Mills.

In Canada, east of the Rocky Mountains, there are at the present time only two mining districts in which the general public is vitally interested. These are Cobalt and Porcupine. The former has been a steady producer since 1905 and has assumed such proportions that from an area of approximately 7 square miles the annual output is over 30,000,000 oz., taking high place among the silver-producing districts of the world, Canada being exceeded only by the United States and Mexico. While Cobalt has shown a decrease of about 1,000,000 oz. during the past year, the high price of silver has created a new record for the value of the total production, approximately 50% of which has been paid in dividends.

The newer Porcupine district has just emerged into the producing stage, the output for 1912 being valued at about $1,750,000. The unofficial figures for the production are: Hollinger, $900,000; Dome, $700,000; and the McIntyre and Vipond, $150,000 between them. Practically all of this output is credited to the last six months of the year, and on account of the mills being new and many changes necessary, it is hardly a fair criterion of what may be expected during 1913; in fact, it is fairly safe to assume that during the present year the total production should reach a value of about $5,000,000.

At the Dome a new tube-mill and filter-press are being installed, and with these in commission the capacity should be increased from 10 to 15%. In addition to this, the company is seriously considering doubling the capacity of the plant, but the labor troubles have interfered to such an extent with the development work, on the results of which additions would be authorized, that it is doubtful if the enlarged mill will be in a position to have much influence on next year's production. In the same vicinity as the Dome is the Dome Lake, where a 10-stamp mill is being erected. This should be in commission by next March and will have some influence on the year's production.

At the other end of the district is the Hollinger mine. The production from this property has been mainly from 30 stamps. Another 10 stamps has been added, however, and, as the mill is now running smoothly, this property, if the present grade of mill-feed is maintained, should during the coming year contribute practically 50% of the total output. In the same neighborhood as the Hollinger is the McIntyre. This company has been operating a 10-stamp mill since last February, and it is now working on a new mill which will have an estimated capacity of 150 tons per day. As a cyanide plant is also being constructed, its production in 1913 will be considerable.

The Vipond mine, in the Pearl Lake area, also has a small mill. Its estimated capacity is about 100 tons per day, but under present conditions it is unable to treat more than 50 tons. The company is considering the erection of a cyanide plant. Of the present non-producing mines, those that may be expected to become producers in the near future are the Miller-Middleton, Dixon, McEnaney, Jupiter, and Plenaurum. The first two are owned by the same people who control the Hollinger, and it is not at all unlikely that when development work has progressed sufficiently to permit of an estimate of their probable value they will be amalgamated with the Hollinger. At the McEnaney, a 10-stamp mill is being erected and should be in operation in a few months. The Jupiter and Plenaurum companies are also considering the erection of mills, but it is doubtful if they will be sufficiently far advanced to make any showing in the year's production.

While at the present time there are only four milling plants in operation in Porcupine, the end of this year should see at least eight either in operation or in course of construction. While no new finds of importance have been made during the past year either in Porcupine or the surrounding townships, the possibilities of this district are by no means exhausted, and considerable life as an important producer may be expected. This district offers the distinction of being the first gold-mining district of Ontario which promises to be a commercial success.

BLACK HILLS, SOUTH DAKOTA

WEDGE ROASTER.--BISMARCK CYANIDE PLANT.—BLACK HILLS SMELTER.

The increase in production for the year in South Dakota, as estimated by the Director of the Mint, is cause for congratulation to the Black Hills operators. According to these figures, South Dakota's total yield of gold and silver was $7,917,832 for the year, as compared with $7,536,268 in 1911, an increase of $381,564. In arriving at these figures I have calculated the silver at $0.60835 for 1912 and $0.53304 for 1911, as the average price per ounce for the years mentioned. The increase in the value of silver was largely responsible for the gain in the silver production, for, although the silver yield was only 496 oz. greater in 1912 than in 1911, the value was $15,386 greater. The Homestake made the largest gain of any of the Black Hills properties, its yield for 1912 being $578,000 greater than in 1911. The Wasp No. 2, Trojan, Golden Reward, New Reliance, Victoria, Black Hills Standard, Monarch, and Richmond all showed increases, the Trojan making the largest gain, with $80,000. The production of the Mogul fell off at least $200,000, as a result of the company losing its big mill at Pluma, which was destroyed by fire in March, the balance of the year the company shipping a small tonnage to Lundberg, Dorr & Wilson. Several new mills are in course of construction, and the present year's production will probably exceed that of the past year.

The Homestake company has commenced work on a large dry-house at the Ellison hoist, and with its completion the number of employees using this shaft will be materially increased. The Golden Star shaft, which in the past has been used largely for hoisting men, has been settling and twisting, and it will not be used so extensively in the future. The Wedge furnace plant of the Golden Reward company has been put in commission, an expert sent by the manufacturers arriving early in the month to get it in shape. Construction work is finished, and all that remains to be done is to get the method of operation arranged to suit the ores. The furnace is of the ordinary pattern as made by the Wedge people, and uses crude oil for fuel. This oil is secured from the Wyoming fields, being hauled about 300 miles. The Detroit interests in the Golden Crest company, against whom the English interests, represented in the Hills by F. W. Bird, secured a judgment for $120,000 and costs in the circuit court here in October 1910, are evidently desirous of redeeming the property and paying off the encumbrance. Under the law of South Dakota a judgment debtor may secure an additional year's time for redemption by paying the costs, interests, and taxes in full for the first year. This the Detroit people have done. This payment necessitated the disbursing of $24,044.49, of which $19,513.20 was paid to Mr. Bird and his attorneys, Kellar & Stanley, of Lead, and the balance, $4,513.29, was paid to the county treasurer of Lawrence county, for taxes in full.

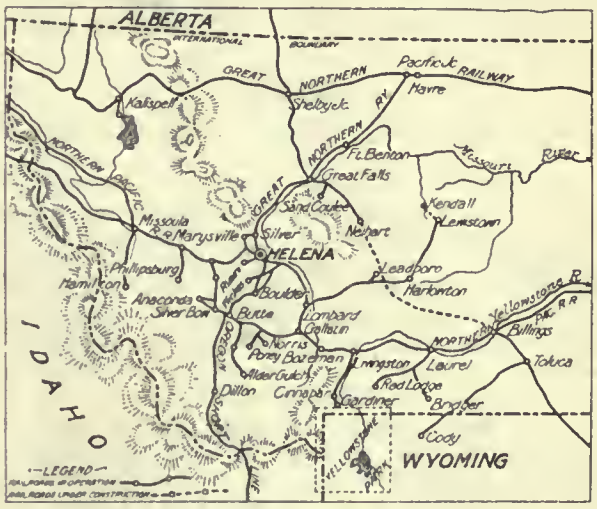
The crushers at the new cyanide plant of the Bismarck company, adjoining the Wasp No. 2, have been started, as the first stage in limbering up the plant and preparing it for operation. The necessary adjustments of the entire plant will probably consume two or three weeks time, and by the end of January it is hoped to have the whole plant in harmonious operation. The entire plant is electric driven, and taken as a whole is well constructed and should achieve good results. The process is much similar to the Wasp No. 2: coarse dry crushing in rolls and cyanidation of the product without classification. The mine is being arranged for working by the glory-hole system, the orebody lying nearly horizontal. The ore is exposed for a thickness of 75 ft. in the open cut, and about 10 ft. of stripping lies above this orebody. The waste is dropped through a winze separate from the ore winze. The mining method should be very economical on this basis, and the entire cost of mining and milling should be between $1 and $1.10 per ton.

E. J. Walter has arrived to assume the position of superintendent of the Black Hills Smelting Co., which has recently completed a plant at Galena. Mr. Walter has investigated the supplies of flux and ores, and believes that he will soon have contracts and a six months' supply for the plant. Pyrite will be secured from the Gilt Edge mine, 15 tons per day in the form of concentrate, and 10 tons per day in the form of heavy iron pyrite; copper ores will come from the Jungle mine, in the Custer Peak district, which is developed to produce easily the 10 tons per day that will be needed; dry ores will come from numerous properties at Galena and Bald mountain; limestone will be secured from a quarry on the hill at the rear of the smelter.

BUTTE, MONTANA

BULLWHACKER LEACHING PLANT.—RAILWAY ELECTRIFICATION.—LIABILITY LAW.

The leaching plant at the property of the Bullwhacker Copper Co. was started on January 6, at least experimentally. It is yet to be determined to what size the ore should be crushed to give the best results by leaching. It is planned to pass the solution through the ore at least twice in an endeavor to bring the copper content of the solution equal to that of the ore, or about 2%. The solution will then be transferred to the electrolytic precipitating-boxes. Those responsible for the plant seem confident of success, and expect to make a 95% saving at a total cost for mining and treatment of 7c. per pound of copper



WESTERN MONTANA.

produced. It has been stated that the ore to be mined will average 3% copper, which would mean a mining and treatment cost of $2 per ton on the above estimate.

According to John D. Ryan, president of the Great Falls Power Co., the Chicago, Milwaukee & St. Paul railway is to be the pioneer among the transcontinental railways in electrifying its main line. Mr. Ryan predicts that this will be the preliminary move in the final electrification of 10,000 miles of Western railways throughout the mountain and coast states. This statement comes as a result of the permit just granted the Great Falls Power Co. by W. L. Fisher, Secretary of the Interior, giving it the right to extend its lines over public land for the purpose of supplying railway lines with electric power. This grant is for 50 years and involves reasonable compensation to the Government. It is stated that steps are to be taken at once to electrify the main line of the Chicago, Milwaukee & St. Paul railway from Harlowton, Montana, to Avery, Idaho, and that $5,000,000 has been set aside by the railway company for that purpose. One of the main reasons for the recent consolidation of power-plants in Montana now becomes apparent, as it would be impracticable for a transcontinental railroad to be dependent on one source of power. By having the Thompson Falls plant, the Great Falls plants, and the Madison River plants lead into the same transmission-line, it is improbable that all sources of supply would break down at the same time.

An important measure is to be presented to the State Legislature, now in session, covering the liability of employers and compensation for workmen. The Butte Miners' Union has appointed a committee of three to lobby for

the measure in Helena. The bill as drafted is similar to the one now in force in the state of Washington.

At the recent annual meeting of the Butte-Milwaukee Mining Company, the controlling interest in the property passed to directors in Duluth, Minnesota. This was to be expected in view of the fact that the Butte-Superior Copper Mining Co. came into possession of the 250,000 shares of Butte-Milwaukee stock as a result of the completion of its contract of sinking the Sellers shaft from the 700 to the 1200-ft. level and driving a cross-cut to the Black Rock shaft on that level.

Glendive, in Dawson county, is having an oil excitement within its city limits, like Los Angeles. The Montana & Wyoming Consolidated, a Sheridan, Wyoming, company, drilled the well which is causing the excitement. Exactly what success was had is not forthcoming, but rumors are to the effect that companies are being formed and available land is being plastered with locations.

The Chicago, Milwaukee & St. Paul railroad has a large force of surveyors at work west of Great Falls, apparently working on a reconnaissance for a through line across the continental divide into the Big Blackfoot country and on to Missoula. It has been stated that such a line can be built on lower grades than the present one through Butte, and will reduce the distance from St. Paul to Seattle by 100 miles. A mineral district of some promise, heretofore without railway facilities, would be opened by the new line.

LONDON

WORK AT GREAT COBAR.—DREDGING AT VILORO.—PAHANG TIN MINES.

Now that the Great Cobar copper mine in New South Wales, owned in London, has made a profit, even though a small one, it is opportune to trace the history of the English company. This company was formed in London in 1906 to acquire the Great Cobar copper mine in New South Wales. The purchase price was £800,000 in cash and £206,000 in shares. The reports on which the transfer was effected were made by J. D. Kendall, C. M. Roiker, and W. J. Barnett. The Lithgow refining works, near Sydney, and the Chesney copper mine were bought at the same time, and two years ago the Cobar Gold mine was acquired, the gold-bearing silicious ores of the latter making a suitable flux for the pyritic ore of the Great Cobar. Many difficulties have been encountered in carrying out the prognostications of the prospectus. Errors were made in the design of the new furnaces; the ore did not come up to expectations as to content; and a succession of labor troubles have intervened; H. C. Bellinger, late of Montana, is now manager. The report for the year ended June 30 shows that 271,827 tons of Great Cobar ore was raised and sent to the smelter; the production from the Cobar Gold mine was 45,778 tons; while 29,712 tons was raised from the Chesney mine. All the ore from the first two was sent to the smelter direct; 20,254 tons was sent direct from the Chesney, together with 1478 tons of concentrate obtained from the remaining 9730 tons. The total recovered was 6736 tons copper, 37,696 oz. gold, and 178,938 oz. silver. The average assays of the various ores are not given, but the general tenor can be ascertained from the figures for the reserves: at the Great Cobar, the reserve was estimated on June 30 at 1,813,087 tons, averaging 2.6% copper; at the Cobar Gold, 302,174 tons, averaging 1.7% copper and 9 dwt. gold; at the Chesney 623,286 tons, averaging 2.6% copper.

Development during the past year at Cobar Gold and Chesney has been entirely satisfactory. At the Great Cobar the 12th level showed a dislocation of the lodes, and diamond-drilling was undertaken with the object of finding the displaced northern orebody. Subsequent work on the 13th level has given much better results, for a cross-cut north has disclosed a body of ore averaging 3½% copper; the cross-cut has passed through 40 ft. and is still in ore. It is believed that this is the lost northern orebody. At the Chesney mine, the erection of the cencentrator was greatly delayed, and it only started work in April last. A Minerals Separation plant is to re-treat the tailing. As regards finance, the income from the production of metals was £635,252; the cost of mining and smelting was £457,222, and the London expenses £9413. The allowance for depreciation was £47,686; £43,488 was paid as interest on £724,800 debentures, and £43,161 has been written off underwriting commission. The balance of profit was £34,356, which was carried forward. It will thus be seen that no dividend has as yet been distributed on the £932,710 ordinary shares.

Information as to the operations at the Viloro dredging property at Oroville, California, is not as a rule published, and the contents of the report for the year ended October 31 are correspondingly interesting. The English company was formed in 1904 to acquire 200 acres in the Oroville district. Walter McDermott is chairman of the company, and T. H. Leggett is consulting engineer. The issued capital is £65,979. Dividends have been paid since the start, and up to October 31 last have totalled 73¾%. The report for the past year shows that 710,257 cu. yd. over 12½ acres was dredged, yielding gold worth $89,277, at a cost of $50,150, leaving a profit of $39,127. The yield per cubic yard was 12.57c. and the cost 6.06c. The amount treated was 164,588 cu. yd. less than during the previous year, the fall being due to the increase in the proportion of stiff clayey ground. Of the 200 acres, 130 has been worked, and of the remainder some are too lean to be profitable. Mr. Leggett estimates that the deposit will be exhausted in from 4 to 4½ years. W. H. James, the manager, reports that the overburden, varying from 8 to 20 ft. in depth, has proved troublesome to remove, and some of it has had to be broken by explosives. After the payment of administration expenses, a profit of £7188 was made, out of which £6597 has been paid as dividend, being at the rate of 10 per cent.

Tin mining in the Malay peninsula is usually associated with alluvial deposits. One of the few exceptions is the venture belonging to the Pahang Corporation, which owns extensive lode-property on the eastern side of the peninsula. Four years ago the property and plant got into a rather neglected condition, and a large amount of new capital was subscribed, to undertake special work recommended by William Frecheville, Reginald Pawle, and J. T. Marriner, the last named being the present manager. Profits were made in the year ended July 31, 1911, but were applied toward extinguishing an adverse balance. The report for the year ended July 31 last shows that the improvement has continued. The 50-stamp mill treated 102,797 long tons of ore, for a yield of 1125 tons of tin concentrate, as compared with 78,448 tons and 973 tons the year before.

The alluvial deposits are being worked by tributers, and the production was 115 tons as compared with 54. The income from the sale of concentrate was £148,755, and the profit, after payment of administration expenses, £45,341. Out of this, £4390 was paid as interest on debentures; £5000 was written off expense of raising capital, £5000 allowed for depreciation of plant, and £10,000 allowed for development and exploration. The year commenced with an adverse balance of £2521, and ended with a divisible profit of £18,879. Out of this, the whole of the arrears in the preference dividend, covering a period of 4 years and 1 month, has been paid, absorbing £15,577. J. T. Marriner, the manager, reports that the crushing and concentration plant has been greatly improved, so that its capacity has been increased and the cost of operation decreased. No less than 28,869 ft. of development work has been done, distributed over eight mines, along 5 miles. The ore sent to the mill came from seven of these properties, the largest amounts being provided by Willink's, Semeliang, Jeram Batang, Teague's, and Pollock's. The most important discovery was at Willink's, where the junction of two or more lodes has provided a large amount of rich ore; at the 500-ft. level the lode has been proved, so far, for 247 ft., averaging 9% cassiterite over a stoping width of 5 ft. As regards reserve, this is not easy to calculate, for so much of it consists of ore left by former owners; while the stamps are not as far ahead on the newly discovered ore.

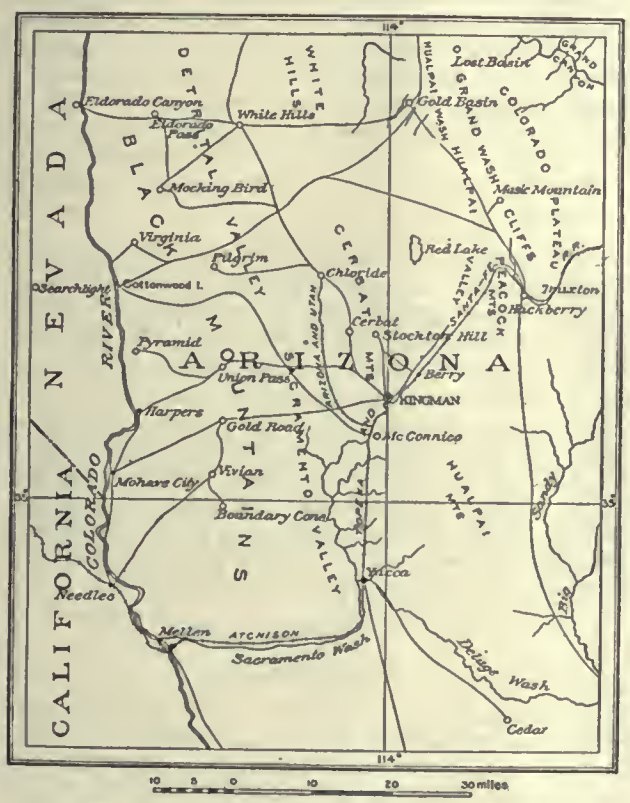
General Mining News

ARIZONA

During 1912 this state produced about 359,000,000 lb. of copper, and the value was increased by over $13,000,000 as compared with 1911, on account of the price of copper being 3.75c. per pound higher. The lead output was about 7,000,000 lb., a decrease of 32%; and the spelter output 8,500,000 lb., an increase of 89%. From the Golconda mine, at Union Basin, zinc ore and concentrate were shipped continuously, in September at the rate of 1200 tons per day.

Cochise County

At the Copper Queen smelter another reverberatory furnace and three McDougall roasters are to be constructed. About 900 men are employed. At the Sacramento shaft, foundations are being prepared for a new hoist, compressors, and boilers, and for change-houses at this and the Southwest shaft. During the past few weeks the Bisbee



WESTERN ARIZONA.

and Warren district mines have shipped nearly 6000 tons of ore per day to the smelters at Douglas.

The cold weather at Bisbee has been responsible for much trouble with ore freezing in cars and subsequent unloading at the Douglas smelters.

Maricopa County

The Arizona Copper Co. disputed its assessment for 1911 and refused to pay the $38,450 demanded in taxes. Suit was instituted, and the Superior Court upheld the assessment, judgment for the entire amount of the taxes, and costs, totaling $43,064, was given the plaintiff, the State of Arizona. The case has gone to the Supreme Court.

Mohave County

During 1912 the Tom Reed mill treated 43,994 tons of ore, and 10,462 tons of tailing, yielding $984,807 and $126,260, respectively, a total of $1,111,067. Dividends paid amounted to $596,637, the total to date being $1,155,169. The Frisco Gold Mines Co., working the Gold Crown group in the Union Pass district, treated 14,000 tons of ore, worth $115,000. The lode in this mine is of great width, and a larger plant is required. The Grand Gulch mine, in the Bently district, near the Colorado river, is shipping 150 tons of copper per month to Salt Lake, the past year's output being worth $127,750. The Union Basin Mining Co. shipped 11,800 tons of zinc ore and concentrate to the smelter at Bartlesville, Oklahoma, which returned $244,400 from zinc and $23,600 from gold and silver. Good ore is obtained down to 500 ft. depth. It is expected that the Gold Road Mines Co. will have produced $800,000 in 1912. The total production from all mines of the county was $2,571,818 during the past year.

Pima County

The Sasco smelter, at Silverbell, will be put in blast in the spring, and will treat over 400 tons of ore per day from the Christmas mine. The smelter has been overhauled, and an aerial tram, one mile long, has been erected at the mine.

A 100-ton capacity plant will be built, and probably a lead furnace to treat ores from Olive. Near this place, the Empire Zinc Co. is expected to erect works to treat zinc ores. The Lewisohns are prospecting their claims in the Rosewater district, Santa Rita mountains. Good sulphide ore has been cut in the North Star shaft at 100-ft. depth. Cross-cutting has been started at the 700-ft. level of the Esperanza, at Chesterfield. The Pontoc copper mines, 10 miles north of Tucson, are being unwatered prior to being prospected.

Yavapai County

At the Blue Bell mine the 900-ft. level is opening good ore. Pumps and ventilating apparatus are being placed. For the latter purpose, 4000 ft. of 15-in. galvanized iron will be used. A small mill is to be erected at the gold claims of Miller and Bawder, in the Santa Maria district. Lessees at the Crosby mine, in this district, treated 44 tons of ore worth $58 per ton. A shipment of 100 tons will be treated from the Fortune mine, in the Walker district.

Yuma County

The Arizona-Empire mine has 35 men working on the old road between Gold Hill and Parker. When this is finished the new road will be constructed and the Auto Delivery Co. will handle over 400 tons of ore per day with 21 auto-trucks. The ore at Gold Hill is quarried and averages $40 per ton.

CALIFORNIA

The latest statistics show that there are 1181 producing mines in California, of which 596 are deep mines, and 585 placers, including dredge, hydraulic, drift, and surface claims. Dredging seems to be the only form of placer work which is showing any marked advance. In deep-mining operations over 2,700,000 tons of ore is mined yearly in this state, by far the larger portion of this coming from the Mother Lode districts. The output of silicious ore has increased to some extent, and this usually averages from $4.65 to $5.25 per ton in gold and silver. Thirteen new stamp-mills, with 163 stamps, were added during 1912; also about 12 Huntington and Graupner mills, and 6 cyanide plants. The stamp-mills of California crush over 2,250,000 tons of ore per year, of which the Mother Lode counties contribute 1,400,000 tons; Amador county yielding 600,000 tons.

Amador County

The South Eureka mine, at Sutter Creek, will be shut down for some weeks owing to a cave-in in the main shaft at a depth of 30 ft., from where it collapsed for over 25 ft., jamming both skips. Nobody was hurt, and the miners escaped through connections with the Central Eureka mine. The 80-stamp mill of the South Eureka had already been shut down on account of the cold weather.

Kern County

Local reports state that the present year will be one of much activity at Randsburg. Electric power will be supplied by the Southern Sierras Power Co. within 30 days. The Consolidated Mines Co. is erecting a 5-stamp mill, and the mine is well opened to supply ore. A Braun rapid reduction mill, with a capacity of 3 tons in 10 hours, using 3 hp., is being installed on the property of the Gold Placer Co. This mill will be used to grind concentrate, so that scheelite can be separated from the gold by a Cummings separator. Four pumping plants at Inyokern were connected to the power plant of the Southern Sierras Power Co.

at San Bernardino. The pumps will require 1000 hp. to supply water for irrigating this district.

Placer County

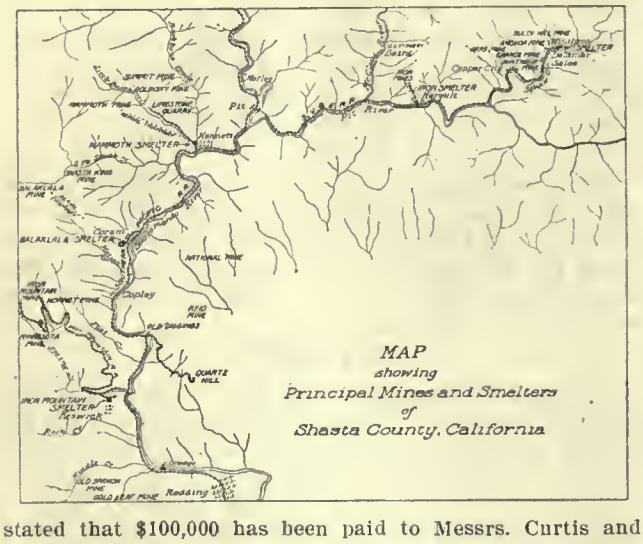
The Keystone drill, which was recently taken to Deer creek, below the Newtown district to test the gravel deposits, has been started. Three men from Alaska will operate the machine under W. Colley, of the Union Construction Co. of San Francisco. Holes will be put down to bedrock, and samples taken every foot, over a distance of 1000 ft. down the creek. If results average 20c. per yard a large dredge will be built.

Sacramento County

Since the Natomas Consolidated of California appointed E. K. Carnes as head of its horticultural work, plans have been made for establishment of a nursery, where all future stock will be raised. Ten acres of irrigated land near Nimbus has been selected. A hot-house has been rented temporarily in Sacramento until the land is ready, and 40,000 olive cuttings are to be planted. Eventually there will be three distinct nurseries—for olives, citrus, and ornamental trees.

Shasta County

(Special Correspondence.)—A syndicate of Seattle capitalists, headed by M. Thompson, has taken over 500 acres of gravel land near Igo, a few miles from Redding. It is



stated that $100,000 has been paid to Messrs. Curtis and Russell, the former owners. A bucket-elevator dredge will be built early in the present year. The same syndicate may acquire the Bryant tract of 1300 acres, in the same district. During the past year the Mammoth Copper Co. produced 28,000,000 lb. of copper from its Kennett smelter. The Noble Electric Steel Co. is increasing the capacity of its electric iron smelter at Heroult. The by-product plant is producing coke, tar, and other materials. Shasta county is estimated to have produced minerals worth $5,400,000 in 1912.

Redding, January 6.

The Mining Congress of Southern Oregon and Northern California will be held in the Armory Hall at Redding on May 14, 15, 16, and 17. A large attendance is expected, especially from Oregon. The last congress was held at Yreka, Siskiyou county.

COLORADO

Bullion valued at $38,194,003.76 was received at the Denver mint in 1912, an increase of $2,954,034.93 over the previous year. The bulk of this was received from Colorado, and small amounts were received from all the Rocky Mountain states.

Clear Creek County

(Special Correspondence.)—The production of this county for the past year is estimated as $1,491,949. The output from the south end of the county showed a 10% decrease, while the north end had an increase of 50%. Twenty-five men are employed at the New Era mine, at Freeland, and large shipments of ore and concentrate are being made.

Georgetown, January 7.

At the Capital-Central mine, on Griffith and Alpine mountains, a drift has been driven 400 ft. on the Aetna vein, which yields a large quantity of ore in the Capitol mine. The company owning the latter property is making plans for extensive development during the current year. Work at the Geneva, on Griffith mountain, is encouraging.

Lake County (Leadville)

The value of the ore mined at Leadville during 1912 averaged $24 per ton; and that treated at the Arkansas Valley plant, not including carbonate of zinc, averaged $15 per ton. The following table shows the production of the past year, as given by the *Carbonate Chronicle:*

	Tons.
Carbonate of lead ore	18,194
Oxidized iron ore	94,979
Sulphide ore	127,834
Zinc sulphide ore	38,619
Zinc carbonate ore	160,779
Silicious ore	25,049
Total	465,454
Gold, 55,492 oz., valued at	$1,147,019
Silver, 3,048,900 oz., valued at	1,856,171
Lead, 23,821,375 lb., valued at	1,065,768
Copper, 2,710,186 lb., valued at	440,405
Spelter, 98,136,060 lb., valued at	6,673,253
Total in 1912	$11,182,616
Total in 1911	8,227,017

The San Juan

This district of Dolores, La Plata, Ouray, San Juan, and San Miguel counties showed in 1912 a decrease of $1,000,000 in output of gold and an increase of 500,000 oz. of silver, 3,500,000 lb. of lead, and 700,000 lb. of copper. Zinc production was also 300,000 lb. less. During 1912, 20,590 tons of ore and concentrate was shipped from Ouray, and the county's output was: gold, $1,955,750; silver, $309,973; lead, $214,470; copper, $98,000; and zinc, $10,000; a total of $2,588,202. The Atlas 20-stamp mill yielded $250,000. At the Camp Bird a winze is being sunk 200 ft. to develop the ore-shoot cut last spring. The Wanakah mill was improved during the year.

IDAHO

Shoshone County

The suit of the Stewart Mining Co. and the Ontario Mining Co. was started at Wallace on January 6. The former company contends that the Ontario veins apex in the Senator Stewart claim, can be traced over their south endline, and that under the law of extra-lateral rights, the ore, valued at about $1,000,000, is theirs. W. Clancy, for the Stewart company, stated that the ore and country rock were similar in each claim. The case is still being heard. On Pine creek, the Nabob Mining Co. will develop the V group of 15 claims, by extending its 2300-ft. adit, and prospect for the upper veins of the V property. This will require 1500 ft. of driving, giving a depth of 1200 ft. on the Idaho vein. Connection with the power-line of the Washington Water Power Co. is being made for electric motors which are waiting at the property. The 1200-ft. adit of the Amy and Matchless claims on Pine creek is to be extended 2000 feet.

The estimated production of copper in this state in 1912 was 7,500,000 lb., which came principally from the Empire Copper Co. in Custer county and the Snowstorm mine in Shoshone county. The lead output was 279,000,000 lb. At Arco, the Wilbert Mining Co. operated a new mill which yielded 1,500,000 lb. The lead furnace at Hahn was burned in September, and a furnace at Clayton, in Custer county, was the only smelter operated in the state. Lead production represented 65% of the total metal output in 1912, or about $12,500,000.

The silver-lead mines of the Coeur d'Alene district paid over $3,000,000 in dividends in 1912. The Bunker Hill & Sullivan paid $850,000; Federal, $800,000; Hercules, $600,-

000; Hecla, $300,000; Success, zinc producer, $300,000; and Snowstorm, copper producer, $75,000.

MONTANA

This state retained second place among the copper-producing states, and in 1912 yielded 310,000,000 lb. Lead production was about the same as in the previous year, namely, 6,500,000 lb. There was a decrease of 41% in the spelter output to 25,520,000 pounds.

Granite County

(Special Correspondence.)—The Royal Basin Mining & Milling Co. recently made its first shipment of copper cathodes from its leaching and electrolytic precipitation plant at Maxville. The Granite-Bimetallic company, of Philipsburg, has completed a 500-ton cyanide plant to treat the tailing from the old mills. If the plant works as well as expected, the impounded tailing will supply it with a profitable grade for many years.

Philipsburg, January 13.

Missoula County

(Special Correspondence.)—The Carter district, near Superior, is active these days. The Chicago, Milwaukee & St. Paul railroad is constructing a spur for loading ore at Spring gulch. The King & Queen mine is hauling ore to bins at that point from its new 1500-ft. tramway terminal. Some work is going on at the Iron Mask, O. R. & N., and the Glen Metal mines.

Missoula, January 13.

Sanders County

(Special Correspondence.)—Butte interests have bonded a large tract of placer ground on Vermilion creek. The ground is to be proved by churn-drills and, if found satisfactory, dredges will probably be constructed.

Thompson, January 13.

Silverbow County

Out of 33 counties in Montana, 17 received $673,358 in taxes in 1912 from the Amalgamated Copper Co., Silverbow receiving $356,428, Deer Lodge $117,920, Missoula $51,298, Cascade $49,639, and Flathead, Ravalli, Lincoln, and Sanders, about $20,000 each. During the past year the 13 groups of mines at Butte produced 322,837,620 lb. of copper from 4,926,141 tons of ore. The year's work of the Amalgamated properties may be summarized as follows:

Men employed	13,941
Wages paid	$16,818,285
Fuel and power	4,724,662
Lumber and timber	3,107,461
Freight	5,859,154
Custom ore purchased	5,102,236
Supplies	2,688,080
Taxes, insurance, general	1,189,684
Total expenditure	$39,489,562
Dividends	$ 6,155,516

NEVADA

The lead production in 1912 was 13,000,000 lb., compared with 3,263,657 lb. in 1911, mines in the Pioche district of Lincoln county and the Yellow Pine district of Clark county furnishing the largest part of the output. The adjustment of litigation at Pioche resulted in increased ore production in that centre, along with the completion of a railroad spur to the Bullionville tailing dump. Zinc production was about 12,000,000 lb., an increase of 233% over 1911. The chief mine was the Yellow Pine, which is equipped with the only concentrating plant in the district.

Esmeralda County

Diamond-drills have never been used for prospecting at Goldfield, and the Consolidated company is to erect a complete plant, and drill from the lowest levels of the Clermont or Grizzly Bear workings.

Lincoln County

At the Prince Consolidated mine a 5-ft. vein, carrying higher metal content than in the upper levels, has been opened on the 400-ft. level. During the week ended December 28, 1847 tons of ore was shipped. There are 19,000 tons of ore broken in the stopes ready for extraction. The diamond-drill is 102 ft. below the 600-ft. level.

Mineral County

Eighteen miles from Schurz, the Queen Regent Merger Mines Co. is actively developing its estate of 700 acres. At the 300-ft. level an orebody 33 ft. wide has been opened. The formation lying above is a hematite of high quality in iron, and contains gold, silver, and copper worth $10 per ton. Work at the Queen Regent has been under way for about 18 months. The Gold Range M. M. & L. Co., at Douglass Camp, is erecting a stamp-mill, which should be finished early in January.

Storey County

At the Sierra Nevada there has been an improvement on the 2500-ft. level. The northeast drift was extended 23 ft. during the week ended January 4, the quartz being 3 ft. wide and worth $6.50 per ton. From the raise, 23 mine-cars of ore were saved, worth $25 and 20 cars worth $6.50 per ton. The Ophir and Consolidated Virginia companies continued enlarging the old McM. Ross winze and have driven to No. 12 level. The Crown Point shipped 773 tons to the Yellow Jacket mill. The gross tonnage from Crown Point, Belcher, and Yellow Jacket was 866 tons, valued at $6000. The Mexican mill treated 319 tons of ore worth $43.32 per ton, with 94% extraction, supplied by the 2300, 2400, and 2500-ft. levels. Four bars of bullion worth $4000 were shipped from the Ophir cyanide plant. Ice-jams on the Truckee river, which supplies the electric-power plant, caused a shortage of power for pumping at the C. & C. shaft, and the water rose within 2 in. of the motors, but in a short time the station was unwatered.

UTAH

Juab County

The Tintic district shipped approximately 500,000 tons of ore, worth $10,000,000, during 1912, an increase of 20% over the previous year.

Utah County

The annual report of the Iron Blossom company for the year ended December 1, 1912, shows the following details: No additional property was acquired during the year. A new electric hoisting plant was installed at No. 1 shaft and is ready for work. An immense quantity of ore has been opened, of better grade than before. At present a winze is being sunk at the contact of the dolomite at white lime in Spy Hollow. The main working adit caved from the 200-ft. level to the bins, and it was necessary to drive a new adit around this caved ground. The deepest ore yet opened is on the 700-ft. level of No. 1 workings, and indications are good for more ore. Development covered 7518 ft., making a total of 31,953 ft. to date.

Ore production:

No. 1 workings, tons	31,855
No. 3 workings, tons	27,612
Metal contents:	
Gold, ounces	12,712
Silver, ounces	1,939,844
Lead, pounds	4,731,504
Gross value	$1,499,136
Net value	$ 907,103
Total revenue	$1,136,445
Dividends paid	$ 400,000
Balance November 30, 1912	$ 332,807

The report gives full details of working costs in a commendable manner. During the week ended January 11 the new electric equipment at the No. 1 working of the Iron Blossom went into commission, this being the eighth mine at Tintic to adopt electric hoisting. The mine will now be developed below the 800-ft. level.

The 1350-ft. level of the Eagle & Blue Bell is showing good ore, and three carloads per day is shipped. At the Yankee mine development is being pushed on the 1800 and 2000-ft. levels.

WASHINGTON

Spokane County

(Special Correspondence.)—During the past year business done on the Spokane Stock Exchange amounted to 4,717,963 shares, valued at $2,116,355. The year was regarded by members as the most promising in history from the point of legitimate mining of the Pacific Northwest. February 19 to 21, inclusive, have been selected as dates for the second annual Northwest Mining Convention, to be held at Spokane. Invitations have been sent to the American Institute of Mining Engineers, electrical, chemical, civil, and mechanical engineers' organizations. On February 22 the visitors will be shown various engineering points of interest about the city, including the Monroe-street bridge, described in *Western Engineering*, October 1912; the work of the Washington Water Power Co. at Long Lake; and construction work of the Milwaukee and O. W. R. & N. Co. railroads.

Spokane, January 9.

CANADA

British Columbia

During the past year development work at the Nickel Plate mine included sinking the incline shaft 400 ft. and driving 300 ft. on four levels opened from it; start of sinking the Dickson incline to 3000 ft.; and diamond-drilling 3447 ft. The Windfall and four other claims were acquired for $150,000. The mill treated 70,239 tons of ore yielding $792,000, with about 94% extraction, the total output to date being $4,600,000.

Ontario

According to the Cobalt *Daily Nugget*, ore produced by mines in the district during 1912 amounted to 21,763 tons, yielding 30,500,000 oz. of silver bullion, valued at $18,500,000, bringing the total to date to $81,817,352, the gross value being $87,000,000. Dividends paid totaled $8,617,000, making $42,000,000 to date. Estimated ore reserves of Cobalt mines are valued at $30,000,000. The principal producers during the year were: Nipissing, 6,075,000 oz. of bullion and $1,800,000 in dividends; and La Rose, 3327 tons of ore, yielding 2,900,000 oz., worth $1,800,000. During December the Nipissing company produced 440,000 oz. of bullion from the Meyer vein. The high-grade mill treated 164 tons of ore and shipped 422,495 oz. of bullion.

Mines at Porcupine are resuming work, and some have as many men as before the strike was declared. About 70 cases under the Lemieux act, brought against employees of the Hollinger mine and others, were heard on January 6. A great deal of interest is attached to the outcome of the cases, which will be the first under the new act.

Quebec

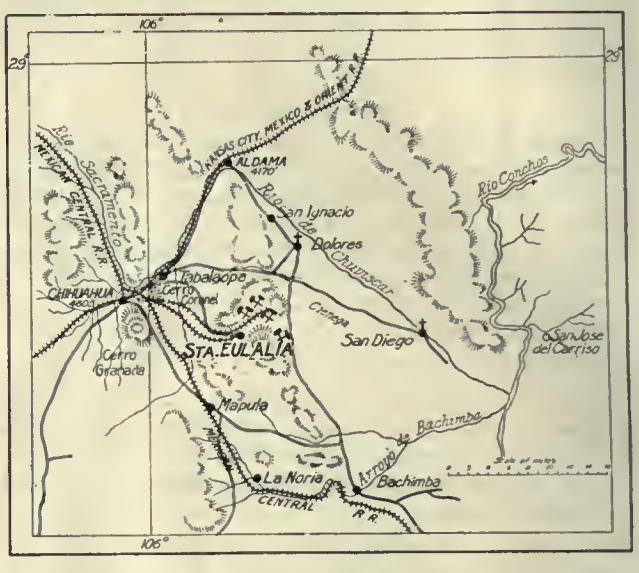
(Special Correspondence.)—The Champs d'Or Rigand Vandreuil, Ltd., has recently given an option on its entire property to A. C. Ludlum, president of the New York Engineering Co., for $1,500,000. This property is in Beauce county, in the province of Quebec, and comprises some 72,000 acres. It has been partly prospected, and was equipped with a hydraulicking plant which has operated successfully during the past season. This mine and its equipment was elaborately described and illustrated in the *Engineering & Mining Journal* of November 25, 1911. Mr. Ludlum now has engineers on the ground checking up former work and endeavoring to prove sufficient dredging area to warrant further equipment. It is his intention to equip the property with several large dredges if the present exploration work proves satisfactory.

Beauceville, January 10.

MEXICO

Chihuahua

(Special Correspondence.)—It is now generally quiet in the mountains. At the Chucheno there is a local guard and a detachment of volunteer troops near by. A new steam-electric plant is being erected and the mine is being re-equipped for this power. Extensive repairs are being made to the mill and the railroad. Auto trucks are running between the mine and the railroad as well as the freight wagons and pack-trains. The Sierra Mining Co. at Ocampo has most of the material for the new plant on the road to the mine, but no move toward erecting has been made. La Republica has definitely shut down. Yoquivo would like to operate, but being in a badly infested district, hardly dares to attempt it. Cusi has shut down until conditions improve. The continued interruptions of railroad traffic constitute the worst features of the present situation. It is nearly impossible to operate a property dependent on the railroad for supplies. The Americans have no quarrel with any party or faction here, no interest in the situation beyond the assurance that they be permitted to do business, and no desire to meddle. But the present tendency of Mexican sentiment seems to be to



PART OF CHIHUAHUA.

eliminate all Americans and American interests. Should they succeed in this, it may be imagined that they will notice a falling off in their revenues, both national and personal.

Chihuahua, January 3.

Guadalajara

The El Favor Mining Co. is shipping high-grade ore and is treating El Favor, Mololoa, and Mirador ores in its mill. A dividend of 1c. gold, amounting to $35,000, will be paid on January 30. The company has in the United States $47,379, and in ore and bullion in transit, etc., $67,341, making a total of $114,720.

American and French capitalists who had an option to purchase the Casados mines in the Hostotipaquillo district for ₱4,500,000 have decided not to complete the purchase owing to the present condition of Mexico. The Consolidated Mining Co., which owns the mines, will erect a 100-ton mill. During development the vein will be opened on the 500-ft. level and the shaft sunk to 600-ft. depth, while high-grade ore is shipped to the smelter.

Sonora

During December the Cananea Consolidated Copper Co. produced about 8,600,000 lb. of copper, while for the past year the total was 80,000,000 lb. At the 300-ft. level of the El Pilar mine, near Santa Cruz, good ore has been opened, and in January five cars of ore will be shipped to the Cananea smelter. Twenty-five men are employed, and a 50-ton mill will be erected in the spring. From the Josefina a carload of 22% copper ore has been shipped. This Santa Cruz district has been quiet for some time, but is again attracting attention. The new smelter of the Minneapolis Copper Co. at Cumpas is ready for work, and an annual production of 15,000,000 lb. of copper is expected. Through the port of Nogales in 1912 there were shipped to the United States 203 cars of ore and concentrate, and 79 cars of graphite.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

AL. FRANK is at Wallace, Idaho.

A. W. PAYNE has gone to Panama.

A. L. GHOLZ is now at Gila, Arizona.

E. A. BERUMNE is here from Mexico.

J. COWAN is here from Salt Lake City.

DONALD FERGUSON has gone to Guatemala.

BERNARD MACDONALD has returned to Guanajuato.

E. RAMMELMEYER is traveling in Italy and Germany.

P. N. MOORE has returned to St. Louis from the East.

WALTER M. BRODIE is now at 45 Broadway, New York.

C. C. GREENWOOD is on a visit to New York from Mexico.

THAYER LINDSLEY is in the West on professional business.

C. W. GRISWOLD and H. DE WERITS are at the St. Francis.

P. S. SMITH has removed to San Francisco from Los Angeles.

J. BANERES DE ALZUGARAY is now at 115 Broadway, New York.

LOGAN BALLEW is with the Empire Copper Co. at Mackay, Idaho.

R. H. ANDERSON is now at 10 Avenida Cinco de Mayo, Mexico, D. F.

J. F. KEMP is returning from Florida, where he has been on a brief visit.

W. W. SHELBY is now with the Moctezuma Copper Co. at Nacozari, Sonora.

P. A. WICKHAM was in San Francisco this week, but is returning to Mexico.

OSCAR LACHMUND has been appointed general manager for the British Columbia Copper Co., Ltd.

ALEX FYFE is now metallurgist for the Cia. Minera y Exploradora de Ventanas, S. A., at Ventanas, Durango.

FRED SMITH, superintendent of the Mohawk and Wolverine mines, has resigned on account of age and ill health.

R. B. BRINSMADE recently returned to Puebla, Mexico, after a two weeks' visit to the northern part of the state of Mexico.

WILLIAM WRAITH was recently presented with a chest of silver by the employees and staff of the Washoe smelter at Anaconda.

J. E. SPURR, EDMUND JUESSEN, S. H. BRADY, and JAFET LINDEBERG were among those who last week visited Rochester, the new Nevada mining district.

GEORGE T. COFFEY, superintendent of hydraulic operations for the Yukon Gold Co., Dawson, Canada, has recently returned to San Francisco and will remain for about three months.

HENRY H. ARMSTEAD is in Guanajuato, Mexico, making an inspection of the properties of the Coimena Mining Corporation, and the Montana & Mexico Mining Co., and will visit the properties of the Mexican United Co. in Tepic and Jalisco before returning to New York.

Obituary

SAMUEL N. KNIGHT died at Sutter Creek, California, January 13, at the age of 76. He was born at Gardner, Maine, and came to Sutter Creek in 1863, where he bought an interest in the local foundry and engaged in the manufacture of milling and mining machinery. A bridge-builder by profession, he was also the inventor of the Knight waterwheel, and in other ways exhibited a high degree of mechanical skill. A public-spirited citizen of the best type, he exerted a remarkable influence over young people, so that the education received by the young men he trained in his shops was moral as well as technical. Though he leaves no family, many mourn his 'crossing the divide.'

Market Reports

LOCAL METAL PRICES

San Francisco, January 16.

Antimony	12—12¾c	Quicksilver (flask)	39.50
Electrolytic Copper	18—18¼c	Tin	52—53¼c
Pig Lead	4 60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	January 16.
Camp Bird Ltd	$ 5½
El Oro	4⅛
Esperanza	9½
Oroville Dredging	1½
Santa Gertrudis	7
Tomboy	6¼

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. January 16.		Closing Prices. January 16.
Adventure	$ 4¾	Mohawk	$ 54½
Allouez	37¼	North Butte	30⅝
Calumet & Arizona	65¾	Old Dominion	49½
Calumet & Hecla	495	Osceola	96½
Centennial	16	Quincy	72¼
Copper Range	47¼	Shannon	11⅜
East Butte	12⅜	Superior & Boston	2½
Franklin	8	Tamarack	31
Granby	35½	U. S. Smelting	41¼
Greene Cananea, ctf.	8⅜	Utah Con.	10
Isle-Royale	28	Victoria	1⅞
La Salle	4¼	Winona	3¼
Mass Copper	4¾	Wolverine	66

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 16.

Atlanta	$ .18	Montana-Tonopah	$1.87
Belmont	8 00	Nevada Hills	1.65
Big Four	.84	North Star	.22
Buckhorn	.90	Ophir	.09
Con. Virginia	.12	Pittsburg Silver Peak	.65
Crown Point	.22	Round Mountain	.20
Florence	.43	Sierra Nevada	.13
Goldfield Con.	2.00	Tonopah Extension	2.12
Halifax	1.35	Tonopah Merger	90
Jim Butler	.73	Tonopah of Nevada	6.00
Jumbo Extension	.35	Union	.14
MacNamara	.21	Vernal	.11
Mexican	.98	West End	1.50
Midway	.35	Yellow Jacket	.17

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. January 18.		Closing Prices. January 16.
Alaska Mexican	$13⅜	McKinley-Darragh	$ 2
Alaska Treadwell	42⅝	Miami Copper	23¾
Alaska United	23	Mines Co. of America	3¼
Amalgamated Copper	72¼	Nevada Con.	18¾
A. S. & R. Co.	70¼	Nipissing	8¾
Braden Copper	8⅝	Ohio Copper	1
B. C. Copper Co.	4⅜	Ray Con.	19¼
Chino	43	Tenn. Copper	35
First National	2⅜	Tonopah Belmont	8½
Giroux	3¼	Tonopah Ex.	2⅜
Goldfield Con.	2	Tonopah Mining	6⅜
Greene-Cananea	8¾	Trinity	4⅞
Hollinger	15½	Tuolumne Copper	3
Inspiration	16⅞	Utah Copper	54⅜
Kerr Lake	2¾	West End	1½
La Rose	2¾	Yukon Gold	3
Mason Valley	8		

In North America, according to the United States Geological Survey, the lowest point is in Death Valley, California, 276 ft. below sea-level; but this is a slight depression compared to the basin of the Dead Sea, in Palestine, Asia, where the lowest dry-land point is 1290 ft. below sea-level. In Africa the lowest point is in the Desert of Sahara, about 150 ft. below sea-level, but the Sahara as a whole is not below sea-level, although until recently the greater part of it was supposed to be. In Europe the lowest point at present known is on the shores of the Caspian Sea, 86 ft. below sea-level. In Australia the lowest point is at Lake Torrens, about 25 ft. below sea-level.

Copper Review for December

By Misha E. Appelbaum

The increase during the month of December in the visible supply of copper in the United States, 19,000,000 lb., was much larger than anyone anticipated, and the surplus of copper has now again reached a comfortable figure. It is useless to try to contradict the fact that even with good business, the best that can be hoped from now on is that deliveries and production will about equal each other, and as a result producers cannot expect any increase in the price of copper or look for any material betterment. The question to decide, however, is whether the enormous deliveries of 1912 can be duplicated in 1913. The production will be fully as large in 1913 as in 1912, and if the deliveries are as large, it will mean that the present price of copper can hold. There is too much uncertainty surrounding the business world to enable one to say that business during the present year will be as good as last year, and for that reason I cannot look for any higher prices. At the same time the intrinsic conditions of the business world are sound enough so as to make one hope against any serious decline. In fact, these arguments can be applied with perfect safety to almost all the metals.

The Petroleum Industry in 1912

According to David T. Day, of the U. S. Geological Survey, the Eastern petroleum fields declined in production, because it was impossible to keep up the great output of 1911 without large additional discoveries of new pools in the older fields. The Eastern decline was, however, offset by the increase in California, where the San Joaquin Valley fields (Midway, McKittrick, Maricopa, etc.) are still at the height of the gusher stage.

Production of Petroleum in the United States in 1911 and Estimated Production for 1912, in barrels of 42 gallons.

State.	1911.	1912.
California	81,134,391	87,000,000
Oklahoma	56,069,637	52,000,000
Illinois	31,317,038	28,000,000
Louisiana	10,720,420	10,000,000
West Virginia	9,795,464	11,800,000
Texas	9,526,474	10,500,000
Ohio	8,817,112	8,500,000
Pennsylvania	8,248,158	8,000,000
Indiana	1,695,289	1,200,000
Kansas	1,278,819	1,300,000
New York	952,515	700,000
Kentucky	472,458	500,000
Colorado	226,926	200,000
Other states	194,690	500,000
	220,449,391	220,200,000

The total value of the product increased markedly, being about $150,000,000 compared with $134,144,752 in 1911.

In all the fields except those of California and the Gulf there was a heavy drain on stocks during the year, so that from a total of 81,789,390 bbl. (over a half year's output) on January 1, the stock declined to 69,000,000 bbl. at the end of the year. This drain reflects the increased capacity of the refining plants of the United States, the greatly increased exports, and a gradual change in the general condition of the industry.

The general decline in production, except in California, would doubtless have been much greater but for the effort to apply laws of supply and demand by increases in prices. Prices advanced so greatly during the year as to stimulate drilling, even in the old New York and Pennsylvania pools, and so checked the decline. Formerly this plan has not been so successful. In the Mid-Continent field also it checked the decline, so that the product will come within 4,000,000 bbl. of the maximum output (in 1910).

Quicksilver in 1912

Preliminary figures collected by H. D. McCaskey, of the United States Geological Survey, from the individual producers show that the domestic production of quicksilver in 1912 was 25,147 flasks of 75 lb. each, valued at the average San Francisco domestic price for the year, $42.04, at $1,057,180. A comparison of these figures with the final published Survey figures for 1911 and 1910 shows a gain over the output of 1911 of 3891 flasks and over that of 1910 of 4546 flasks. Twenty mines were reported as producing in 1912, of which 16 were in California, against 22 producers in 1911, of which 19 were in California. The production for 1912 showed a larger increase than was estimated in our issue of January 4, and generally expected, but it is not thought that a correspondingly large increase can be looked for in 1913.

The production of quicksilver in California in 1912 was 20,613 flasks, valued at $866,571, against an output of 18,860 flasks, valued at $867,749, in 1911. It was the largest production since that of 24,635 flasks in 1905. The increase was due mainly to the yield of the New Guadalupe mine, in Santa Clara county, but also to increased output from several other mines. In San Benito county the New Idria mines yielded slightly less than in 1911, but remained the largest producers in America and are to be credited with nearly half the entire output of California.

No production of quicksilver was reported from Arizona, Oregon, Utah, or Washington in either 1912 or 1911. In Nevada there was a largely increased output from the Mercury mines, near the old Ione district, in Nye county, where a modern Scott furnace has been in operation, and a small production was reported from the Telluride prospect, near Beatty. Considerable prospecting and development of quicksilver deposits have been reported from Bare mountain and other localities near Beatty, and in other districts in Nevada, and the production from this state may further increase in 1913. The Shoshone mines, near Ione, were not producers in 1912. In Texas, the Chisos mine at Terlingua, Brewster county, continued to make a considerable production. The combined output of quicksilver in Nevada and Texas for 1912 was 4534 flasks, valued at $190,609, against 2396 flasks, valued at $110,240, in 1911.

The market was fairly good for quicksilver in 1912. The imports were again in considerable excess over the exports and the demand was generally strong and apparently somewhat larger than the domestic supply. Prices began the year at $42.50 per flask for San Francisco domestic as the January average, rose to $44.40 for the March average, and thereafter gradually declined to the December average of $40.50—the average San Francisco domestic price for the year being taken at $42.04. The corresponding price in 1911 was $46.01. Exports of quicksilver from the United States in 1912 are estimated, from the records of the Bureau of Foreign and Domestic Commerce of the Department of Commerce and Labor, at 24,000 lb., valued at $14,000. In 1911 the exports were 21,841 lb., valued at $13,995.

Production of Iron Ore in 1912

Preliminary estimates of iron ore mined in 1912, based on the quantity mined during the first eleven months of the year plus estimates for the month of December, were received by the United States Geological Survey from 26 of the largest iron-mining companies in the United States at the close of the year. As the combined output of these 26 companies represents more than 80% of the iron ore mined in the United States, it is considered that the condition of the industry is fairly well gauged by their production, especially as both the Lake Superior and the Birmingham districts are well represented.

The average increase in the production of iron ore by these representative companies was 26.6%. Certain companies showed a decided decrease in production and others reported as much as 80% increase, but the outputs of such companies as reported abnormal production are not sufficiently great to largely affect the grand totals.

From the returns received it is estimated by E. F. Burchard, of the Geological Survey, that the total quantity of iron ore mined in the United States in 1912 was between 54,500,000 and 57,500,000 long tons. This quantity represents an increase of between 25 and 32% compared with the production in 1911, which aggregated 43,550,633 tons. It is therefore possible that the high record of iron ore output attained in 1910, 56,889,734 long tons, may be slightly exceeded, although the returns received thus far, which are only approximate figures, are not quite sufficient to justify a definite comparison with the figures for 1910. Red and specular hematite constituted about 90% of the output, most of the remaining 10% being divided about equally between limonite, or brown ore, and magnetite, with a very small quantity of siderite, or spathic ore.

In the Lake Superior district the production of iron ore apparently increased in slightly greater proportion than the average for the country at large, the total shipments having increased from 32,783,163 long tons in 1911 to nearly 48,750,000 tons in 1912. Production in the Birmingham district, Alabama, was largely increased in 1912, especially through the large output of the Red Mountain group of Clinton hematite mines operated by the Tennessee C. I. & R. Co. The production in Tennessee, North Carolina, and Virginia apparently has not greatly increased, if at all, above that of 1911.

Tungsten Production in 1912

The quantity of tungsten ore mined and marketed in the United States during 1912, according to preliminary figures collected by Frank L. Hess, of the United States Geological Survey, was equivalent to about 1290 tons carrying 60% of tungsten trioxide and was valued at $492,000, besides which a smaller quantity was mined but not marketed. This is an increase over the output of 1911, which was equivalent to 1139 tons of 60% ore and was valued at $407,985. The average price paid per unit (the unit is 1% of a short ton, or 20 lb., of tungsten trioxide) was about $6.35 in 1912, compared with $4.89 in 1911, but the extreme variation seems to have been less in 1912 than in the previous year. Although higher than in 1911, the price paid was unsatisfactory to the miner. It ranged from $5.80 to $7.25 per unit for ore running 60% or more of tungsten trioxide, and $8 was being quoted at the close of the year. Probably more concentrate was sold at $6 than at any other figure.

As usual, the largest production from any single district was made from the unique ferberite deposits of Boulder county, Colorado. About 1200 tons of ore of various grades was shipped out, equivalent to 775 tons of 60% ore. The Primos M. & M. Co. and the Wolf Tongue M. Co. are the largest producers in the district. The Wolf Tongue M. Co., which works its properties by a leasing system, introduced an important new feature during the year by furnishing electric hoists free to its lessees, and the company also pays a portion of the cost for sinking each shaft. The lessee pays for the cost of electric current used. It seems probable that this innovation will lead to an increase in production from the properties during 1912, unless the price should drop seriously.

In California the Atolia M. Co., which controls the Atolia field, at the north edge of San Bernardino county, increased the production of its remarkably pure scheelite over that of 1911 and was the largest individual producer in the United States. A small quantity of scheelite was also taken out in the Stringer district, a few miles north and west of Atolia. A discovery of scheelite was reported from the west side of the Rand mountains, but no ore was sold. A few tons of mixed wolframite and scheelite was shipped from the vicinity of Nipton, in the east end of San Bernardino county.

In Arizona a few tons of hübnerite concentrate was shipped from the dry placers and some ore from the veins near Dragoon; hübnerite ore was shipped from Arivaca to Denver, for concentration; and some scheelite concentrate was shipped from Oracle, where scheelite is associated with gold and silver ores. Small shipments of hübnerite were made from Osceola and Round Mountain, Nevada, and Patterson Creek, Idaho. A small quantity of hübnerite was concentrated at Loon Lake, Washington, but none was shipped. One small shipment of wolframite was made from Lordsburg, New Mexico.

Uranium and Vanadium Mining in 1912

The figures for the production of uranium and vanadium ores during 1912 have not been satisfactorily reported to the United States Geological Survey, and the output has therefore been partly estimated by Frank L. Hess from various data in his possession. Shipment of uranium and vanadium ores during 1912 has been in the hands of about a dozen persons and firms, and as in previous years the ores have come mostly from southwestern Colorado, with a smaller production from southeastern Utah, between the San Rafael swell and the Colorado line.

The production of uranium appears from preliminary estimates to have been equivalent to a little less than 26 short tons of uranium oxide, or approximately 22 tons of metallic uranium, a slight increase over 1911, when the production was equal to about 25 tons of uranium oxide, or 21.2 tons of the metal. The vanadium output of 1912 seems to have been equivalent to a little less than 300 tons of metallic vanadium, a somewhat larger quantity than that of 1911. The uranium-bearing ores were all carnotite, a variable compound of uranium and vanadium with other elements, found with several vanadium minerals in sandstones of Jurassic-Triassic age in the high plateau region of Utah and Colorado. So far the richest and largest deposits found are in Montrose county, Colorado, in Paradox valley, Long Park, the McIntyre district, and adjacent territory, extending into San Miguel, Dolores, and Mesa counties. In Utah the deposits mined are in Emery and Grand counties. Deposits which were unproductive during the year occur in Rio Blanco, Routt, and Moffat counties, Colorado, and in Uinta and San Juan counties, Utah. The percentage of uranium oxide (U_3O_8) in the ore varied from 0.5 to 6.32. The percentage of vanadium oxide (V_2O_5) in the same ores varied from 1.42 to 13.63. The relation between the uranium oxide and the vanadium oxide was likewise variable. At one extreme was an ore that carried 8.15% V_2O_5 and 1.54% U_3O_8; at the other extreme was an ore that carried 5.79% V_2O_5 and 6.32% U_3O_8. Of the more widely known uranium mineral, pitchblende or uranite, a few hundred pounds was mined near Central City, Gilpin county, Colorado. It was all sold as specimens and to laboratories, probably for experimental work. A few pounds partly altered to gummite and other secondary minerals was found in mining mica near Penland, North Carolina.

The larger part of the vanadium ore produced was a sage-green sandstone colored by the vanadium-bearing mica, roscoelite. It was mined near Newmire, San Miguel county, Colorado, and the vanadium was obtained in the form of iron vanadate at the local reduction plant of the Primos Chemical Co. The iron vanadate is shipped East to be smelted into ferrovanadium. Vanadium ores, probably volborthite and calcivolborthite, were prospected on Pass creek near Malachite, Huerfano county, and southeast of Silver Cliff, Custer county, Colorado, but no production was made. No vanadinite is known to have been mined for vanadium in this country during the year.

Prices varied much, but 25 to 30c. per pound for the contained vanadium oxide and $1.30 to $1.50 for the contained uranium oxide where it exceeds 2½% seem to have been the rule. The prices were considered too low by some producers, and their ore was stored awaiting a rise. Most of the ore goes to England and Germany and is said to be wanted especially for the radium content. The price of metallic vanadium was much below former years and from $4 or $5 per pound it fell to $2.50 and $2 for the contained vanadium or ferrovanadium, undoubtedly owing to competition between American firms. The imports of roasted sulphide ore from Peru were large and the production of ferrovanadium was probably the largest to date.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

CONCENTRATING ORES BY FLOTATION. By T. J. Hoover. 221 pp., ill. *The Mining Magazine*, London, 1912. For sale by the *Mining and Scientific Press*. Price $3.75.

A more timely book than this volume of Mr. Hoover's is difficult to imagine. After years of experiment and, unfortunately, litigation, chiefly in foreign countries, flotation processes have been brought to a point where rapid application upon a working scale is now the order of the day, and important plants in North America have already been constructed or are planned. Every well informed engineer is eager to become possessed of accurate information concerning the principles of flotation without undergoing the enormous amount of mental labor performed by the comparatively small group of men, among whom Mr. Hoover ranks to the fore, who have brought these processes to their present degree of perfection. The tremendous importance of flotation in ore-dressing practice lies in the fact that it utilizes common but unfamiliar phenomena for the successful treatment of material unamenable to older methods. This is so important as to deserve some elaboration.

In ordinary wet concentration of ores (omitting minor methods) the vital factor is the difference in specific gravity of the minerals treated, so that particles of equal volume have different mass. By the skilful use of water currents this may be employed to separate minerals from each other. The forces involved in this are large and are modified by other lesser forces that produce little effect on particles of moderate size. As the size of the particle decreases the gravitational force decreases, since it is dependent upon the mass, which varies as the cube of the diameter. The minor forces are dependent upon the surface area of the particle, which rapidly increases in proportion as the diameter increases. Thus, if a cube of 4000 sq. in. surface is broken into 40-mesh particles, the total surface area of the particles is over 30,000,000 sq. in.; in other words, the importance of the minor forces, as compared to the major force of gravitation, has been multiplied nearly 9000 times. If the material is very finely divided it will not sink, even in still water, except after the lapse of a long time. Thus ordinary methods of wet concentration break down when applied to finely divided material; they are not adapted to slime concentration. But milling practice has constantly tended toward the treatment of finer and finer material, since lump ore is comparatively difficult to procure, while deposits in which small amounts of valuable mineral occur are relatively abundant. And just as with the growing necessity for abundant power, rapid transportation, and easy communication, inventors devised the steam-engine, locomotive, and telegraph, so with the need of new methods of ore concentration the principles of flotation have been developed.

Like the development of electrical apparatus, flotation is partly dependent upon common phenomena of everyday life, of which the ordinary man takes no notice because he makes no use of them, and partly based upon new relations which have until now escaped observation because their perception was impossible without well directed experiment. The basal features are not at all obscure, and a Western 'school-marm,' in washing greasy sample-bags in hot soapy water, observed the essential factors that govern the modern processes. From that observation, nearly thirty years ago, to H. L. Sulman's more recent studies of the hysteresis of the contact angle between liquids and solids is not so far a cry as might appear. Drops of water sprinkled on a dusty floor similarly afford opportunity for the observation of some of the most significant phenomena of flotation, to one who is able to perceive their significance. The obscurity in which flotation methods have been enveloped is chiefly due to the desire of investigators to secure for themselves all the commercial advantages which might accrue from them. The fact that no contribution to the advancement of this important new development in the art of ore dressing has come from any of our technical schools or universities, with the single exception of the important work of K. A. Mickle, is a severe commentary upon the usefulness of the work which is being carried on under their auspices.

Returning to the book itself, which obviously demands some space in a book review, it should first be noted that Mr. Hoover is among those best entitled to speak with authority concerning flotation, having been intimately associated with much of the most important work done and having made important personal contributions to the art. He has been able, therefore, to prepare a detailed study in simple language and has included in this volume all that any ordinary engineer will need or care to know concerning flotation. The history of the experimental work which has led up to the present state of the art, and the litigation between patentees are admirably summarized, since in the present unfortunate state of our patent laws, litigation concerning patents is as much the affair of the operators as the patentees. The theory of flotation is briefly discussed in an easily understandable way, though the section on commercial effectiveness, page 59, is rather obscure. On the other hand, on the following page, the desire for simplicity leads to the use of a misleading comparison between the coagulation of soap solution by acid and the coagulation of sulphides by oil. The former is, of course, a chemical phenomenon and the latter a physical one; whatever resemblance exists being purely superficial. Mr. Hoover mentions that H. L. Sulman and H. F. K. Picard have in preparation an elaborate study of the theory of flotation. While this will be welcomed by investigators, Mr. Hoover's briefer exposition of the matter will meet the needs of most engineers. A chapter devoted to tests by flotation on ores will be one of the most useful features of the book. Five following chapters are devoted to detailed descriptions of the various processes. Considering how intimately Mr. Hoover has been engaged in the development of the art it is remarkable that he does not exhibit more bias in his comment. Not unnaturally, his own work receives full consideration, and opinions will differ as to the justice of the importance assigned to the work of others; thus Potter is perhaps somewhat slighted, and Hyde's work overemphasized. The operator is, however, concerned less with degrees of credit than with commercial returns. A chapter is devoted to the consideration of the economical factors of flotation methods, that is of corresponding importance. A full bibliography concludes the book, and will be of great assistance to those engaged in experimental work along these lines. It is not too much to say that Mr. Hoover has given us the most notable book of the year in this condensed summary of a new art with which every mining engineer should possess some degree of familiarity.

Recent Publications

STEER FEEDING. 37 pp. Bulletin 163. Purdue University Agricultural Experiment Station. Lafayette, Indiana, 1912.

TWENTY-FIRST ANNUAL REPORT OF THE CANADIAN BUREAU OF MINES. 1912. Part I. 309 pp.; ill., maps, plans, index. Toronto, 1912.

THE DOUGLAS OIL FIELD, CONVERSE COUNTY, AND THE MUDDY CREEK OIL FIELD, CARBON COUNTY, WYOMING. 50 pp.; ill., maps. Bulletin No. 3, Wyoming State Geol. Survey. Cheyenne, 1912.

THE STONE INDUSTRY IN 1911. By E. F. Burchard. Advance chapter from 'Mineral Resources of the United States, 1911.' 96 pp., maps. Washington, 1912.

PHYSIOGRAPHY AND STRUCTURE OF THE WESTERN EL PASO RANGE AND THE SOUTHERN SIERRA NEVADA. By C. L. Baker. University of California Publications. 25 pp.; Ill. Berkeley, December 1912.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1911. Part IV. St. Lawrence River Basin. By C. C. Covert and R. H. Bolster. 98 pp.; Ill.; index. Water Supply Paper 304. U. S. G. S. Washington, 1912.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

GYRATORY CRUSHERS totaling 19 are at work at the Homestake mine and mills; and storage-bins hold 6200 tons of ore.

OIL STOCKS in the United States on January 1, 1912, were 81,789,390 bbl., while at the end of the year they were reduced to 69,000,000 bbl., according to the U. S. Geological Survey.

'STRAIN-BURST' is a term proposed to be used on the Rand instead of air-blast, which refers to the sudden dislocation of rock in many mines. In the Champion Reef mine, India, 'bursts of rock' are still common, and the damage done by them often leads to considerable expense in repairing the workings affected. It is stated that records show a substantial decrease in their number.

EROSION of the land surface in the United States is of enormous extent, and 270,000,000 tons of dissolved matter and 513,000,000 tons of suspended matter are transported to tidewater every year by the various streams. If this erosive action had been concentrated upon the Isthmus of Panama at the time of American occupation, it would have excavated the prism for an 85-ft. sea-level canal in about 73 days.

STEAM-DRIVEN AUXILIARIES in a power-plant are more satisfactory than electric. In steam pumps the consumption is high, 60 to 100 lb. per b-hp.-hr., but by exhausting into a feed-water heater, the latent heat is regained. With electric drive, the power is taken from the thermally inefficient main engine and though only one-third or one-fourth as much steam will then be required, the latent heat will be lost. There is also a common feeling that steam is more dependable.

PYRITE was mined in the Urals to a greater extent than ever in 1912, but owing to the great distances in Russia this has not affected the situation in the western provinces, where foreign pyrite supplies numerous chemical works. A new industry in the manufacture of fertilizers and superphosphates is being built up in the Urals. Despite the activity of the copper mines in Russia, the sulphur fumes are still wasted. The copper companies are too busy making metal to worry about the sulphur.

STATISTICS recently collected by the Bureau of Mines show that about one-third of the fatal accidents and one-fourth of the non-fatal ones in the past seven years have been due to the steep inclination of the coal beds. Because of the steep inclination of the coal beds one man cannot visit nearly so many working places in a given time as he can in a mine where the beds are flat. The result is that working places are not visited with sufficient frequency by the mine officials. This fact, coupled with the readiness of the average Washington coal miner to 'take a chance' to save a little time or work, is responsible for many of the accidents.

MORTAR-BOXES of steam stamps at the Lake Superior copper mills are fitted with a device for removing mass copper of fist size and smaller, which may have escaped the eye of the feeder, or may have been liberated from the rock by the stamp. This consists of a pipe connection with the mortar-box, through which water is forced into the mortar under such pressure that the copper can pass down the pipe against the stream, while the lighter rock is restrained and kept in the mortar for further crushing. These hydraulic mortar-cleaning devices are of great assistance in maintaining the capacity of the stamp by removing metal which it would be useless to try to crush, and by rendering it unnecessary to operate the mortar for periodical cleaning by hand.

MINERS may cut from locations upon public land (excluding land in the National Forests) without asking for a permit, all the timber necessary in the mining and development operations; but as he is only an occupant operating under a license, although owning the mineral under his possessory right, he does not own the timber so as to be able to make whatever disposition of it he wishes, until the issuance of the receiver's receipt in the process of patenting the claim. Up to the issuance of the receiver's receipt, he cannot sell any timber from his claim; and it appears that he cannot lawfully cut timber from his locations, without a permit, for other purposes than that connected with their development and the milling, smelting, or reduction of his ores.

SECTIONALIZED mortar-boxes made for mountain transport are seldom satisfactory, unless the ore to be milled in them is exceptionally friable and a high duty can be obtained with a light stamp. So far no attempt has been made to sectionalize the Nissen stamp, but 2-stamp batteries are under construction for one of the latest Mexican mills, situated where transportation is difficult. Among other types of crushing machines which are capable of being sectionalized are the smaller sizes of rolls and the ordinary or No. 5 Krupp ball-mill. The use of rolls in mountain districts is not altogether to be recommended, other than in connection with small properties. The wearing parts make bad mule loads, and, in consequence, the repair cost is high. In the sectionalized ball-mill the liner plates are made so as to form good mule loads, and the machines, when erected, can be worked as efficiently as the ordinary mill. A further advantage with the ball-mill lies in the fact that in the event of a shortage in the supply of steel balls, any scrap iron or steel of similar size and shape can be used, the shanks of old battery shoes making excellent temporary substitutes for steel balls. By an increase, or decrease, in the load of steel, the output from a ball-mill can be raised above, or lowered below the normal amount without altering the screening. There is, however, a limit to the overloading, as the perforated grinding plates have only a certain delivery to the coarse screens.

PLUNGER PUMPS elevating mill pulp often give trouble through emptying the sump, and then refuse to pick up their load again, when the sump fills up. This is overcome at several mills in Kalgoorlie by means of a self-priming apparatus. The duplex Cornish pump, with plungers 10 by 48 in. lifts pulp from the stamps to a diaphragm-cone, and also from the tube-mill and the grinding pan. The pump is provided with counterbalances. The object of this gear is to constantly keep the pulp within an inch or so of the bottom of the suction pipe, which is done in the following manner: the counterbalance, 2 by 3 ft., is filled with water. A 1-in. pipe is connected with the pump barrel, as close to the stuffing-box as possible, and is led to the counterbalance. On the up-stroke of the plunger, pulp is drawn up the pump suction pipe, and also from the counterbalance. On the down-stroke, the pulp is forced through the pump delivery column, and also into the counterbalance, only a small quantity surges to and fro between the pump-barrel and the counterbalance. When the pump is on the point of forking, the amount of pulp necessary to prevent it from doing so is drawn from the counterbalance, and is returned on the down-stroke. A cock may be fitted to the pipe leading from the pump-barrel to the counterbalance, so as to adjust the quantity of pulp surging to and fro. The advantages of this balancing method are: that the pump being always nearly in fork, the sump is practically empty; no intermittent choking with sand occurs; the delivery through the rising column is constant; and the pump pit then provides the necessary storage for drainage from the stamps and grinding or other plant, when the mill is stopped for any purpose. There is, of course, a slight loss in the volumetric efficiency of the pump; but, on the other hand, a higher plunger speed can be adopted, since the use of the counterbalance eliminates air-lock shocks. The loss of power caused by the surging of the pulp from barrel to counterbalance is small.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

ASSESSMENT WORK—EVIDENCE OF PERFORMANCE

An affidavit that plaintiff has in his possession the affidavits of three men to the effect that certain mining assessment work was not done for a certain year is not evidence of such fact.

Anderson *v.* Robinson. (Oregon) 127 Pacific, 546. November 12, 1912.

SURFACE OWNERSHIP AND MINERAL RIGHTS DISTINCT

The surface ownership of land may be in one person and the ownership of the minerals in another, so that the owner of land may convey the surface to one and the minerals to another, or reserve them to himself, or vice versa.

Ball *v.* Clark, (Kentucky) 150 Southwestern, 359. November 1, 1912.

OIL LEASE—CANCELLATION DENIED

Where an oil lease contained an implied covenant that the lessee would drill as many wells as were necessary to develop the property to the mutual benefit of both lessor and lessee, and the lessee drills only three wells, in the absence of allegations definitely showing that this number was insufficient or that the lessor was fraudulently draining the territory through wells drilled on adjacent land, a bill in equity for cancellation of the lease was dismissed.

Hall *v.* South Penn. Oil Co., (West Virginia) 76 Southeastern, 124. October 8, 1912.

REPAYMENT OF PURCHASE MONEY DENIED

Where an applicant for patent for a mining claim, after due notice that charges have been filed by an officer of the Government affecting the validity of the claim, fails to make any denial of the charges or to apply for a hearing and the application is thereupon rejected, he is not entitled, in the absence of a showing, that the default and judgment were taken as the result of mistake, surprise, or excusable neglect on his part, to repayment of the purchase moneys paid in connection with the application for patent.

Jefferson Lime Co., 41 Land Decisions, 288. August 19, 1912.

MINERAL LAND WITHIN RAILROAD GRANT

The discovery of the mineral character of the land within the primary limits of the grant made to the Southern Pacific Railroad Co. by the Act of July 27, 1866, at any time before the issue of patent will defeat the grant. Deposits of petroleum are mineral within the meaning of that Act. The mineral character of a tract of land within such a grant is prima facie established by its classification as oil-bearing land; but the company is entitled, upon proper notice and showing to a hearing to show error in the classification.

Southern Pacific Railroad Co., 41 Land Decisions, 264. July 11, 1912.

RELATION OF PATENT TO DATE OF FINAL RECEIPT

Where two of the four locators of a mining claim, after doing all the assessment work thereon for two years, took steps to forfeit the rights of their co-owners by notice, and thereafter applied for and obtained a patent in their own names, but after obtaining final receipt from the land office and before issuance of the patent conveyed the claim to third parties by deed, it was held that the patent when issued became operative by relation from the date of final receipt, and that their conveyance subsequent to that date divested them of all interest. Hence the forfeited co-owners could not erect a trust on the title of the locators nor would any conveyance by the locators to such co-owners subsequent to the issuance of patent vest any title whatever in the co-owners. Suit was also barred by laches.

Cassidy *v.* Silver King Coalition Mines Co., (Utah) 199 Federal, 100. August 15, 1912.

Modern Steam Stamps

The Nordberg type of steam stamp is now being used in the newer mills of the Lake Superior region, according to *Metallurgical and Chemical Engineering*. These stamps are of the steeple-compound type, with cylinders mounted on round column framing of rigid construction, and standard mortar with solid anvil blocks below. The low-pressure cylinder is placed above the high-pressure, and connected thereto by means of a distance piece of cast iron, giving access to the stuffing box. The high-pressure cylinder is also mounted on a distance piece, for the same purpose. The cylinder heads are so constructed that they will break out in case they are struck by the pistons, thus saving the balance of the machine from destruction in case of such accident. The low-pressure cylinder is provided with Corliss valves at top end only, for the downward stroke. The high-pressure cylinder has valves at both ends, the lower valves controlling steam admission and exhaust below the high-pressure piston for the purpose of raising the stamp shaft.

The valve gear is of Nordberg patent type with double disc differential motion. There are six eccentrics, one for each valve, the eccentrics driving the lower high-pressure valves and the low-pressure valves being mounted on the pulley shaft, while those driving the upper high-pressure valves are mounted on the secondary shaft. Graduating dials are provided for each eccentric, indicating the petition of their central lines relatively to each other. By this arrangement it is expected to get a higher economy in steam than with the old arrangement now used, this economy resulting mostly from a free exhaust at the bottom, whereby the vacuum carried by the condensers can be more fully realized on the stamp piston than with the arrangement where only one valve is used to control the distribution of steam at the lower end of the cylinder. It is also plain that by this arrangement a more delicate adjustment of the steam distribution to both ends of the stamp can be obtained than by a two-valve arrangement.

The bearings on which the secondary shaft is mounted are fitted to a slide wherein they can be adjusted in such a manner that the ratio between the fast and slow motion can be varied between wide limits. The fly-wheel on valve-gear shaft is turned on rim edges, and adapted for belt drive. No loose pulley is used in connection with this arrangement, but it is expected that a tightener will be employed to stop and start the valve motion. Arrangements are made whereby the admission to the top and bottom of cylinder can be independently controlled. A reheating receiver is provided between high-pressure and low-pressure cylinders. Pistons are made of cast steel with cast-iron packing ring. Piston rods of forged steel with flange at lower end connecting to stamp bonnet. The bonnet, or connection between piston rod and stamp, is fitted with a cushioning disc of rubber. Stamp shaft guides are formed in the framing and are fitted with phosphor-bronze boxes, arranged so as to be easily and quickly removed.

The stamps make 106 strokes per minute and are provided with a signal which warns the operator when the bed of ore on the die is becoming too thin for safety. The high-pressure cylinder receives steam at 140 lb., and the low-pressure cylinder at 35 pounds.

The capacity of these stamps is tremendous to one who is familiar only with the gravity stamp which is such a common machine in Western gold mining regions. Those at the Ahmeek crush 625 tons of ore per day each, with far less noise and vibration than would accompany the operation of a 50-stamp gold-mill. The mortar boxes are fitted with two screens, steel plates punched with ⅝-in. round holes, placed in front and back. In the ordinary course of operations these plates last about three weeks. The stamp shoes weigh about 700 lb. when new, and have a useful life of about 13 days. At the end of that time they are worn to a weight of from 300 to 325 lb. and are removed.

Gold valued at $61,400,000 was imported into the United States in 1912, namely in the form of ore and bullion.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

STORMS 'held up' the transcontinental trains this week, but the California Board of Control overlooked the opportunity to accuse the State Mineralogist of train robbery.

LITIGATION in the Coeur d'Alenes is rife at present, and the end is not yet in sight. The case in the District Court brought by the Stewart Mining Company against the Ontario Mining Company has just been decided in favor of the latter. A new trial will be asked.

CONGRATULATIONS are due to Mr. J. A. Holmes and the United States Bureau of Mines, as that useful institution is hereafter to be titled. Congress has passed the bill definitely extending the work of the Bureau to Western metal mines and clearing up many other doubtful points in the original law.

CONVERTIBLE bonds to the amount of $5,000,000 are to be issued by the Granby Consolidated Mining, Smelting & Power Company, Limited. It had been planned to finance the new work at Hidden Creek out of operating profits, but pressure for dividends has resulted in declaration of a 1½ per cent disbursement with simultaneous announcement of the bond issue.

PRESENTATION of the John Fritz medal to Mr. Robert W. Hunt, in New York recently, marked a pleasing recognition of excellent work. To engineers generally the award was the more pleasing because Mr. Hunt has stood first of all for scientific accuracy in steel making. Previous awards have been to Lord Kelvin, Thomas Edison, George Westinghouse, and Robert T. Porter, excellent company for any engineer.

FURTHER details regarding the State Mining Bureau of California were made public this week. In a widely published letter Mr. W. H. Storms stated that the active opposition of the Governor had only been incurred when he discharged two political incompetents who had been given places at the request of the Governor. It was *post hoc*, if not *propter hoc*, that the Board of Control became active and made the groundless charges we discussed last week. Upon publication of this letter the Governor announced the removal of Mr. Storms and appointed Mr. Fletcher M. Hamilton to the position. His right to discharge Mr. Storms is denied and is, we understand, subject to considerable doubt. The whole situation is a disgraceful exhibition of the effect of petty politics on the conduct of what should be an important bureau for

scientific assistance to the mining industry. We reiterate that the fundamental organization is wrong, and rights, duties, and responsibilities should be more clearly defined. The proposal, however, to substitute for State Mineralogist a mine inspector indicates a complete misapprehension of the proper functions of the two officials, and the removal of an honest capable official because he insisted on efficiency in subordinates, cannot be too severely condemned.

PHILIPPINE development is to be undertaken by a strong American syndicate headed by Mr. Edward H. Fellows. The new concern is organized along the lines of the Canadian Mining & Exploration Company, but will not confine its attention to mining. A fund of $3,000,000 has been raised for preliminary work, and it is proposed to organize subsidiary companies to handle each new industry as developed. The parent concern will be known as the American-Philippine Company.

Secretarial Ethics

In a circular letter issued last week by Mr. Karl Eilers and Mr. Charles Kirchhoff, an attack is made upon the Committee of Nominations of the American Institute of Mining Engineers because of its failure to present the name of Mr. Joseph Struthers for another term as Secretary. The committee, which consisted of Messrs. P. N. Moore, D. W. Brunton, S. W. Mudd, C. P. Perin, John Birkinbine, and Arthur L. Walker, spent several months in careful consideration of the needs of the Institute and nominated unanimously Mr. Bradley Stoughton, of New York, for the position of Secretary; an excellent choice. Knowing the pains which the members of the committee took in studying the situation, and the high character of the men composing it, there can be but one conclusion—that the gentlemen named consider the best interests of the Institute to demand that a change be made in personnel as well as in policy in the conduct of the Institute. In this we heartily agree with the committee, and in all of it there is nothing personal. The objections to reëlection of Mr. Struthers rest on other grounds. He is so unfortunate as to be intimately concerned with certain policies in the conduct of the affairs of the Institute, policies that we and many others believe should be eradicated. The fact that he and his friends see nothing to condemn in these, makes it necessary if possible to eliminate them from control.

The whole matter is in one sense academic. If the new constitution and order of business be adopted by the members, and we believe they should and will be, selection of the Secretary will be taken out of the hands of the membership at large and made a function of the enlarged Board of Directors. The latter will be in fact as well as in law the governing body of the Institute, and the Secretary, being an employee of the Board, will, properly enough, be selected by it. Nominations of members of the Council and a Secretary of the Council, have only been made in order to fulfill the terms of the law; in fact, it is hoped that the Council will cease to exist February 18 when the ballots in favor of the new constitution are counted.

In view, however, of the attack made upon the nominating committee, it is but fair to state the situation squarely. Mr. Struthers, in a circular letter to the members some weeks since, presented his candidacy upon the basis of his record, and appeal having been made upon that basis, it is proper that attention should be called to certain facts in the record that are matters of public knowledge. In brief, *the position of Assistant Secretary, and later of Secretary of the Institute, has been used to make money out of members of the Institute in addition to the official salary.* The facts are all stated in the report of the Committee of Five distributed last June, though in such form as to have escaped attention of many. In connection with meetings of the Institute it has long been customary to arrange excursions from New York to the meeting place and return. Frequently these excursions have been continued beyond the place at which the formal sessions were held. Many members of the Institute have enjoyed the excursions and these have contributed materially to its popularity. We have already expressed our approval of the policy of having such excursions and the opinion that the legitimate expenses of the Secretary on such occasions should be paid by the Institute. Because of a supposed inability of the Institute to assume financial responsibility in such cases, it has been customary for the Assistant Secretary, and lately the Secretary, to conduct them as private business ventures. No statement of profits or losses, if any, has ever been made public. It has lately become known that the excursions have resulted in material profit. Perhaps this would be, as maintained by the Secretary, purely a private matter between himself and participants, if it were not for the following facts. Quoting from the report of the Committee of Five, "there was interminable correspondence conducted in large degree from the Institute headquarters, on Institute stationery, and at Institute expense. There has been at times an assistant engaged from outside the Institute membership to attend to these details of business, but at a salary paid from the Institute funds. During the excursions the salaried officers in the Institute's service, except the office force of clerks, have usually participated in the trips, and mostly at Institute's expense." The committee segregated expenses on account of excursions amounting to $8373.77, covering 1904 to 1911, and stated, "there have been further expenditures incurred for circulars, postage, and conducting of correspondence which are impossible to segregate." The cost to the Institute for participation in the excursions in 1909, connected with meetings at New Haven and Spokane, amounted to $1639.45. In this sum was charged the expenses of the Secretary, and Assistant Secretary, *and of the extra employee hired at Institute expense to attend to the business of the excursions, the profits on which went to private individuals.* In other words, the Institute itself was put to extra expense in order that a favored few might make a profit. As already stated, the amount of this profit

is unknown, but whether large or small, the principle, we hold, is wrong. In one instance when objection was made to an unexpected bill for extras sent to participants in an excursion, the Secretary admitted that if none of the members paid the bill he would still not lose money on the excursion. Since the total for extras amounted to approximately $5000, the expected profit was certainly not less than that sum; a tidy little addition to a year's salary. As illustrating the point of view of those who fail to see anything to condemn in this situation, it is worth while to repeat the defense made by one of the Secretary's friends. He urged that such profits were entirely reasonable and proper, and stated with evident approbation, that on an earlier excursion an Assistant Secretary had enjoyed in addition to other sources of profit, a commission on money spent in the dining cars of the special train. With those who accept this as a defense there is no room for argument. We merely respectfully differ, and differing, we urge all who wish a complete change in the conduct of affairs to support the Committee on Nominations, to vote for the new constitution and new order of business, and not to fail to execute promptly their proxies in favor of Messrs. James Douglas and A. R. Ledoux. As Mr. Douglas points out elsewhere in this issue, in the evolution of institutions, the time comes when one-man control must give way to a larger participation, and it is desirable that the change be made with as few heartburnings as possible. But, we would point out, the change must be made if the Institute is to retain the confidence of its members.

Electric Hoisting Problems

Development of electric hoisting during the past decade has been extraordinarily rapid, and what has been accomplished in adapting electric motors to the work of hoisting at high speeds from great depths is known to but few. The electric hoist most familiar to the average man is found on elevators in office buildings, where the slow rate of hoisting and the moderate height of lift make the use of an electric motor both easy and convenient. When electric power began to be generally available throughout many parts of the West its advantages for the operation of small hoists, both above and underground, were quickly recognized. The disadvantage of the high peak load incurred in starting the cage or skip was as quickly perceived, and modifications of motor construction were made to better adapt them to hoisting purposes. Starting torque is the prime essential in the choice of an electric motor for hoist service, and the development of the intermittent service type of motor greatly improved the service rendered, though did not appreciably better the load factor upon which contracts for power are commonly based. In the case of small hoists this is not a serious matter, especially where a number of small hoists tend to average their peaks. In the case of large electric hoists, such as that at the Hecla mine, in Idaho, recently described in these columns, this difficulty has been met by the use of a heavy fly-wheel, or Ilgner transformer, as it is generally known abroad, and the service rendered by electric hoists of this type has been highly satisfactory.

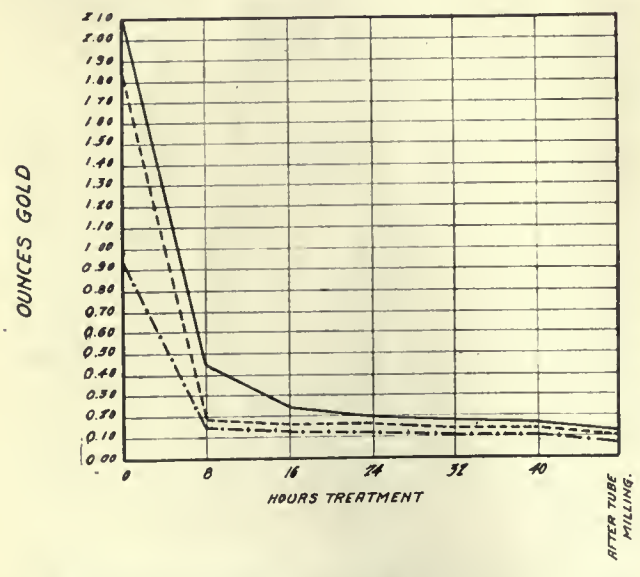
Electric hoists in this country have not, however, so far been built for hoisting from great depths at high speeds. The Hecla hoist has an ultimate working depth of 2400 feet, but is not now working beyond 1200 feet, presumably at a speed not greater than 1000 feet per minute. On the Rand, electric hoists have been used for depths of 4000 feet in vertical shafts and 5000 feet on inclines, the maximum hoisting speed being 3500 feet per minute, and have given such satisfaction that it is unlikely that additional steam hoists will be constructed, now that the Victoria Falls & Transvaal Power Company, Ltd., has made an ample supply of electric power available. In a recent paper presented before the North of England Institute of Mining and Mechanical Engineers, Mr. A. W. Brown has described South African practice in this regard, and his description of the plant at the Brakpan No. 2 shaft, where an induction motor hoist, driven through hand-operated tooth clutches, is used for hoisting ore, will be of great interest in this country. The use of tooth clutches is peculiar, from American standards. For lowering and hoisting men as well as ore, a motor-generator set, with Ward-Leonard control, is used, similar to the Hecla hoist. For control when lowering at the high speed used, mechanical brakes need to be supplemented by power braking, and an interesting electrical brake has been developed. This, to quote Mr. Brown, consists of "a water-cooled stator of cast iron surrounding a field-magnet system similar to that used in the engine-type of alternating current generators, and keyed to the drum shaft. When the magnet-ring rotates, and the field is excited, the induced eddy currents in the stator exert a powerful drag on the magnet-ring, thus giving a braking effect without mechanical friction. In actual service this brake has shown itself capable of lowering an unbalanced load of 9000 pounds at a speed of 200 feet per minute, and of controlling the rate up to the full speed of 3500 feet per minute." A similar result is attained in the hoists in use here by weakening the generator field while the motor is running, the functions of the set being thus reversed, the motor operating as a generator, and the generator as a motor delivering mechanical energy to the fly-wheel. In either case, in the event of failure of the power supply, the braking effect would at once vanish, reducing the hoist to dependence upon the mechanical brakes. The risk involved where the lowering of large numbers of men to great depths is a feature of everyday work, is evident, so the matter is giving South African engineers much concern, and the appointment of a commission is urged by the *South African Mining Journal*. To a hasty observer it would appear as though the problem might be quite simply solved by the use of an exciter, direct-connected to the drum shaft, the braking effect thus being rendered independent of the power supply. Solution of the problem by our antipodean colleagues will be of much interest to engineers in this country, since deep level mining is becoming more a factor our practice. In an early issue we expect to publish an interesting study of the factors governing the choice of a motor for hoisting service.

Treatment of Concentrate at the Goldfield Consolidated Mill

By J. W. Hutchinson

Since this article is intended to supplement the series which appeared in the *Mining and Scientific Press* during May and June of 1911, those interested are referred thereto for a description of the former process for treating concentrate.

It will be necessary to say here only that the acid wash, bromo-cyanide, and peroxide that were formerly applied to the raw concentrate have been discontinued. The concentrate, previous to roasting, is subjected to a preliminary treatment with alkaline cyanide for the purpose of reducing the value of the material to be roasted in order to minimize the dust loss. For instance, the loss in roasting has been determined to be approximately one-half of one per cent of the value of the material roasted. When the roasting plant was put in operation the raw concentrate entering the plant assayed 10 oz. in gold. The loss on concentrate of this grade would have been $1 per ton. The preliminary treatment given before roasting removed 85% of the value, leaving a product to be roasted valued at $30, and the loss in roasting this material was 15c. per ton. Further, it was demonstrated conclusively in the laboratory that neither a complete raw treatment nor treatment of the rich concentrate after roasting would yield so complete recovery as the combination of the processes, and that this combination treatment could be given as economically as either of the single treatments. For this reason it was decided to dispense with all the more expensive details of the raw process and to roast the tailing from this modified raw treatment.



The raw concentrate recovered from the 78 Deister concentrators (the 16 secondary tables are not now used), amounting to 6% of the weight and containing 67% of the value of the ore, is collected in flat-bottomed tanks, equipped with the adjustable square shaft agitator, which was fully described in the former articles; it is here neutralized with lime and by means of a centrifugal pump elevated to three Pachuca agitators, in which it is agitated during 8-hour periods in a two-pound solution of cyanide. Decantation at the end of the period is still practised and the charge is re-agitated with a freshly precipitated solution. Five periods of 8 hours each, followed by decantation, are sufficient to remove from 80 to 85% of the value of the concentrate. It is the intention to send to the roaster a product valued at $25 to $30, and this treatment is varied with the grade of the ore so as to accomplish this result. The pulp from the Pachucas, when dissolution is completed, is delivered to a storage tank from which it is pumped to the Kelly filter-press for filtration and drying. The latter is accomplished with air and the moisture is reduced to 12%. The consumption of cyanide during the raw treatment is 2½ lb. per ton of concentrate, and lead acetate is used in the proportion of 1 lb. per ton.

By means of a hoist and scraper, approximately 20 tons per day of the accumulation of concentrate on the dump is conveyed to the Kelly press bin and mixed with the concentrate filtered. A 14-in. conveyor, set at an angle of 17°, receives the concentrate from this bin, passing it over a Blake-Dennison automatic weighing machine en route to the bins in the roaster plant. The concentrate from this conveyor is distributed by means of a swinging bucket elevator to two bins having 45° sloping bottoms and 1620-cu. ft. capacity, from which it is fed by means of two 12-in. screw-conveyors, making three-quarters of a revolution per minute, to two slow-moving belts. These belts discharge the concentrate through the arches of the furnace between the first two rabbles. The original feeding arrangement was a 12-in. screw-conveyor, 23 ft. long from the ore-bin to the furnace. The strain caused by the packing of the concentrate made this machine impractical. The screw was cut down to 10 ft. in length and used for feeding only, and the concentrate is now conveyed from this feed-screw to the furnace by the belt above mentioned.

Roasting is accomplished in two Edwards (54 spindle) duplex furnaces, 112 ft. long by 13 ft. inside, with an effective hearth area of 1456 sq. ft. each, and each furnace is capable of roasting 40 tons per day of concentrate, of which the following is a typical analysis, the average sulphur content being 18.76 per cent:

Mesh.	Weight, per cent.	Sulphur, per cent.	Total S, per cent.
100	9.5	5.34	2.70
150	8.5	11.74	5.27
200	22.5	18.59	22.28
—200	59.0	22.37	70.30

The hearth area required per ton of concentrate roasted per day is 36.40 sq. ft., equivalent to 55 lb. of concentrate per square foot per day. The slope of the hearth is ¼ in. per foot. The space between the furnace side-walls was filled with waste from excavations to within one foot of the hearth-line. This material is decomposed surface rock full of clay. It was wetted down and tamped thoroughly and cov-

ered with one foot of screened sand to form the hearth, in order to reduce the breakage of revolving parts. Since all details of construction can be obtained from the accompanying figures,* there is no necessity for repetition. There are two rows of 27 rabbles; 25 of these revolve at 2.25 r.p.m. and the last two on the finish at 4.5. This speed was decided on after testing the furnaces at speeds varying from 1.6 r.p.m. to the speed now used. Lower speeds did not reduce the sulphur in the discharged product, decreased the capacity, and in no way affected the dusting. In addition to being a most satisfactory furnace to operate, the Edwards has the distinct advantage of producing a minimum of dust. The fear of serious loss from this feature of roasting caused the delay in adopting the two-stage treatment. That it was groundless has been proved by operation. Only 1½% of the material roasted passes out of the furnace as dust, and only ½% is lost. When the accompanying analyses quoted and that below are considered, the performance seems remarkable:

Mineral.	Percentage.
SiO_2	51.60
Fe	19.90
S	18.93
Al_2O_3	2.00
CaO	0.20
MgO	0.10
Sb	0.08
Te and Se	0.46
Cu	0.50

One man per shift operates the entire plant, including feeding, firing, oiling, and attending cooler and elevator. The bins are filled on the day shift, and have sufficient capacity to run for 24 hours. Each furnace receives power from a 10-hp. motor, and including the feed-screw and belt, which are driven from the furnace shaft, requires 4½ hp.

At the start all the fire-boxes were used for several weeks. The first to be discontinued were the middle boxes. For several months thereafter fuel was burned in the front boxes and on the finishing hearth. As stated above, the moisture in the material fed the furnace averages 12%. Approximately 6 sq. ft. of hearth area per day ton is required to remove this moisture, and the concentrate is not thoroughly dried until the fourth rabble is reached.

An attempt was made to discontinue the fire in the front box, with the result that the moisture traveled farther down the furnace and a decided decrease in capacity was caused. It was then decided to dispense with the fires on the finishing hearth and to burn all the oil required in the front boxes. This is the present practice and has resulted in reducing the fuel consumption approximately 45%. Nine gallons of crude oil is required per ton of concentrate, equivalent to 3.3% of the weight. The sulphur begins to oxidize at the seventh rabble and is burning freely at the tenth. Doubtless because of the extremely fine state of division of the sulphide, after once becoming ignited, roasting is carried to satisfactory completion without additional fire at the finishing end. This, of course, is contrary to the usual practice when roasting previous to cyanidation, since it is customary to raise the temperature at this point, but it has been demonstrated conclusively here to be the most economical practice for this material. Were roasting ahead of chlorination being done, the scheme would not be feasible, since a dead roast would be required and the soluble sulphur would be objectionable. However, at this plant the treatment required by the roasted material prior to cyanidation, removes the sulphate and obviates the necessity of a complete roast. It is no doubt true that the fineness of the pyrite makes this practice possible and that coarser concentrate would require different treatment in the roaster. E. D. Peters in his 'Principles of Copper Smelting' makes the following observation:

> Theoretically, the smaller each particle of sulphide, the more rapid and thorough will be its oxidation. It takes an appreciable time for the oxidation process to penetrate into the centre of even a very small particle of the sulphide mineral. It begins its work upon the surface, and the more surface it is allowed to operate upon, the more oxidation there will be in a given space of time.* * * Consequently, if there were no disadvantages arising from the employment of very finely pulverized ore, it is evident that there would be no limit to the fineness at which it would be advantageous to have our ore for roasting; so that, if it were as fine as soot or rouge powder, it would roast instantaneously, * * * but in practice there are difficulties which more than offset the advantages arising from the rapid and thorough oxidation of this very fine ore. Among the more obvious of these difficulties are: the great expense of pulverizing ore to this fineness; the enormous production of flue-dust in the roasting furnaces from the fine particles carried away by the draft; the tendency of the sulphide particles to melt from the heat arising from instantaneous oxidation; the fact that such excessively fine ore lies solid in the roasting furnace, offering no interstices for the penetration of air into the deeper layers.

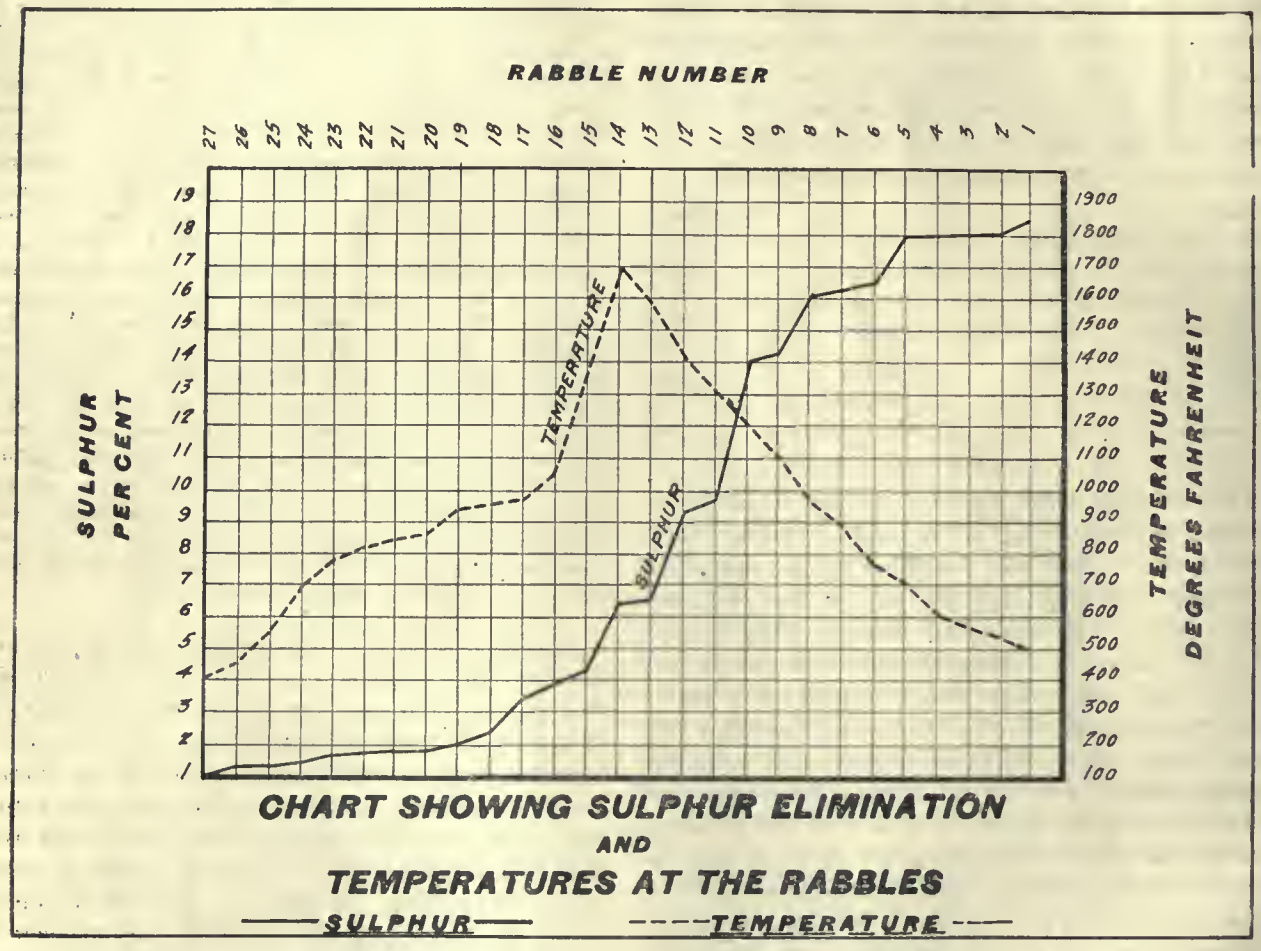
As can be seen from the screen analysis, the product fed the furnaces has been pulverized so that 80% passes a 150-mesh screen and this 80% contains 92½% of the total sulphur. Obviously, the problem here has been to avoid excessive loss from dusting and the melting of particles. In the matter of admitting air to the hearth, the practice here varies from the usual in that all side ports are kept closed, except six near the finish. In this way, most of the air entering the furnaces is preheated by passing over the practically roasted ore before it reaches that port of the furnace where heat is required, and thus saves fuel by not excessively reducing the temperature at this point. With a given degree of comminution the factors governing the oxidation of pyrite are, time, temperature, and oxygen. The first is inversely proportional to the last two. For instance: Oxidation at the surface of the earth is accomplished in long periods of time at low temperature and an abundance of oxygen; the same chemical result can be obtained in an assay muffle in 60 minutes with high temperature, while in practice the result is obtained in a number of hours. Since the combustion of sulphur produces dead atmosphere, and since combustion ceases entirely when the amount of SO_2 in the surrounding air reaches 12%, it follows that oxidation proceeds more rapidly in pure air than in air diluted with reducing gases. However, since a large excess of air or draft increases fuel consumption and stack losses, the economic limit of any furnace is reached

*See part II.

when the decrease in cost of labor and power resulting from increased capacity is more than offset by the increased cost of fuel and increased stack losses. This point has been demonstrated here by repeated tests. There is no difficulty in increasing the capacity of the furnaces by burning more fuel and increasing the draft, but there is no resultant economy from such increase on this extremely fine material. Since the element of time is not only essential, but an economical factor in the commercial oxidation of pyrite, it seems that where the tonnage to be treated is sufficient to justify the increased capital outlay, greater economy can be effected by allowing greater hearth area per day-ton of concentrate roasted. The material roasted here is so out of the ordinary and requires such unusual treatment, it has been thought advisable to go quite into detail in order to explain the theory on which the practice is based.

The accompanying chart of temperatures and sulphur elimination will show the progress of the concentrate through the furnaces. All temperatures were taken with a Brown electric pyrometer, using a platinum-rhodium couple, and for the sake of uniformity the readings were taken one foot above the hearth-line. The concentrate loses 17% of its weight in roasting.

(To be Continued)


RABBLE NUMBER
27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
SULPHUR PER CENT
19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
TEMPERATURE
SULPHUR
1900 1800 1700 1600 1500 1400 1300 1200 1100 1000 900 800 700 600 500 400 300 200 100
TEMPERATURE DEGREES FAHRENHEIT
CHART SHOWING SULPHUR ELIMINATION
AND
TEMPERATURES AT THE RABBLES
SULPHUR
TEMPERATURE

Silver miners of the world must consider the currency of the Orient a matter of paramount importance. No little space has been devoted to discussions of the recent tendency of India to hoard gold in the same manner as it was formerly accustomed to hoard silver. A large demand for silver has been anticipated in the awakening and reorganization of China. It is, therefore, important to silver-producing properties that it is proposed to put China on a gold-standard basis. G. Vissering, of the Bank of the Netherlands, Amsterdam, Holland, has attracted much attention by his suggestions for a reorganization of Chinese finances and the establishing of a 'gold exchange' standard similar to the system which Mr. Vissering put into force in the Dutch East Indies. China's needs for currency reform are imperative, and it is quite conceivable that in order to conform to the prevailing standard of the civilized world a gold basis will be established. But in any case, it is likely that silver will indefinitely continue in use by so conservative a people, since the Chinese distrust bank-notes unless the solvency of the banks is unimpeachable. Silver producers have during the current year taken much hope from the better outlook. A price of 63½c. ruling during the past three or four months, as compared with 54c. a year ago, has been a matter of no little encouragement; encouragement which would have resulted in considerably increased output had it not been for the unsettled conditions in Mexico during the past year and a half; conditions which preclude the enlisting of any new capital for mining enterprises of any kind in Mexico, whether gold or silver. As a result, the large low-grade silver orebodies, with higher prices to make developments possible, have had to see a better silver market without any progress being made in mining. In the meantime the gold output of the world shows every sign of decreasing. Only the increase on the Rand prevented a fall in output last year.

Mining on the West Coast of South America

By Howland Bancroft

Throughout the year just passed, South America received an increasing amount of attention from the mining and investing public, and the mining industry of that part of the continent with which this article deals was characterized by steady progress. Exploration was carried on in all of the Republics in the western part of South America and many new projects were launched. With few exceptions the better known mining companies maintained or increased their output. The following account of present conditions in the Republics of the West Coast is based upon personal observations in Peru, Bolivia, and Chile, and published notes on Colombia and Ecuador.

Colombia

Precious metals represent Colombia's principal mineral output and of them gold is far in excess of silver. From the department of Antioquia it is estimated that the 1912 production of gold will be in the neighborhood of $2,500,000, which represents the major share of the total gold production of Colombia.

Gold.—The El Recreo mine, in the department of Tolima, is reported to have produced some 860 oz. of gold bullion, netting $19.20 per oz., from 1244 tons of ore taken out in development from September 1, 1911, to August 31, 1912. The Gauleala Mines Co. owns a large area of mineral land in the district of Mallama and during 1912 is reported to have erected a modern cyanide plant. Details of operations are lacking. Drilling for dredging operations on the Cauca and Nechi rivers in the department of Antioquia is said to have met with success, and the Breitung Mines Corporation has been formed to expand the mining activities of Breitung & Co. of New York. The Oroville Dredging Co. of California is about to begin work with a modern dredge on the Nechi river near Zaragoza, and two other American companies are considering the placing of dredges on the Cauca. The Colombian Mining & Exploration Co. owning gold and silver mines in the districts of Supia and Marmato, in an annual report for the year ended September 30, 1911, states that developments have been satisfactory. Ore reserves of the Marmato Hill mine, the principal property of this company, are stated (September 30, 1911), to be 81,547 tons averaging 0.48 oz. gold. During the year covered by the report 15,399 tons of ore was milled and 7400 tons cyanided, with a total recovery of $166,511. The semi-annual report of the Frontino & Bolivia Co. for the six months ended December 20, 1911, shows a loss of $21,054, being the excess of working costs over the revenues. This company reports 17,147 tons of ore raised from the Silencio, Salada, and Donagan's mines, the yield being 6296 oz. gold. Ore reserves on December 20, 1911, are stated to be as follows: Silencio 8769 tons averaging 0.9 oz.; Salada 9534 tons averaging 0.4 oz; and Donagan's 5863 tons averaging 0.225 oz. At Amalfi, an American company is reported to be running a bedrock adit 1000 ft. preparatory to commencing hydraulic operations. In Anori, another American company is reported to have commenced work on a 2000-ft. adit. On the upper Porce river, Colombians are said to have obtained over $130,000 worth of gold in two years working the Gabine mine. The La Clara mine, in the vicinity of the Gabine, is said to have yielded $30,000 to American operators in four months.

Miscellaneous.—The Tolima Mining Co. had a successful year. The report issued, covering the year ended June 30, 1912, states the silver production to have been 649,844 oz. The profits for the year amounted to $92,971, out of which a little over one-half was devoted to redemption of debentures and about one-quarter was distributed as dividends. The La Lozana and some adjoining platinum properties near Buena Ventura are reported to have been purchased by the Consolidated Goldfields of South Africa. Deposits of copper, iron, coal, and petroleum have received some attention during the past year, but developments have not been extensive.

Ecuador

Ecuador has not received the attention that the mineral deposits of that country would seem to warrant, and but little mining news of importance is to be chronicled for 1912. The principal gold producer of Ecuador is the South American Development Co., which operates a lode mine north of Guayaquil. A company is reported to be dredging placer ground in the province of Esmeraldas. Gold-bearing quartz veins are reported at Gualaceo and in the southern part of Ecuador. Promising gold placer deposits are said to occur in abundance on the eastern watershed from the province of Loja to the province of Imbabura. In the western part of Ecuador the gold placers of the province of Cuenca are reported to be the richest. Deposits of copper, iron, lead, silver, and coal are known to exist in Ecuador but have received little attention. This is possibly due to the fact that transportation facilities are meagre and until more railroads are built there are but small chances of utilizing the mineral wealth of that country.

Peru

Projected railroads and a revision of the mining laws kept pace with the increased mining activity in Peru during 1912, and many important developments have taken place. Copper, silver, petroleum, and vanadium head the list of mineral products in point of production.

Gold.—In Peru the Inambari Gold Dredging Concessions, Ltd., is considered the principal company operating gold placer property, having taken over the Inca Gold Development Co. property in the Carabaya and Sandia districts. A dredge was completed during 1912 and commenced operations. The New Chuquitambo Gold Mines, Ltd., operating a mine, 40-stamp mill, and cyanide plant at La Quinua,

PANORAMA OF CERRO DE PASCO 'TAJO,' REPRESENTING THE SURFACE WORKINGS

near Cerro de Pasco, is crushing and treating from 2000 to 3000 tons of low-grade ore monthly. Some difficulties have been experienced in treating the ore, but experiments have been conducted with a view to eliminating the trouble and an 85% extraction of the metals is looked for by the management. The Aporoma Goldfields, Ltd., commenced hydraulicking on its placer deposits in the province of Sandia, Peru, and a test clean-up on May 31, on 6000 cu. yd. of gravel yielded 46 oz. gold. The cost of treatment is said to be 4.6c. per cubic yard. The deposit is reported to cover two square miles and to vary from 50 to 400 ft. in thickness. The Nueva California placer deposits in the province of Aymares are reported to have been investigated, and in the Potaz district some development work was accomplished. Frank Klepetko and Frank Bryson are said to have a concession to develop gold-placer ground along the Santa and Chuquicana rivers. The Sociedad Aurifera Andaray-Posco, Ltd., in the province of Condesuyos is reported to have commenced producing.

Silver.—Peru ranks about even with Bolivia as a producer of silver, these two Republics contributing four-fifths of the silver production of South America. The company owning the silver mines at Caylloma has been reorganized as the Sociedad Explotadora de Caylloma Consolidada with a capital of £100,000, in 400,000 shares of 5 s. par value. A deep drainage adit over 8000 ft. long is being driven at the rate of about 100 ft. per month to tap the orebody on the eighth level. The Colquilisca mine is shipping ore to the Huarueaca smelter from which is recovered about 1,500,000 oz. silver annually. This mine and smelter belong to E. E. Fernandini. A small cyanide plant, erected to treat a large tonnage of silver tailing resulting from arrastre operations on oxidized ores of the Cerro de Pasco deposit, proved unsuccessful.

Copper.—The Cerro de Pasco M. Co. continues to be the largest copper producer in Peru and ships from 3,500,000 to 3,700,000 lb. per month, of which a portion is from custom ore. The Backus & Johnson smelter at Casapalca has increased its output to about 700,000 lb. copper matte per month and is reported planning to double its output by blowing in another furnace. From 500 to 600 tons of ore, carrying from 8 to 15% copper and from 10 to 40 oz. silver per ton, is shipped daily from the Morococha district to the Casapalca and Cerro de Pasco smelters. The greater part of the production comes from the Morococha Mining Co., controlled by New York men affiliated with the Cerro de Pasco company. The Docena mine at Cerro de Pasco shipped about 8000 tons of copper ore per month to the Cerro de Pasco smelter. The Peruvian Mining, Smelting & Refining Co. is reported to have failed, due to lack of ore. Development work was actively pushed throughout the major part of the year on the Ferrobamba property. A. C. Burrage is reported to be developing a copper deposit near Huancayo in the province of Tajacaya. An option on the Sayapullo properties is said to have been given to French interests. The Huinac Copper Mines, Ltd., in the province of Huarez was absorbed by a company formed in London in July, known as the Huinac Consolidated Copper

CERRO DE PASCO SMELTER AT LA FUNDICION, PERU.

SMELTER AT CASAPALCA, PERU.

OF EARLY SPANISH MINING ON THE CERRO DE PASCO PROPERTY, PERU.

Co., Ltd., and having a capital of $2,000,000.

Miscellaneous.—Sulphur is being produced in the department of Piura by the Sociedad Azufrefa de Sechura, and deposits of sulphur are reported to have been discovered in the southern part of the Republic. The American Vanadium Co., operating the mines at Minasragra, continue shipping patronite ores and are credited with producing a majority of the world's vanadium output. Coal ash from a deposit near Huanuco, said to contain 25% V_2O_5, attracted some attention to this new field. Asphaltite deposits of Yauli, said to contain 1% V_2O_5, are reported to contain from 25 to 40% V_2O_5 upon being burned to an ash. Emeralds have been discovered in the department of Cuzco near Chuquicahuana. The dump ores and selected argentiferous zinc ore of the Carahuacra mine, now controlled by the Sociedad Minera de Carahuacra, Ltd., are being treated by pan-amalgamation with a 60% recovery of the silver content. The management is reported to be considering the installation of the process of the Minerals Separation Co., Ltd., to effect a saving of both zinc and silver. Two tungsten properties in the Conchucas district are reported to have received some development and small mills are said to have been erected on both properties. Bismuth ore was concentrated in the plant of E. E. Fernandini. In the province of Aymares nitrate fields are said to have been discovered in from Chala. The oilfields of northern Peru have continued to increase their output, a large part of the product having a local market. The fields are of especial importance because of the high grade of the oil. Coal lands have been denounced in connection with the Burrage copper project beyond Huancayo and will be developed.

Bolivia

The mining industry of Bolivia has been materially benefitted during the past year by the completion of the Arica-La Paz railroad and the extension of several branch lines connecting with the Antofagasta á Bolivia and the Bolivian railroad. Tin continues to be the chief mineral product of this country and considerable interest has been shown in explorations for deposits of this mineral. The silver production remains about normal. Copper deposits in Bolivia have not received the attention that they warrant and no new developments of note have been reported. Petroleum fields in the southeastern part of the Republic have been investigated and the coal deposits of the Titicaca region cause occasional comment.

Gold.—Gold mining is not one of Bolivia's most important industries, in fact it hardly deserves mention as there was but little active operation during 1912 and no placers of importance were worked. The so-called 'Ferguson' letter, so widely read, caused a small stampede to the Tipuani river, but thus far no important discoveries have been reported from this region, although it has been known for a long time that placer deposits of more or less value occurred along this stream. Undoubtedly future explorations and development will bring the gold mining industry of Bolivia into a more prominent place than it now occupies.

Silver.—Bolivia ranks first as a silver producing

PANORAMA OF THE ITOS TIN PROPERTY, ORURO DISTRICT, BOLIVIA.

PANORAMA OF THE PODEROSA MINING COMPANY PROPERTY AT COLLAHUASI, CHILE. SHOWS THE SAN CARLOS AND PODEROSA HEAD-FRAMES AS WELL AS DUMPS, HAND-JIGS, AND OTHER HAND CONCENTRATING DEVICES.

country in South America, and, while there were no important new developments in the silver mining industry in Bolivia during 1912 and statistics of the production during this period are not at hand, it is to be supposed that the total output will compare favorably with that maintained for the past few years. The total output of silver from Bolivia is variously estimated at from $3,000,000,000 to $6,000,000,000. At present the annual production is in the neighborhood of 7,000,000 oz. The principal silver mines are those in the departments of Oruro and Potosi. The Huanchaca is the most famous producer of silver in Bolivia. It is to be remarked that many of the tin deposits carry appreciable amounts of silver.

Copper.—Copper mining in Bolivia is also one of the lesser industries of that Republic and the total production is estimated at from 200,000,000 to 300,000,000 lb., with an annual production ranging from 4,000,000 to 5,000,000 lb. The Corocoro native copper field is, perhaps, the best known. Here are the properties of the Corocoro United Copper Mines, Ltd., the Compania Corocoro de Bolivia, and several others of lesser importance, the two named representing the only active producers in the district. The former represents a recent consolidation of several properties now held by French interests and the latter represents a Chilean company formed in 1873. Copper is mined, milled, and put on the European market at a cost ranging from 13c. to 10c. per pound. With modern improvements now under way at the Corocoro United it is thought that costs will be reduced to 9c. per pound. The content of the ore which is hoisted ranges from 3 to 5% copper. It is concentrated up to 88%, although the average content of the concentrate is thought to be more nearly 75%, and the tailing is rewashed by Indian women with a 60% copper concentrate resulting. Other promising copper fields in Bolivia are the Chacarilla, Carangas, and Turco. A smelter has been erected at Quechisla for the purpose of producing copper matte.

Tin.—Bolivia ranks first in the world as a tin lode mining country, producing one-quarter of the world's supply of this metal from lode mines. The properties are controlled by native and foreign capital, although the United States is hardly represented in Bolivian tin projects notwithstanding the fact that this country consumes one-half of the total world's production of tin. It is interesting to note that the properties controlled by Simon Patino, a native Bolivian, yield over one-third of the total tin production of Bolivia. The La Salvadora mine in the Uncia district is probably the premier tin mine of the world and it has a yearly production estimated to be over 13,000,000 lb. of tin. The Avicaya property is another large producer with a yearly output of about 3,000,000 lb. of tin. Another large producer is the Huaina-Potosi property with a yearly production of nearly 1,000,000 lb. of tin. Among the more prominent deposits may be mentioned those of Huaina-Potosi and Quimsa Cruz in the department of La Paz; those of Morococala, Huanuni, Oruro, and Avicaya in the department of Oruro; those of Llallagua, Uncia, Potosi, and Chorolque in the department of Potosi; and those of the province of Arque in the department of Cochabamba. Of the 21 most active producers in Bolivia the majority of the tin comes from about 10 mines. There are in Bolivia over 100 tin prospects which are worked intermittently, the owners desiring to interest foreign capital in their development.

During 1912 the Porco Tin Mines Co. was formed for the purpose of developing the Porco mines in Bolivia. The ore reserves are estimated at 45,000 tons of 4.4% tin. Simon Patino is reported to have purchased the important group of tin mines at Huanuni for a consideration of $2,000,000 and by so doing he has put an end to conflicting interests in that district. Acquiring tin properties in Bolivia is not an easy matter, as mines sell on past records rather than on actually developed ore reserves and all of the owners of tin property have inflated ideas as to the real value of their deposits. Nevertheless the field offers large opportunities for future investigation. There are several modern concentrating plants in operation in Bolivia and all of the tin ore is shipped from this country as barilla, containing at least 60% metallic tin. British ports receive four-fifths of the Bolivian product, the other fifth going to Havre and Hamburg.

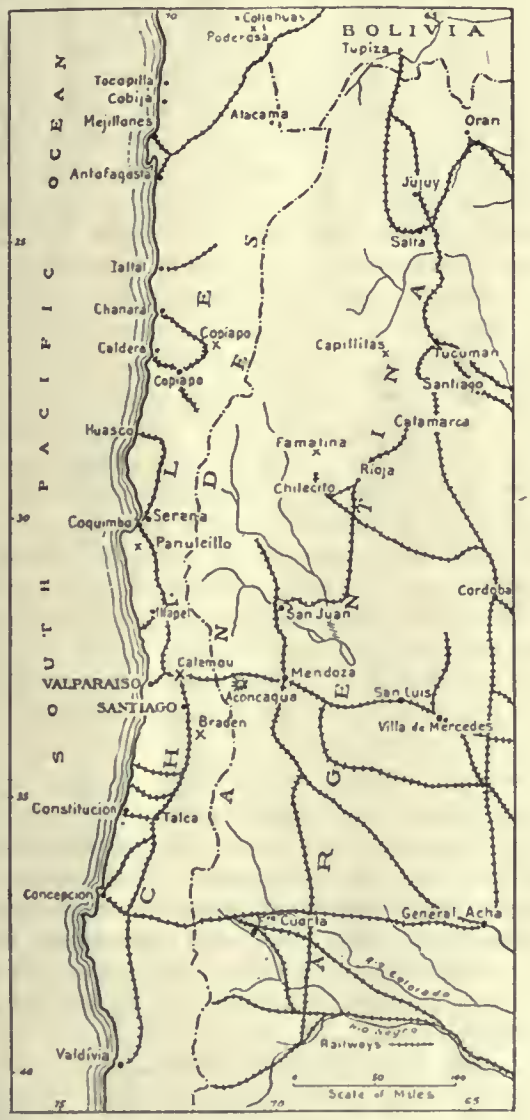
Miscellaneous.—Deposits of antimony, bismuth, tungsten, and molybdenum, which exist in Bolivia, have received but little attention during the year just passed.

Chile

During 1912 railroad building progressed notably in Chile, chiefly in connection with the Arica-La Paz railroad and the new Longitudinal Railway of Chile. Naturally the mining activity was somewhat stimulated. The nitrate industry is reported to have enjoyed a very prosperous year, while the copper production of Chile received a marked impetus due to

the entrance of Braden in the list of shippers. Exploration work was carried on for new nitrate fields, and for new deposits of coal, oil, iron, copper, and other mineral substances, and many new developments were undertaken by mining interests.

Copper.—Chile leads all South American countries in the amount of copper it produces. Early in 1912 the Braden Copper Co. entered the field of active shippers and it is estimated that over 300,000 tons of 2.5% ore has been concentrated with a saving of from 50 to 75% since operations were started. This property is reported to have 30,000,000 tons of



CHILE AND WESTERN ARGENTINE.

2.5% copper ore blocked out, with the future possibilities of a considerably larger ore reserve being developed. The ore is concentrated and smelted at the company's plant. The nominal capacity of the mill is 2000 tons per day and the smelter is equipped to handle the concentrate resulting from milling operations. Experiments on the ore by the Minerals Separation Company, Ltd., have been carried on during the year and it has been determined to adopt that company's process. Operations at the Poderosa Mining Co., in the Collahuasi district, were disappointing and the annual report for 1911 shows the loss resulting from operations during that period to have been about $82,600, which brings the total debit belance at January 1, 1912, to over $228,000 and makes the outlook for this high-grade copper property exceedingly discouraging. The ore reserves on the same date were stated to be but 21.000 tons averaging 22% copper, with 110,000 tons of 4½% ore on the dumps. The Cia Minera de Collahuasi, operating in the same district on similar deposits, continues to be a profitable enterprise and is said to ship about 3000 tons of 25% copper ore per month. The mining methods and equipment are crude but the company manages to make a considerable profit from operations. The ore reserves are reported as 100,000 tons of high-grade ore containing from 21 to 25% copper and 250,000 tons averaging 9% copper. Silver and gold contribute appreciably to the value of the ore. Operations of the Central Chile Copper Co. during 1911 proved unprofitable as shown by the annual report issued by the company to cover that period, and the adverse balance at the end of 1911 totaled nearly $50,000, of which some $10,500 represents the loss for 1911. The increased price of copper during the year just passed may have the effect of eliminating this debt. A. C. Burrage and the firm of M. Guggenheim's Sons are developing a copper property at Chuquicamata about 100 miles east from Antofagasta and about six miles from the Antofagasta á Bolivia railroad, to which a branch line has been built.

Nitrate.—The nitrate industry continues to be the chief source of revenue to Chile and the production during the first six months of 1912 was estimated at 1,218,000 tons. During 1912 the statement was published by the delegate of the Chilean government to the International Congress of Applied Chemistry that the "surveyed and certified tonnage opened up at the present time ready for extraction is fully 250.000,000 tons." Also that vast unsurveyed areas of nitrate ground were known to exist on the Chilean pampas so that "there are probably in round numbers, 1,000,000,000 tons of nitrate in the deposits of Chile." December 2, 1912, the government of Chile was reported to have held an auction sale to dispose of nitrate lands. Although a number of new plants have been put in operation it is said that the total output will not be appreciably increased, due to the gradual exhaustion of the highest grade deposits.

Iron.—The government of Chile is reported to have appropriated 100.000 pesos (about $22,000) to be used in continuing explorations of the iron resources of the Republic. In Coquimbo five groups of mines are reported to contain 200,000,000 tons of iron ore and other large deposits are said to occur in Atacama and in the departments of Vallenar, Freirina, and Antofagasta.

Miscellaneous.—The gold discovery at Putu caused some comment during the year but only small operations are reported. Tin is said to have been found in the province of Atacama. Petroleum is known to occur in southern Chile, but has received little attention. Borax deposits in central Chile are being actively worked. A new coalfield is reported to have been discoverd north of Santiago, and the sulphur deposits near Ollague have attracted some attention.

Secondary Sulphide Enrichment of Ores—III

By C. F. Tolman, Jr.

Side of the Basin Problem

*I was one of a party of engineers which examined a property, the value of which depended upon whether or not the concentration of sulphides was greater underneath the main drainage line or basin than under the side of the basin. The locality cannot be given because the problem is not yet settled, but the data are cited because they show the practical bearing of some of the points previously discussed and also that the problem is often a complicated one, and where incomplete data only are available, the conclusions are apt to be unsatisfactory. The croppings, well exposed over most of the area, consist of a stained, leached, and partly silicified schist, showing throughout a thorough speeking of the rock. These specks vary in size from a pin point to 0.1 inch in diameter, being cavities filled with hydrated iron oxide and hematite. All members of the party agreed that these speeks were the remains of oxidized sulphides, probably largely pyrite. The chief topographic features were a precipitous but low mountain range of schists, and a broad basin excavated in the softer schists at the foot of the mountains. The upper end of the basin showed attractive stains of copper carbonates and silicates, especially along fractures, but less specking than was noted below.

After the examination, development was continued in the higher portion of the basin, with a result of showing a disseminated deposit of pyrite, but lower in copper content than desired. The question now arises: Is the copper concentrated in larger amounts under the basin? Some of the questions involved are: Is the topography young or mature? Has the enrichment had time to concentrate under the central drainage line? What was the copper content of the leached area? If it contained no copper originally, no enrichment is to be expected. Does the lack of copper stains in the central portion indicate a lower grade of original ore than on the side, or does it indicate a more complete leaching? Finally, will the concentrated underground flow down the axis of the valley so dilute the copper salts that they will not precipitate the copper?

There is some difference of opinion among those interested in regard to these points, and the answer will be determined only after further development. It is to be noted, however, that a geological examination alone, without the advantage of underground workings, determined the existence of a disseminated deposit, as well as its areal extent, but could not make predictions as to the copper content.

The Length of Time Necessary for the Formation of a Commercial Secondary Sulphide Deposit

I once examined in detail a disseminated deposit, which is so instructive as an example of the first stages of the processes of enrichment, and further suggests something as to the time involved in the fashioning of a commercial deposit, that a few of the features will be sketched here, although permission to name the locality has not been obtained.

These features are as follows: A primary copper-bearing pyritization, accompanied by intense silicification, took place in the outer zone of a fine-grained porphyry which is the marginal facies of a normal coarse-grained granite intrusion. The area has been elevated recently and thoroughly broken up by post-mineral faulting and fracturing. The latter is so recent that sunken crushed zones form natural depressions that, on account of their irregularity, have been popularly explained as prehistoric mining excavations. Secondary enrichment has been initiated, appearing especially in shear zones, about 80% of the metal being concentrated in veinlets and sheeting, and the rest as disseminated particles. Enrichment underlies the hills, and the commercial ore lies directly under the silicified caps, having not reached down into the coarser granite. Oxidation has not been sufficiently active in this arid climate to produce strongly acid solutions, the latter carry large amounts of secondary silica, the chalcocite once formed redissolves more readily than the pyrite when reattacked by oxidizing solutions, and the drill-holes invariably show pyrite above the chalcocite. The enriched ore occurs far above the water-level, and apparently shows no relation to any former water-level. One drill-hole that was put down to reach water found no enrichment whatever at the water-level. The secondary sulphide deposit shows great irregularities, both in regard to thickness and capping. Most of these are explained by differences in sheeting and fracturing. A peculiar condition difficult of explanation is the occurrence of two rather distinct zones of enriched ore, between which, and above and below which, is low-grade pyrite. (See Fig. 11.)

The surface staining, the veination, etc. (the 'indications' of the prospector), are better developed here than in the case of any other of the disseminated deposit which I have examined, and casual examination suggests that one of the greatest of this class of deposits occurs here. However, further study shows that the process of enrichment is in its infancy, and it will take a geological period or two to thoroughly rework and enrich the deposit.

This example emphasizes the fact that enrichment, like most geological processes, is extremely slow. In weighing the possibilities of an undeveloped or partly developed deposit of this kind, the length of time erosion has taken place is one of the most important factors. Certain engineers would lead us to believe that they can leach rock in place in mine workings within a reasonable length of time, and if this is true they must accelerate nature's processes a millionfold. A second point worthy of note is that in the severely arid regions precipitation of

*Continued from p. 141.

sulphides may take place above the water-level, perhaps at some point where there is a local concentration of moisture. In more humid regions the water-level controls the deposition, and this is certainly true where the process is long continued. Finally, secondary chalcocite may occur below considerable amounts of pyrite (as much as 200 ft. at places in the property discussed), provided that the pyrite is above the water-level.

Climate and Enrichment

Climate is an important factor in effecting sulphide enrichment, but since the subject has not received the intensive study it deserves, data are not at hand for even a satisfactory elementary discussion. Winchell's recent article[38] gives valuable data regarding the effect of cold sub-Arctic climates. My own experience has been confined to the Western arid and sub-arid regions, and therefore the following brief discussion is inductive rather than deductive. Of the many varieties of climate[39] recognized, only three or four types will be considered.

Temperate Humid Climate of Eastern United States.—The temperate humid climate of the Eastern United States causes a rapid and complete disintegration of the material above the water-level. The abundant underground water lies rather close to the surface, so that no large amount of vein stuff has been worked over. The secondary sulphides are precipitated promptly at the very top of the underground water-level. The deposit is high grade—often nearly pure chalcocite—but the zone is thin, from a few inches to perhaps a score of feet.

Cool Climate Bordering on Aridity.—Such a climate has produced the great copper-ore deposits at Butte. The climate is not cold enough to retard the chemical action, the water-level is at considerable depths, and the amount of descending water is sufficient to attack the material above the water-level. It is not necessary to caution those who have followed the discussion thus far, that climate is only one, and perhaps not the most important, factor of the many that have combined to carry enrichment to an extreme at Butte.

Semi-Arid to Arid Climate of the Southwest.—Considerable variation of climate causes the irregularities of the enrichments which are found in the Southwest. Where there is sufficient moisture, high temperature accelerates decomposition, but in many places the deficiency of the meteoric waters leads to incomplete leaching. Unaltered sulphides may extend to the surface in one place, while close at hand stronger fissures may collect the water and cause oxidation to great depths.

Cold Sub-Arctic Climate.—This climate is least favorable to the process. Often recent glaciation has removed the secondary products that might have been developed during a preceding more favorable climate. Abundance of water, the fact that the water is close to the surface, and the frozen condition of the surface for a large portion of the year protect all but a shallow surface zone from oxidation, and the cold waters have little oxidizing power. It seems very improbable that under such conditions any commercial secondary sulphide enrichment can be formed. Winchell[40] describes a peculiar veneering of the surface rock by secondary chalcopyrite, formed under a forest-covered and constantly saturated soil of British Columbia and adjacent regions, and as I have learned from various prospectors and engineers that such a superficial coating is a common thing in this region, this may be taken as a type of enrichment under sub-Arctic conditions. If the great chalcocite deposits of the Bonanza mine, Alaska, are secondary, as suggested by F. H. Moffit,[41] they must have been formed when climatic conditions were very different from what they are at present.

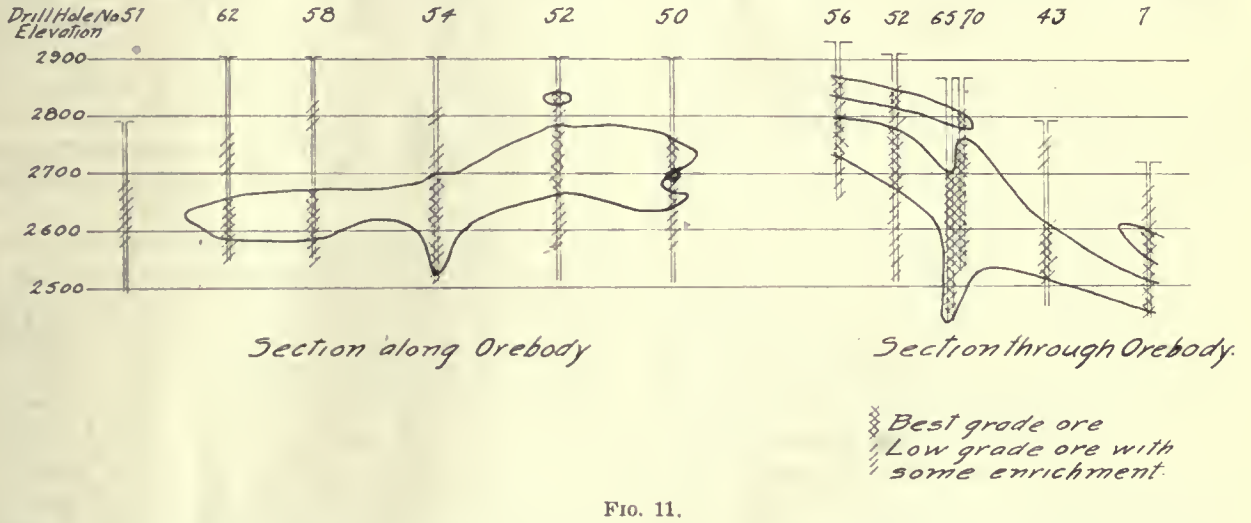


FIG. 11.

Laboratory Data

The point of immediate interest to the student of secondary enrichment is the investigation of structures and minerals in the exposed surface rock which can be proved to be residual after the sulphide veins, veinlets, and disseminations. A comprehensive discussion would include all ore minerals and rock alterations caused by all the various types of primary mineralizations, and then the changes developed in the belt of weathering. Here, however, discussion will be confined to a few of

[38] Winchell, H. V., 'Secondary Sulphide Enrichment,' *Eng. & Min. Jour.*, Feb. 17, 1912, pp. 364-367.
[39] Tolman, C. F., *Jour. Geol.*, Vol. 17, pp. 151-155, 1909.
[40] *Loc. cit.*
[41] U. S. Geol. Surv. Bull. 448, p. 78.

the more important residual structures and minerals that can be recognized by the aid of the hand lens, and which are formed above the disseminated ores of the Southwest. The original mineralization of these deposits occurs as a disseminated pyritization of the body of the rock, accompanied by sericite and quartz in a fine-grained mosaic, and by veinlets of solid, more or less cupriferous pyrite.

Enrichment first attacks the disseminated pyrite by depositing a film of chalcocite around the former, and by continued action finally replaces the entire grain of pyrite. This replacement generally destroys the sharp crystal form of the pyrite, the chalcocite appearing as 'sooty grains', although occasionally I have noted beautiful pseudomorphic replacement of large pyrite crystals by chalcocite. In many cases secondary silica completely replaces the rock, the chalcocite grains varying in size from dust-like specks discernible with difficulty under the hand lens, to specks as large as a pin-head. The massive pyrite veinlets which are barren of quartz are replaced simultaneously by quartz and chalcocite.

Under attack of strong acid solutions, kaolinization is more prominent than silicification, the chalcocite specks are always in the sooty form, the crystallographic outline of the pyrite is lost, and the pyrite veinlets are changed into massive chalcocite without the addition of silica.

Two cases must be considered: (1) The surface waters are working over a deposit of enriched ore; (2) the primary ore is attacked for the first time, and the grade of the secondary deposits depends directly upon the amount of copper in the primary deposit. It is evident that all gradations occur between ores that have undergone long-continued enrichment, and the elimination of nearly all the iron of the pyrite, to those that have received only a slight enrichment before passing into the zone of oxidation. Above the water-level the important processes are the kaolinization and silicification of the country rock, the oxidation and solution of the sulphides and the occasional development of copper carbonates and silicates accompanied by residual and vein silica.

Residual surface siliceous crusts are very common, and, on account of their resistence to erosion, cap the hills. This surface cap may be composed of a mixture of chalcedony, chyrsocolla, and copper carbonate. The residual specking and veination is often destroyed, and it may be necessary to dig below the silicious crust, sometimes only a few inches thick, in order to study the former. Similar silicious copper-stained crusts are found in the arid region where the copper stain may come from overlying formations, or from occasional veinlets, and unless accompanied by specks and indications of extensive veination, do not indicate valuable underlying deposits.

The residual specks after chalcocite appear as dust-like disseminations of hematite or limonite, while pyrite often develops small crystal casts, either empty or filled with limonite. At Ray one finds especially good examples of surface rock retaining all the structure of the disseminated enriched ore. The latter is a silicified rock, showing the schist structure and a grayish blue color from the very fine disseminated chalcocite. The surface rock appears the same under the lens, the color being red instead of blue as hematite dust takes the place of the chalcocite dust.

In general a large amount of iron in the cap rock indicates pyrite rather than chalcocite. Chalcocite veinlets below the water-level are represented at the surface by quartz veinlets, either chalcedonic or of crystalline crustified quartz. I have found numerous examples of chalcocite and pyrite veinlets grading into barren quartz veinlets above, and believe that these may generally safely be interpreted as indicating sulphide veinlets when accompanied with specking described above. Pyrite veinlets, however, show hematite, limonite, or silicious limonite veins at the surface, while chalcocite veins generally alter into pure white quartz veins.

The most intense phase of alteration is a bleaching and kaolinization of the surface rock, a good example of this being over the great Sharkey orebodies at Ray. Even under these conditions, the residual specks are rarely destroyed, although the veination is obscured. Such an alteration, in an area showing all the phenomena described above, indicates a concentration of the enrichment at this point.

Secondary sulphide enrichment is only the last one of a series of complicated processes by which concentrations of ore are formed. The earlier processes are of equal interest and often of greater importance than the one discussed here. The valuation of a secondarily enriched orebody generally involves the investigation of the series of primary ore depositions, for we cannot have an important enrichment without a strong primary mineralization. A story told by a prospector will illustrate how brilliant stains do not necessarily indicate valuable ore deposits.

He explained that he was prospecting in the Apache country of southeastern Arizona, and noted some bright copper streaks in a rock cut made in regrading the old county road. The bright copper stains seemed out of place in a rock that showed no other signs of mineralization; and climbing the cut he found the old road above, and alongside it was the wreck of a wagon destroyed and partly burned by the Indians on one of their raids. The stains led up to a point on the edge of the cut, and at this point he found some oxidized copper rivets which had fallen out of the wrecked wagon.

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Pig iron amounting to 12,950 tons was shipped from Hankow, China, to the United States in 1910, but only 2425 tons was shipped in 1911. In the Chinese year from January 30, 1911, to February 7, 1912, 4465 tons of pig iron was shipped to the United States. Shipments to Japan were 58,535 tons, to Australia 5765 tons. These shipments were made by the Han-Yeh-P'ing Iron & Coal Co., which mined 359,467 tons of ore during the year and produced 93,337 tons of pig iron.

The MacNamara Mill, Tonopah

By M. W. von Bernewitz

This modern little plant has been in operation for a year and is satisfactorily treating a hard ore carrying 20 oz. silver and a few grains of gold per ton. An electric hoist, with flat ropes, at the main shaft hauls self-dumping skips of 2000-lb. capacity to the surface, where the ore is emptied into a storage-bin. The ore is fed upon a 36-in. rubber sorting-belt; about 6% is discarded as waste, the remainder then passing through a No. 3 Kennedy gyratory crusher, and is taken to the mill-bin by bucket-elevator. This bin has a flat bottom, is of 200 tons' capacity, and has the ordinary rack-and-pinion gate on the ore-chutes to the feeders.

RACK-GEARED MOTOR DRIVING STAMPS.

The mill includes ten 1400-lb. stamps, dropping 8 in., 98 times per minute, and crushing 7 tons per stamp per day, through a No. 12 ton-cap slotted screen. As will be seen from the accompanying illustration, each 5-stamp battery is driven by a 20-hp. Westinghouse back-geared motor. This may be described as a type 'M.S.', 440-volt, 60-cycle, 3-phase motor, running at 555 r.p.m., the pinion on the armature shaft engaging with spur wheel on the short pulley-shaft, which runs in bearings on the back of the motor, there being a 14-in. belt driving the bull-wheel on the 6½-in. cam-shaft. These motors have given complete satisfaction, and they were recently opened after about eight months' work, inspection showing that the tool marks were hardly worn off the gear-wheels, which work in grease. No doubt this style of drive reduces friction greatly, as there is no counter-shaft, except the little pulley-shaft, and no tightening gear for the belt. The friction in this case amounts to about 90%. Careful tests have shown that five stamps absorb 17.75 hp., including 1.61 hp. for friction, or 3.55 hp. per stamp. As a check on this reading, the following old rule can be used:

$$\frac{1400 \times 98 \times 8}{33{,}000 \times 12} = 2.77 + 20\% \text{ for friction} = 3.32 \text{ hp.}$$

It may be added that at the new Belmont 60-stamp mill there is a 60-hp. motor for 20 stamps, which weigh 1250 lb. each. This drives a short jack-shaft, which in turn drives two batteries of 10 stamps. This is similar to the drive at the Goldfield Consolidated, only there the motors are 50 hp. each, and at the Desert mill of the Tonopah Mining Co. the same is true. The West End mill has four units of five stamps each, actuated from a common motor-driven counter-shaft by friction clutch-pulleys, which arrangement gives no trouble. Besides the two motors driving the MacNamara stamps, there is a back-geared motor driving a Dorr classifier and agitator in the thickening-tank. This method of transmitting power is well worth the attention of all engineers.

Foundations for the two batteries are of reinforced concrete. The mortars (Chalmers & Williams, No. 16-E) have a heavy base, and stand on sheets of rubber; while the battery-posts are set in cast-iron sole-plates, also standing on rubber. The cam-shafts are 6½ in. diam. The ordinary Blanton cam is used, and none have been broken so far. Stems are 4 in. diam., working in Pacific guides made by the Demarest company, and none have been broken. The Pacific guide consists of a metal frame into which are fitted cylindrical metal shells that are not held by keys or the like. The screens are fitted 3½ in. from the stamp-shoes, and through a No. 12 ton-cap square-slot screen the average duty per stamp was 7 tons of ore per day, but recently coarser screens have been used, and the duty has risen to over 8 tons. Crushing is done in weak cyanide solution having a temperature of about 70°F. Feeders of the improved Challenge type, which may be called a double monkey-wrench grab, deliver the ore to the stamps.

MACNAMARA MILL.

The pulp from the stamps goes direct to a Dorr classifier, working at 12 strokes per minute, the coarse material being fed into a 5 by 16-ft. tube-mill revolving at 26 r.p.m., through a spiral feeder. Pebbles are fed in at this point, amounting to 250

lb. per day, consumption being about 3½ lb. per ton milled. Slacked lime equal to 2½ lb. per ton is added in the classifier. The tube-mill discharge is returned to the classifier by a 5-ft. Frenier pump, which gives no trouble, the coarse material again passes through the tube-mill and so on, forming the usual closed circuit, in which only the overflow from the classifier can get away. In the batteries, 25% of the ore is slimed, while the final pulp, which is pumped to a Dorr thickener, shows 73% through 200-mesh screen. This is fairly coarse when compared with other mills, but is found to be fine enough for good results.

All the classifier overflow is pumped to a Dorr thickener, 12 by 26 ft., the gear of which travels at one revolution in eight minutes. Clear solution overflows to the battery storage-tanks, and when its silver content becomes high, it is decanted off to the 'silver' tank. The thickened slime, specific gravity 1.22, flows by gravity to three 15½ by 25½-ft. Trent agitators for 48 hours' agitation in a 2-lb. KCN solution. The agitators hold 80 tons of dry slime each, and cyanide and lead acetate are added here, as well as live steam, bringing the temperature up to 115 to 120°F. This has been found beneficial, as with cold solutions extraction falls off considerably. This type of agitator gives satisfaction, and even after an enforced shut-down, little trouble is experienced in starting. Air for the agitators is produced by a motor-driven compressor with 6 by 10-in. cylinders, the working pressure being 25 lb. per square inch. Each agitator has a 4-in. Campbell & Kelly centrifugal pump, direct-driven by a 7½-hp. motor, for circulating the slime through the agitator arms. From the Trent vats, the slime is pumped to a 19½ by 27½-ft. stock or storage-tank, which has a chain-driven pump for circulation.

STAMPS, CLASSIFIER, AND TUBE-MILL.

From the stock tank, pulp flows by gravity to the vacuum plant, which consists of 50 leaves, each 5 by 10 ft., and treating 20 tons per charge. Forming cakes takes one hour, and washing two hours, with a 5-minute final water-wash at times, while the whole cycle consumes about four hours. The cloths last well, and have been on about 12 months so far. They are given a 24-hr. bath in 2% hydrochloric acid, about two leaves being treated per day. The washed slime-cakes are blown off with high-pressure water into a full tank of water, and the pulp pumped away by a 4-in. pump to ponds. Although the slime from the storage-tank goes to the filter-vat by gravity, it is helped by a belt-driven Campbell & Kelly pump, which also pumps excess back to that tank, and does the circulating in the filter-tank. In October last the filter-tank was struck by lightning and completely destroyed, save the leaves; but in a short time a new one was built.

Solutions from the filters are clarified and run through four precipitating-boxes charged with zinc shavings. The precipitate is dried to about 10% moisture in a steam-drying pan, mixed with fluxes, and melted in an oil-burning tilting-furnace. An extraction of 93% is made. The operating cost per ton in November 1912 was as follows:

Crushing and conveying	$0.176	Assaying	$0.071
Stamp batteries	0.340	Superintendence and foreman	0.233
Dorr classifier	0.145	Heating solutions	0.253
Tube-mill	0.523	Water service	0.178
Dorr thickener	0.030	Compressed air	0.017
Agitation slime	0.776	General expense	0.073
Filtering and discharging slime	0.237	Surface and plant	0.050
Precipitation	0.116	Total cost	$3.299
Refining	0.097		

New York Metal Market

The report of the Copper Producers' Association for December, issued January 8, not only showing an increase in stocks of over 19,000,000 lb., but permitting the statistics of the year to be viewed as a whole, on the heels of which came news from abroad that the Balkan situation was not mending, marked a turning point in the copper market. Immediately following the report prices softened, then declined. Future delivery metal was especially hard hit. March and April 'delivered' was in a few days offered at close to 16c., and on January 13 sales were made around 16⅛c. for these months. Both domestic and foreign business was eagerly sought, even some of the large producers directly offering concessions, or doing so indirectly by asking for tenders. Some of the trade declared that an absolutely open market existed. On January 13 an offer of electrolytic at 17⅛c. immediate delivery, was met with the statement that a large producer would sell for 17c. On January 16 the market continued unsettled and irregular, although slightly firmer because of a more pronounced disposition on the part of consumers to buy. Some buying was reported on a basis of between 16.25 and 16.40c. for delivery in Europe, with domestic sales at 16⅜c. for February and March. The situation abroad was weak from similar causes, and between January 10 and January 15, standard or speculative copper (which is distinct from copper metal, but which has a reflective effect on the commodity) dropped £6. Despite the break, consumers who have stayed out of the market except when they could not avoid buying, have continued to hold off, apparently in the hope of still lower prices. Many of them are emphatic in their assertion that 15c. is enough to pay for copper. While a good domestic buying movement will stiffen the market, it will not resume the hardness characteristic of so many months until European buying in good volume is resumed.

Determination of Copper in Matte

By Vance P. Edwards

*The method given below is one in daily use in a lead-smelting plant, and while it is based upon the standard iodometric method for copper, certain short cuts are introduced which make it possible, with practice, to turn out a copper analysis (accurate to 0.1%) in half an hour.

Weigh ½ gm. of finely pulverized dried sample into a 250-c.c. casserole with lip; cover with watch-glass; add 5 c.c. concentrated hydrochloric acid; digest on hot plate for one minute; add 5 c.c. concentrated nitric acid; heat until in solution; pipette in 5 c.c. concentrated sulphuric acid, using a pipette (the tip of which has been enlarged in order to deliver the acid as quickly as possible), placing the tip well into the casserole, the cover glass, of course, being left on. Take down to sulphuric acid fumes over a naked flame, there being little danger of bumping. When all nitric acid is replaced, remove from the flame; pull the cover glass part way off, and, if necessary, the casserole may be carefully set in a shallow pan of cold water. As soon as the fumes have ceased to be evolved, which will be in about two minutes, replace the cover glass and run in cold water as fast as possible, using a tip with at least a 2-mm. opening, care being taken to hold the tip several inches from the casserole; at first shooting the water in a little at a time until the most violent action is over; then dilute to 50 c.c., boil well for five minutes to get all the iron salts in solution. If lead is not desired on the same sample, it will be sufficient to boil for two minutes.

Filter into a 250-c.c. beaker containing a piece of sheet aluminum bent at right angles; wash the casserole and precipitate twice with hot water; add one to two drops of 1:1 hydrochloric acid to the beaker containing the copper; cover and place on hot plate. The addition of the hydrochloric acid will greatly increase the speed with which the copper is plated out, due to the fact that the ferric salts are more quickly reduced by the liberation of hydrogen from the reaction between the aluminum and hydrochloric acid. Hydrochloric acid is regenerated as fast as used. The hydrochloric acid will also precipitate any appreciable amount of silver which may be present, thus eliminating a source of error in titration.

When the aluminum is clean, or the solution clear, remove from the hot plate; filter through an open filter (black label No. 589), taking care to keep as much of the copper as possible in the beaker; wash off the aluminum and put it on the filter rack; wash the copper on the filter into the point and wash the copper in the beaker, by decantation, twice with hot water. Place the beaker containing the copper under the funnel; stand the aluminum on edge in the funnel and pour 3 to 5 c.c. of hot nitric acid (1:1) over the aluminum and filter paper; wash both well; cover the beaker and place on hot plate and heat until all the copper is dissolved; add bromine water until the solution is slightly colored; boil off the excess, remove from the hot plate; add 1 c.c. excess ammonium hydroxide, and by placing a stirring-rod in the beaker the excess of ammonia may be boiled off with less danger of bumping. Add 2 c.c. excess strong acetic acid to the boiling solution; boil for one or two minutes in order to be sure any basic salts of copper are in solution. Remove from the hot plate; take off cover glass; dilute with cold water to 40 c.c. and place the beaker in a cooler. Titrate when cold with thiosulphate which has been standardized against C. P. copper (1 c.c. equals 1% for half a gram sample), using potassium iodide and starch

*From the *Chemist-Analyst.*

Mexican Pig-Iron Industry

By H. M. Wolcott

The only important manufacturer of pig iron in Mexico is the Cia. Fundidora de Fierro y Acero, of Monterey, Nuevo Leon. The anual report of this company for 1911 states that its output of pig iron for that year was 71,337 tons, an increase over 1910 of 26,246 tons. While the pig iron generally produced in Mexico is somewhat soft, and consequently has to be mixed with foreign irons to make a satisfactory casting, it is said that the iron manufactured by the Monterey plant is as good as that produced in the United States or other countries, and that the company does not find it necessary to mix foreign irons with its output. In the fiscal year 1910-11 2681 metric tons (metric ton = 2204.6 lb.) of pig iron, valued at $46,672, were imported into Mexico, supplied by the following countries: Great Britain, 1963.6 tons, value $33,173; United States, 663.2 tons, value $12,236; Germany, 38.6 tons, value $825; China, 15.1 tons, value $351; France, 0.5 ton, value $87. The duty assessed by the Mexican Government on imported pig iron is: On iron in ingots of first fusion or in filings or scrap, ₱0.02 per gross kg. (equivalent to about 0.45c. per lb. avoirdupois); on iron, roughly wrought (bar) in ingots, and steel in ingots, ₱2.50 per 100 gross kg. (about 0.56c. per lb.). In addition to this duty a surtax of 5% is assessable under the provisions of the Mexican budget law of June 3, 1912.—*Daily Consular and Trade Reports.*

Cost of Mt. Lyell Copper

During the half-year ended September 30, 1912, the revenue of the Mt. Lyell company from sale of copper and superphosphates, and from railway traffic was $1,565,337, the total working cost being $825,528 divided as follows:

	Per ton.
Mining 155,243 tons	$2.33
Mine preparatory works overburden account—50c per ton on 21,523 tons of open-cut ore raised during half-year	0.07
Mt. Lyell mine underground development account—8c. per ton on 74,724 tons of ore mined underground	0.04
Smelting expenses, 157,296 tons of ore	2.10
Converter expenses (bessemerizing)	0.25
Freight and charges on copper	0.59
Total per ton of ore	$5.38
Office expenses, prospecting, taxes, and depreciation	$0.92

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

American Institute of Mining Engineers

The Editor:

Sir:—The Land Fund contributions continue to come in. The Fund now reaches, in cash and promises, over $35,000. The number of replies received in response to the invitations to contribute which I sent to our membership, does not really exceed ten per cent. If the indifference arises from any feeling, to the effect that the recent discussion with regard to the past administration of the Institute is likely to lead to its disintegration, I am sure that dread may be dismissed.

I think we have to regard the development of our great educational institutions in the same light as we do our great industrial and mercantile corporations. The day of individual activity has passed, but, at the time that these institutions were dependent upon the energy and activities of an individual, it was the only way they could have been carried on. Their prosperity today is due to the unselfishness and willingness of the individuals, who laid the foundation for future prosperity, and built the first or second stories of the structure to which today story after story is being added by co-operative energy instead of individual energy. Without Dr. Raymond's help in the past the Institute would not be what it is today; but the past is past, and the Institute at large, recognizing that fact, is adopting a different organization and a different system of management. We know, in the commercial world, that the changes from the old system have brought about litigation, heartburning, more or less injustice, and many other causes of discontent and dissatisfaction; and the changes which we have all been trying to bring about in the Institute have not been devised, and will probably not be carried into effect, without hurting somebody, and without the exercise of more or less forebearance and willingness to forego one's particular notions, and yield to the will of the majority. There are among us in the East floating rumors of rabid discontent and threats of destructive nature on the part of the Western members. We hear talk of starting an opposition institute in the West, and of the intention of publishing and ventilating the original report of the Committee of Five which, as originally written, was a mere suggestion, never adopted by the majority of the Committee, never accepted by the Board, and which therefore is to all intents and purposes a private document, which it would be of course a breach of courtesy to publish. I cannot think that the above is really the attitude of the great body of the Western members.

Last year, under Mr. Kirchhoff's administration, and this year under Mr. Kemp's, radical steps have been taken toward so altering the constitution and the administration of the Institute that the members at large shall take a deeper interest in its affairs, and all co-operate, through local sections, in increasing the volume, without diminishing the quality, of the scientific literature which has made our *Transactions* famous the world over. The method of organizing the excursions in the past may be open to criticism. That is a matter of difference of opinion; but, forgetting the things that are behind us, let us look forward to the duties that lie ahead of us in the future, and co-operate to create harmony and infuse enthusiasm into our membership. My share of the work has been to try to raise the fund necessary to pay off the balance due on the Land Fund, and thus avoid the raising of the dues. We draw our membership in great measure from the salaried officers, not from the capitalists who employ them, and I know from experience that $5 or $10 is to some men at some period of their lives a sum of considerable importance; and therefore personally I have been extremely anxious to avert, if possible, an increase in membership dues, and I believe that I shall succeed.

JAMES DOUGLAS.

New York City, January 10.

Labor and Social Progress

The Editor:

Sir—I am sending you these lines expressing the views of enlightened workmen concerning the 'ill advised' strike at Bingham and Ely. In your editorial of November 2 you stated that nothing was gained for the men other than what might have been obtained by peaceful means. If we are to believe the *Press*, the strike was a peaceable one, but you say that peaceable means might have obtained equal results. Does stopping work mean warfare? There is much room to doubt that the small gain granted the men would have been obtained had no concerted action through their organization been taken. Such steps for bettering the conditions of the worker are not in line with the policy carried out by the combinations domineering at these places. That the wage scale was not advanced when copper was 16c. last May proves that pressure was necessary. The outcome at Ely and Bingham does not "indicate the futility of syndicalism," as you say, but the lack of it. Syndicalism we are not in favor of, but it is plainly evident that causes for its existence are everywhere present in embryo and it is only a matter of time when our country will be beset with conditions similar to those in England last spring. But this more or less formidable expression of our economic interest will disappear when the cause for its existence shall have disappeared, which is the aggressions of capital.

You say, "the demand for higher wages based upon the increased profits" will to many minds, "present a degree of reasonableness" (it certainly will), but if such a principle is to be admitted, then the way is open to a corresponding reduction of wages when profits are smaller. Is not this principle everywhere carried out? Do not the industries shut down periodically and make tramps of us? Are we not in want during depressions? Are we not forced to curtail our consumption of utilities because of

our over production of commodities? We live so long as we find work and find work only when our work increases capital. This is just dawning on his majesty, the American laborer, and our 'leading gentlemen' may expect a change by virtue of this awakening.

You argue thus, "the line of progress in industrial development is steadily toward the stabilizing of the conditions of the workers, who are less able to bear reverses than the men who employ them." Certainly, but how can we stabilize conditions in a society founded on the antagonisms between the producing non-possessors and possessing non-producers, on the one hand, and on the other the anarchy of production? "Any program of betterment for the wage-earner which overlooks this fundamental principle cannot lead to ultimate success." The action of the men in raising their standards of living will do much toward the stabilizing of conditions and is therefore in harmony with "this fundamental principle" which will lead to "ultimate success." The reason the conditions are so unstable now is because they are too stable. In other words, society will have to go through a period of great social unrest in order that it may be taught how to rid itself of its antagonisms and have social rest.

Syndicalism is a splendid weapon for wresting the means of life from the exploiters of labor, but it has one great drawback—it will not work. We cannot remain with hands folded long enough, which proves the futility of the movement. It is hoped that the profession will give the labor question the serious consideration that it merits. History teaches us that it is a dangerous one to ignore. Should our very best citizens continue to ignore fundamental conditions and stupidly attempt to stop economic development, bloodshed will be inevitable. Except for your facts and logic, your argument is a good one.

A Laborer.

Long Beach, California, December 15, 1912.

[In a journal devoted to technology such as this, it is commonly impossible to afford much space to the discussion of social problems. But our correspondent's letter is, except for the profitless quibble with which it opens and the empty innuendo with which it concludes, so interesting and so expressive of one view-point of the matter that we are glad to accord space for it and for necessary comment as well. For useful discussion of social problems, however, it is necessary to have a certain measure of agreement upon fundamentals, and to one who believes that modern society is "founded on the antagonisms between the producing non-possessors and the possessing non-producers" our remarks appear in much the same light that a discussion of the prophylaxis of typhoid fever would to a Christian Scientist. In our view any discussion of social problems based on the belief that the *entrepreneur* and the laborer are natural enemies is as unlikely to lead to right conclusions as a system of hygiene which supposes that the hands are the natural enemies of the feet because the feet are obliged to carry them about and are clothed in harsh cowhide while the hands wear soft kid. In both cases the parts of a whole organism have different functions to perform and may perform them badly or well and the difference in functions indicates a necessary coördination rather than a basal antagonism. In plain words, the laborer cannot find a 'job' unless an *entrepreneur* has started a business to employ him; nor can the latter carry on his business unless there are laborers to do the work. The circumstance that the *entrepreneur* engages in business to secure a profit from the utilization of his capital, and the less he pays his laborers the greater will be his profits, does not indicate that capital and labor are fundamentally antagonistic, for similar relations characterize every phase of human life. The workman is paid a certain sum for 8 hours' work; the less work he does in that time the higher his rate of pay per foot pound of energy expended. Or, if the company boards him, the more food he eats the more he gets for his labor. But if he eats more food than his system requires, he will suffer rather than profit from taking it; if he does too little in a day he will be dismissed; and if an employer pays his laborers less than a proper wage for the service performed he will suffer through being unable to secure the best class of workmen, or perhaps even a sufficient supply of any quality. Such relations are semi-automatic, but their failure, through the complexity of relations, to completely and immediately adjust themselves easily, leads to wrong conclusions. The proper wage for any given service varies from year to year, but readjustment is not immediate and complete because that is impracticable in the conduct of business. The apprentice who starts in at $10 per month does not get $10.25 per month as soon as he has learned a little; his first increase is probably to $15 per month. His service was not worth $10 during the first month, later it was worth more, but from a business standpoint it was not practicable to adjust service and recompense more exactly.

Stabilizing conditions for the wage worker is an outgrowth of fundamental characteristics. The workman renders a fixed service for a fixed return, the *entrepreneur* risks his capital and energy to secure a variable profit which may be larger or may be negative, a loss, in other words. He pays his laborers whether he makes a profit or not; in other words he carries the risk incident to carrying on the business. If there is a loss he shoulders it; if there is a considerable profit he is entitled to it as a return for the risk incurred. Where the return to the laborer is contingent upon the profit or lack of it resulting from his work, he ceases to be merely a laborer and becomes in some degree a partner in the enterprise. This is not, despite the widely held views to the contrary, a desirable relationship, because the profit which does or does not accrue does not depend in most cases upon his efforts. For example, a drummer properly receives a commission upon the sales he makes, because he directly influences them, the workman who made the article does not get a commission upon sales because his influence upon them is negligible. On the contrary the workman would properly object to having the recompense for his work depend upon the results secured

by someone over whom he has no control. To be specific, a miner has no claims whatever upon such increased profits as a copper mining company may derive through management. He may properly demand increased wages when there is a rise in the general level of the commodity prices; but there is no fundamental logical, or moral ground upon which to base a demand for increased wages where, through a temporary rise in the selling price of its product, the company which employs him makes increased profit. In certain industries the employer has gone to his employees with a request that they help him carry his loss by accepting lower wages in order to tide him over a period of loss. The laborer thus becomes in a sense a partner in the enterprise, and it may be to his advantage to do so, for otherwise the employer may be forced to close down and the laborer be thrown out of employment. But any such arrangement as this or the others mentioned complicate the clear cut relations between the employer who takes the risk of his enterprise and the laborer who assumes no risk, but sells his labor for a stable price. The employer is supposed to possess sufficient reserve to tide him and his business over periods of no return; the employee possesses little or no reserve and the line of progress in modern development has been to stabilize conditions for the workingman, so that periods of stress may be minimized. In Japan, for example, some of the mining companies sell rice to their employees throughout the year at a fixed rate which is often materially lower than the average market rate, which fluctuates greatly between one harvest time and the next. The slight financial loss to the company is charged to wages account and brings more than a corresponding degree of comfort to the miners. Large companies in America frequently maintain stores at which goods are sold to employees at a small margin above cost-price to prevent their being exploited by local merchants, and an Australian company has recently opened a butcher shop for the same purpose. Compulsory compensation of workmen for accidents is in process of becoming established by state legislation throughout the Union and a number of large companies have made arrangements for the pensioning of aged employees. In England national insurance against ill-health for all employed persons, and insurance against unemployment in certain callings, has recently been put in force.

Right conceptions of communal relations grow slowly and provision for the support of the dependents of deceased wageworkers, and similar devices to give to the honest worker an assured steady income and as large a degree as possible of protection against reverses of fortune are yet in the future. Progress lies in this direction and not in syndicalism. The strike at Bingham and Ely was ill-advised because it was in a large degree an attempt to secure from the operators recognition of the Western Federation of Miners, and in our opinion, the increase in wages finally obtained could have been secured by more peaceable means than the calling of a general strike. The Western Federation of Miners has proved itself unworthy of recognition. The rank and file of its members, honest, hard-working men, have been dominated by a coterie who have directed the policy of the organization along lines that are not only stupid, but have been at times, ignorant, vicious, and criminal. For the enemy of society we have no sympathy, whether he wear tailor-made suits or overalls.

Neither has society "to go through a period of great social unrest in order that it may be taught how to rid itself of its antagonisms and have social rest." This is often more violently expressed by labor agitators, who declare that only terrorism will be effective in securing an adjustment of present social problems. This is the reverse of truth. At no time in history has the voice of labor commanded more attention than at present and at no time have the needs of labor been more considered. One hundred years ago large numbers of men throughout the world were living in slavery. Last week, with the final freeing of the Russian serfs, legalized slavery disappeared from the civilized world. Living conditions for rich and poor have been growing better and those who declaim that "the rich are growing richer and the poor poorer" know not the facts of the case. The poverty of the slums of New York and Chicago is affluence compared with the poverty in China and India, though by the great increase in wealth and comfort throughout our country it may seem more bitter than a few decades ago when the Sunday newspapers were fond of listing the few people in the United States who were worth over a million dollars. Social unrest similarly seems more serious today when pot-house oratory is scattered broadcast by the aid of the printed page, and the rascals, who in former years would sulk into an alley to 'slug' the foreman, are able with a few pounds of dynamite in an instant to involve lives and property in wholesale destruction. We believe in labor unions, we applaud the efforts of laboring men to better their condition, but for violence and criminal methods, whether employed by rich or poor, we have only condemnation. Much progress has been made and the rate is more rapid than at any previous time. The outlook is bright and perhaps its most discouraging future is that so many intelligent men among the workers show themselves possessed of so little real insight into the true factors of social problems.—EDITOR.]

Flotation Patents

The Editor.

Sir—In your issue of December 28 last you published a letter from Jacob D. Wolf under the heading of 'Flotation Patents.' For the information of those who may have read Mr. Wolf's letter, and speaking for Minerals Separation, Ltd., I am instructed to say that Mr. Wolf's statements are wholly false and his assertions ridiculous. In the last paragraph of his letter he threatens the company with litigation, and therefore the board of directors of Minerals Separation, Ltd., has instructed Henry D. Williams, of 76 William street, New York City, to accept service on behalf of Minerals Separation, Limited.

EDWARD H. NUTTER.

San Francisco, January 21.

Official Ballot of the American Institute of Mining Engineers

Officers and members of the council under the present constitution: President, Charles F. Rand, New York. Vice-presidents, C. W. Merrill, San Francisco; T. H. Leggett, New York; J. A. Holmes, Washington. Councillors, H. L. Smyth, Massachusetts; F. W. Denton, Michigan; E. V. d'Invilliers, Pennsylvania. Secretary of council, Bradley Stoughton, New York.

Directors and officers under the new constitution: President, Charles F. Rand, New York. Past-presidents, Charles Kirchhoff, New York; James F. Kemp, New York. Vice-presidents, Sidney J. Jennings, New York; George C. Stone, New York; B. B. Thayer, New York; C. W. Merrill, San Francisco; T. H. Legget, New York; F. W. Denton, Michigan. Directors, W. L. Saunders, New York; E. V. d'Invilliers, Philadelphia; C. S. Robinson, Youngstown; R. W. Brock, Ottawa; H. L. Smyth, Watertown; Walter H. Wiley, Los Angeles; J. A. Holmes, Washington; J. J. Ormsbee, El Paso; J. W. Finch, Denver; J. W. Richards, South Bethlehem; J. W. Malcolmson, Kansas City; H. V. Winchell, Minneapolis; Stanley A. Easton, Kellogg; E. P. Mathewson, Anaconda; G. G. Crawford, Birmingham; L. D. Ricketts, Cananea. Directors (to fill the unexpired term of Messrs. Rand, Stone, and Kemp), R. W. Hunt, Chicago; James Gayley, New York; R. V. Norris, Wilkes-Barre.

Directors from the old board who will fill their unexpired terms in the new board in accordance with the new constitution, James Douglas, J. F. Kemp, A. R. Ledoux, E. B. Kirby, C. F. Rand, and G. C. Stone. Vice-presidents of the Council holding over, Karl Eilers, Waldemar Lindgren, B. B. Thayer. Councillors holding over, A. E. Carlton, W. J. Oleott, E. L. Young, John H. Janeway, Jr., Sidney J. Jennings, Joseph W. Richards.

Platinum-mining will be undertaken by the Ovsyankin Company of the Urals, which has just been formed of purely Russian members. This company controls 109 placers in the Orenburg Government, some of which have been carefully investigated and are being exploited by *staratelli* (free laborers). This company expects to be able to start three of its gold-washings and refineries on the ground. Generally speaking, all over the gold district there is feverish activity in both surface and underground work.

During November the 40-stamp mill of the Abosso Gold Mining Co., Ltd., in West Africa, treated 9100 tons, yielding $81,000, at a cost of $6 per ton, the net profit being $16,000. The Taquah Mining & Exploration 30-stamp mill treated 5460 tons, yielding $76,000, at a cost of $8.30 per ton, net profits being $21,000. The Ashanti roasting and cyanide plants treated 13,839 tons, worth $202,000, with a profit of $80,000.

Graphite exported from Korea to Japan in 1911 amounted to 131,044 tons, valued at $65,885.

Special Correspondence

NEW YORK

DECLINING COPPER MARKET. — ALASKA GOLD MINES. — IRON MINES IN CHILE.

Recent developments in the copper situation have been most interesting. Ever since November, when the price was pegged at 17¾c. per pound for refined copper, consumers in this country have been assuming more and more of a determined attitude, and have been subsisting upon such purchases as were sufficient only for immediate needs. This position was further and greatly strengthened by the December figures of the Copper Producers' Association, showing a gain in accumulated stocks of refined copper of approximately 20,000,000 lb. The strength of the various interests in control of the copper metal market, without regard to the distinction as to whether they may have been working in harmony by mere coincidence or by express agreement, seemed to be invincible, yet this group of moneyed interests has seen fit to make, within the past few days, some very marked concessions, and evidently the retreat is not yet ended. Copper metal has been marked down from 17¾ to 16½c., and even this concession has obviously failed to bring domestic consumers into the market. The present controlling groups are without question too strongly intrenched and too completely in touch with all phases of the situation to allow themselves to suffer any such disaster as has overtaken from time to time the various former attempts to control the market in copper metal. It is worth while, however, to note the various factors which brought about the 'pulling of the peg.' It was not alone the addition of 20,000,000 lb. of copper to the existing surplus; it was also the knowledge that stocks of copper were and are held at the refineries, an element of which the strength could only be estimated by the consumer. There was also the new copper, which in large part failed to make itself felt during the past year, but which will be a most important addition during the twelve months to come. Federal investigations have also come to be recognized as serious matters and not to be lightly invited. What weight may have been given to a possible investigation can, of course, be but matter of conjecture. At any rate, the manufacturers have proved themselves victorious in the stand they have taken, and are now vigorously pressing for further concessions.

As might have been expected, the tendency of copper shares was downward under the influence of the metal market. The exceptions which deserve to be noted were Greene-Cananea, upon the hope of better conditions in Mexico, and Trinity copper, the latter advancing on reports of successful tests of the Bradley process made at the Washoe smelter, which process, it is said, will be installed at the Trinity's mines and, it is hoped, will permit of active operations. The Mines Company of America reports that conditions in the localities surrounding its various properties have so far improved that all of its mines are now in full operation. In spite of the various and sundry troubles encountered during the year, a gross production during 1912 was achieved of $2,400,000, from which a net profit was made amounting to $600,000.

The Homestake Mining Co. of South Dakota has gone its wonted way so long and at so steady a pace, paying regularly 50c. per share monthly, that it comes with something of a sense of surprise to note any financial operations of the company outside of the regular routine. It is now announced that the company is to capitalize expenditures made out of earnings, during the past seven years, for replacements, betterments, and additional property, to the extent of $3,116,000, which stock increase, if ratified by the shareholders, is to be distributed in March in the form of a 15% stock dividend. In the meantime the regularly monthly dividend of the company has been increased from 50c. per share to 65c. per share.

The shares of the Alaska Gold Mines have been the feature of the outside market in the mining list, and bid fair to

prove proportionately as profitable as Chino copper, which was also a Hayden-Stone underwriting. A recent statement put out by the latter is to the effect that it has been fully demonstrated from the operations of the old mill that 75c. per ton is an ample estimate for mining and milling the ores. It is also stated that the 6000-ton mill which is to be erected as quickly as possible is to be but the nucleus of the milling plant with which the property will eventually be equipped, and that a capacity of 20,000 tons per day will in all probability be provided as quickly as the ground can be put into shape to furnish the ore.

Theodore Dengler has been appointed to the vacancy made in the staff of the Mohawk and Wolverine mining companies by the resignation of Fred Smith, who was superintendent of these two companies for many years. Mr. Smith is known throughout the Michigan copper country as one of the old-fashioned mining superintendents who kept in close touch with his men, a large number of whom, now employed by the Wolverine, went with him when he went into the employ of that company in 1890.

As a checkmate to the recent acquisition of a large body of iron ore lands in Brazil, by a group of English and American financiers, Charles M. Schwab, of the Bethlehem Steel Co., of Pennsylvania, has recently returned from Europe after having completed the purchase of a large tract of iron ore land in Chile. The property is known as the Tofo iron mines and is said to contain 100,000,000 tons of very high-grade iron ore. Mr. Schwab states that he contemplates building a fleet of at least ten vessels to begin with, to carry the ore from the mines at Coquimbo on the Pacific coast through the Panama canal for eventual delivery to the plant at Bethlehem. It is expected that the ore can be carried from mine to vessel by an aerial tramway.

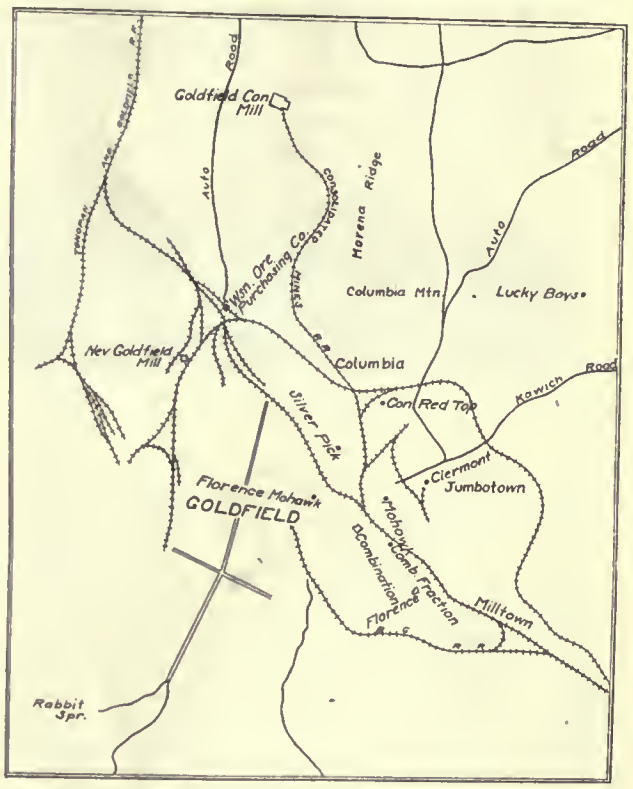
GOLDFIELD, NEVADA

NEW ORE IN COMBINATION.—WORK AT JUMBO.

In the Combination mine of the Goldfield Consolidated, an orebody has been discovered, development upon which, on the 130-ft. level alone, is estimated to have added $500,000 net to the visible ore reserves of the company. This ore was found immediately under the engineering office, northwest of the Combination shaft, and in what has been known as the foot-wall country that has been pronounced barren by some supposed authorities. The ore is shown by development to be an extension of the Combination 'glory-hole' orebody, from which a large tonnage of rich, free-milling ore was produced. Officials of the company say that at one point this ore is 40 ft. wide and the entire mass will average $25 per ton or better. The value of the discovery may prove much greater than indicated by this estimate, as no attempt has yet been made to cut the ore-shoot, either above or below the level on which it was first opened. During the past year the energies of mining companies in the Goldfield district have been devoted almost altogether to preparatory and dead work, shaft-sinking and exploring or prospecting. This year a large amount of development work will be done, and much of this will be at from 1000 to 2000-ft. depth. Work below the 1000-ft. levels of the Consolidated and Merger mines has already demonstrated the extensive fissuring of the rock that had been held by many to be the limit of enrichment at depth, and the operations planned should, within the year, determine with some degree of accuracy the value of the territory under development.

An agreement entered into during the week between the Atlanta Mines Co. and the Goldfield Merger Mines Co. provides for the immediate sinking by the Merger company of its main or St. Ives shaft to a depth of 1750 ft. and for driving a cross-cut at this depth to the boundary of the Atlanta. At this point the Atlanta will assume the development of its own ground, working through the Merger shaft, and this work is to be done with all possible expedition. A sinking pump has been ordered, of ample capacity to handle any flow of water that may develop. The present hoisting capacity of the Merger is ample to work both properties, and the pumps lately installed in the St. Ives shaft are capable of raising all the water reaching the shaft from the 1330-ft. level to the surface, the sinking pump raising it to the station sump on the 1330-ft. level. This constitutes a radical change from the tentative plans announced several months ago by the Atlanta directors, when it was thought that the better plan would be to open this ground from the 1400-ft. level of the Grizzly Bear mine. K. M. Simpson, the engineer in charge of the 'outside' Wingfield properties, has been named as general manager for the Atlanta company. The Merger shaft is now down 1400 ft. It is 7 by 18 ft. and is being sunk with the aid of air drills. Over 130 ft. has been made in a single month. The Atlanta company has $100,000 cash in its treasury.

Operations of the Jumbo Extension Co. are now upon a substantial profit-earning basis. The Polverde mine has sufficient ore developed, according to the company's engineers and management, to supply for a year at least the Bonnie Claire mill, 36 miles south of Goldfield, to which the mine is shipping from 90 to 100 tons per day. The



GOLDFIELD AND VICINITY.

mill was largely remodeled by this company, and the only process now employed is concentration, although there is a complete cyanide plant in connection with the mill. A recovery of 72 to 74% is obtained, and the concentrate is shipped to the International Smelting & Refining Co. at Tooele, Utah. Ore of better grade, refractory by reason of its content of silver and copper, is shipped to the sampler of the Western Ore Purchasing Co. and has averaged $60 to $85 per ton. On the 900-ft. level of the mine a diagonal cross-cut has exposed a 7-ft. face, assaying $350 per ton, but its extent is unknown, as the cross-cut is being driven ahead to prepare a sill for a raise to the intermediate level, and the twisted appearance of the vein at this point renders it impossible to determine the course of the ore, which is near an extensively faulted area. Stopes on the 800-ft. level are producing a good tonnage of excellent milling material, and a winze will be extended from the 940-ft. level on the rich ore-shoot to determine the best point to raise for the ore from the 1017-ft. level.

Extensive work has been started on the ground of the C. O. D. Consolidated by the Goldfield Mines Operating Co., which has secured a five-year lease embracing the Gold Bar and parts of the C. O. D. and Victor claims, and is working at the Gold Bar, Victor, and Florence-C. O. D. shafts. This work has begun since the first of the year, and already a body of good ore, 6 ft. wide, has been exposed on the

185-ft. level of the Gold Bar. The electric hoist formerly at the Sills shaft has been installed at the Florence-C. O. D. shaft, which was sunk by lessees on the flat below the Gold Bar. The work is under the direction of G. C. Webb.

MELBOURNE, AUSTRALIA

HAMPDEN CLONCURRY.—TWO BROKEN HILL MINES.—MT. LYELL.

Of all Australian mines, the Hampden Cloncurry, of Queensland, is perhaps the one which is at the present moment most generally regarded as having a first-class prospect before it. The past half-year has been one of great interest because it has marked the close of a prolonged construction campaign. Smelting was started by the middle of July, and it is expected that the first dividend will be paid in February next. The present capacity of the mine for production is shown by the returns for September, October, and November, which are as fellows: Ore, 12,932 tons; matte, 2125 tons; blister copper, 2117 tons; fine copper, 2096½ tons; gold, 1183 oz.; silver, 24,332 oz. The ore reserves are estimated at 238,000 tons, containing 24,800 tons of copper, and if the negotiations for the purchase of the Mt. Gregor Cloncurry mines be brought to a successful issue, the reserve will be considerably increased. The ore is chiefly pyritic, and is separated at the main shaft into fine and coarse for separate treatment. The smelting plant consists of two furnaces, the blast being supplied by two Bellis & Morcom vertical high-speed air-compressors, each capable of giving 6500 cu. ft. of air per minute at a pressure of 5 lb. per square inch.

Like most of the other big Broken Hill mines, Block 10 has had a very satisfactory half-year, owing largely to the high level at which the market prices of the metals have been standing. The new mill at this mine has been a great success, producing a concentrate rich in both lead and silver and making higher recoveries. The costs are: ore extraction, per ton milled, 15s. 2.59d.; development, 1s. 2.15d.; milling and treatment, 5s. 2.17d.; general expenses, 1s. 0.71d.; total, £1 2s. 7.62d., equal to about $5.48. There is, however, a fly in the ointment of the Block 10 company in that the present reserves are calculated to give only two years' supply for the mill, and the finding of any new orebody is beginning to be despaired of. In Block 14 the outlook is even worse. This mine is almost entirely dependent upon its carbonate ore, its only other reserve being between half a million and a million tons of low-grade sulphides. The mine has been so extensively bored that there can be little hope remaining of any discovery to prolong its existence.

Although the Mount Lyell Mining & Railway Co., Ltd., made a clear profit of over $500,000 during the six months ended September 30, no dividend has been declared, in view of the disaster at the mine that ushered in the current half-year. This has already involved the company in very heavy expenditure and is certain to involve it in much greater, for a Government commission is now beginning to inquire into the cause of the outbreak of fire in the mine workings, and, even if the company be acquitted of blame, the cost to it will assuredly be considerable, while, if it be found in any way blameworthy, it will doubtless be mulcted in very heavy damages and for compensation to the families of those who lost their lives. Apart from this unpleasant feature of the position of the company today, it is noteworthy that, despite the improvement in the net profit, things are not going altogether satisfactorily. For one thing, the grade of the ore smelted is distinctly on the decline, though the estimate of the grade of the ore reserve has never been altered to match the decline. And, while the grade of the ore is going down, the costs of mining are going up. The working cost per ton of ore, as a matter of fact, fell slightly during the past half-year, but the reduction in the copper content caused a considerable rise in the working cost per ton of copper. The policy of the company in accumulating a reserve to provide for possible emergencies is therefore a wise one to pursue.

AUSTIN, TEXAS

THE BIRD MINE.—SALE OF THE BURRO.—ANCIENT MINES.

Development work upon the Bird silver mine, situated 12 miles east of Alpine, has been started by W. B. Phillips of Austin and James Lafarelle of Alpine. It is claimed that there is a large amount of rich ore upon this property and that it will soon be brought to a producing stage. Several new test shafts will be sunk and the extent of the orebody proved, preparatory to increasing the working force. Regular shipments of zinc ore are being made from the Bonanza mine, situated in the Quitman mountains, two miles from Lasater station, on the Southern Pacific, west of Alpine. This ore runs from 40 to 44% zinc and the shipments are made to smelters in Kansas and Oklahoma. Operations upon this property are to be upon an enlarged scale early in the coming year, it is stated. A. M. Turney, of Alpine, has leased from W. W. Turney and A. M. Caruthers, for a period of 25 years, the Caruthers silver and lead mine, situated 10 miles east of Alpine. Some development work has been done upon this property, and ore that netted $80 per ton was shipped. Recently an examination of the mine was made by engineers, and they made a highly favorable report. Mr. Turney will put a large force of men to work developing the mine.

The Burro mine, situated near Etholene, in the Quitman mountains, has been purchased by the Southwestern Mines Co. This property was formerly owned and operated by Messrs. Owen, Nichol, and Briggs, and considerable gold ore was shipped. It has been inactive for some time. The new owners are now cleaning out the old workings and will install a steam-hoist and other modern equipment, preparatory to resuming mining operations. J. R. Harper, A. P. Coles, and Lewis W. Smith, all of El Paso, own a promising copper claim, situated 15 miles north of El Paso, which they are now developing. The shaft is now down about 75 ft., and a hoisting plant will soon be installed. Considerable importance is attached in mining circles to the recent discovery of ancient Spanish workings in the Quitman mountains near Etholene station. These old mines were brought to light by a cave-in caused by a heavy rain. They are near the Lulu B. claims, which are owned by William Crosby and son of El Paso. Explorations have been made of these ancient Spanish mines, and they are shown to contain very extensive workings. Mr. Crosby and his son are carrying on development operations upon their properties in that section, and it is expected that work will also soon be started on the ancient Spanish mines.

H. A. O'Neal, of Atlanta, Texas, as trustee for a syndicate of Philadelphia men, has signed a contract for the lease of the iron furnace and pipe works of the State of Texas, situated at the penitentiary at Rusk, and the first instalment of $1666 of the annual sum of $5000 that is to be paid the state under the contract has been paid. In addition to this lease contract, the syndicate is given permission to purchase iron ore from the state's holdings. The lease is for two years, with the option on the part of the lessees to extend the contract for an additional four years. The contract does not provide for the use of convict labor in the operation of the iron industry, but it is expected that what ore is mined from the state's lands will be done by convicts under the supervision of the penitentiary authorities. It is announced by Mr. O'Neal that the syndicate has already spent $250,000 cash in acquiring iron-ore lands in eastern Texas, and that an additional $20,000 will be spent in improving the plant at Rusk. Under the terms of the contract the furnace must be placed in operation within six months from January 12, 1913. The special purpose of the syndicate in leasing the state's iron furnace is to conduct extensive experiments with the view of determining fully whether the industry can be made profitable, and if the results are as satisfactory as are now expected, development of the syndicate's ore-beds on an extensive scale will be started. The operations of this syndicate are said to have no connection with the large iron-ore develop-

ment work that is now being carried on in Cass county, Texas, by Charles M. Schwab and associates.

JOHANNESBURG, TRANSVAAL

AVERAGE WORKING COSTS.—OUTPUT OF U. S. A.—COPPER PRODUCTION OF TRANSVAAL.

According to the usual analysis issued by the Chamber of Mines, the average cost per ton milled on the Rand for October showed a decrease of 5d. The cost in September was 18s. 8d. and for October 18s. 3d. per ton. A reduced cost of 2d. per ton was anticipated as a result of the cheaper freight rates on coal to the Rand, but to what extent the reduced cost may be due to this change, it is difficult to say. One striking feature of the October returns was that the lower costs were accompanied by a fall in the average yield of the ore sent to the mills of 7d. per ton, this being a repetition of former experience on these fields, where a higher yield has generally resulted in higher costs, and vice versa. The average yield in October was 28s. per ton, as compared with 28s. 7d. per ton in September and 28s. 9d., the highest average yield of any month of the year, in August. Owing to the reduced yield, the lower costs were not reflected in the average profit per ton milled, which in October was 9s. 10d. per ton, as against 10s. in September and August. Nevertheless, owing to the greater tonnage milled in October, the total working profits were £1,079,334, as compared with £1,040,820 in September, and £1,055,315 in August. The same 53 companies produced in October as in September, and this increase in the total working profits would seem to confirm the view that on the Rand higher total working profits can be more easily attained by milling large tonnages than by attempting to raise the grade unduly by artificial means; while as to the advantages of the former practice in the long run, there can be no two opinions. It is known that several mines have been milling ore of higher content than the average of the workable ore reserves, and to some extent the improvement in the average grade of the ore milled during 1912 is no doubt due to this. But it is clear that mines following this practice must in the end be left with a large accumulation of low-grade ore.

The returns issued by the Mines Department of the Union of South Africa give the total value of the mineral output of the Union (excluding diamonds) for October as £3,566,182. Probably if diamonds were included it would mean the addition of another £750,000, so that at the present the monthly mineral output of the Union of South Africa is well over £4,500,000, of which no less than £3,500,000 comes from the Transvaal. Gold amounts to no less than £3,268,927 of this huge total. The value of the October output was higher than any of the preceding four months, and, judging from the large area of the Far East Rand goldfield still untapped, it is probable that the output of gold from the Witwatersrand field will continue to increase for some time to come. Much, however, will depend upon the provision of adequate capital, for after the extensions and new developments of 1910 and 1911, there has been a comparative lull which will produce a corresponding lack of progress in the gold output for next year. There can, however, be little doubt felt that the Witwatersrand gold-mining industry must continue to expand in the future, and with the adoption of suitable mining methods the deep-level mines will be able to maintain their position for many years to come, despite the comparative low grade.

The value of the Transvaal output of copper in the month of October only amounted to £6130. But as there is only one copper mine working in the Transvaal, and that really developing in readiness for railway connection, present-day achievements are not any indication of the value of the copper prospects of the Transvaal. This mine, known as the Messina, is situated to the north of Pietersburg, and to the present the development results have shown the lode to average by assay 10%. Of this grade, about 170,000 tons of ore is already blocked out. The consulting engineer estimates that once the mill now under construction is completed and railway facilities available, the profit should be in the neighborhood of £240,000 per year. The outcrop of the lode was proved for a distance of nearly 4000 ft. along the strike, and the prospect of several producing copper mines being started in the neighborhood is considered encouraging.

LONDON

ORE SORTING ON THE RAND.—POSSIBLE ECONOMIES IN PRACTICE.

The decision of the metallurgists of the Consolidated Gold Fields of South Africa to abolish the sorting of ore at surface at Knights Deep, again draws attention to the relative advantages of close sorting as against handling a large tonnage of lower-grade ore. The extraction is only 17s. 5d. per ton milled, and the working cost is 11s. 6d. A few months ago the Simmer East was absorbed. For some time these mines have had a joint mill containing 400 stamps, 270 being used by Knights Deep and 130 by

RANDFONTEIN MILL.

Simmer East. The whole of the 400, together with 9 tube-mills, is now under one control and the plant now ranks as the fourth in size on the Rand. In October over 100,000 tons was crushed. There were only three other companies to exceed this figure: Randfontein Central, 217,089 tons; Crown Mines, 167,800 tons; and East Rand Proprietary, 148,500 tons. But from the point of view of gold output, Knights Deep ranked only eleventh, with £81,981. Four mines, the Ferreira Deep, Robinson, New Modderfontein, and Village Main Reef, exceeded this output, though treating less than half the tonnage. The monthly capacity is now being increased to 120,000 tons, by the addition of two more tube-mills. Sorting at surface has never been largely employed, but a great deal of waste has been employed for packing stopes. The width of the deposit does not afford much scope for surface sorting. At the Simmer East the ore is of different character, for the main gold-carrier is a thin and rich grit, and more harm than good is therefore done by sorting at surface. It is estimated that sorting to reject 3000 tons per month would cost £300, while the cost of milling it would be only £90; but this, of course, is not the real economic gauge. Figures show that as the average grade decreases, so does the percentage of waste rejected. Possibly the argument should be stated the other way round in some cases, though it cannot be doubted that in more cases, especially in deep levels, the ore is nowadays of uniformly low grade, and consequently the average content would not be substantially increased by more careful sorting. In looking through the returns by various companies, it is clear that the largest amount of sorting is done by the companies with the highest-grade ore. It will thus be seen that the abolition of sorting at a low-grade mine is not due to an unreasoning big-tonnage craze. The resident on the Rand is on the side of the big mill, the abolition of sorting, and the consequently prolonged life of the mines, having at heart the continued prosperity of the great South African community, rather than the interests of European shareholders whose only desire is to reap as big profits as possible in the shortest time.

General Mining News

ARIZONA

Gila County

The Miami mine produced 32,814,643 lb. of copper in 1912, at a cost of 9½c. per pound, which cost included a charge of 31c. per ton of ore to cover depreciation.

Recent developments in the Blackjack mine, on Lookout mountain one and one-half mile southeast of Bellevue, show that it may prove to be valuable. The ore is a conglomerate containing ruby and native silver, gray copper, gold, and galena. The mine has been opened by adits.

Maricopa County

The Big Blue property consists of 19 claims, containing copper and silver ore. E. V. Browne, of Los Angeles, and others have purchased the rights of a new chemical process of ore treatment and will erect a plant at the Big Blue. It will extract copper from carbonate ores, and treat 3% ore at a profit.

Santa Cruz County

At the old Alto mine, eight miles from Patagonia, lessees have opened high-grade ore which promises to be of importance. Mine timber and machinery have arrived for the Trench company, which is financed by Butte, Montana, men.

CALIFORNIA

Calaveras County

(Special Correspondence.)—On account of shortage of water and the extremely cold weather, which has frozen the small supply left, the Utica and Tuolumne power plants are out of commission. Consequently most of the mining properties furnished with power from these concerns are temporarily closed down. This county is experiencing the coldest weather in 30 years. H. A. Kuns, manager for the Waterman Mining & Milling Co., is doing some extensive prospecting on that property with a core-drill. It is understood that he intends boring numerous holes to a depth of 1000 ft. before sinking a shaft, which will require at least two years. This is an innovation in quartz mining, and is being watched with interest by large mining concerns. Mr. Kuns, besides being one of the principal owners of this property, is backed by Los Angeles capital. He also planned and built the power plant and 10-stamp mill for the Original Mining Co., operating a property on the Merced river. He introduced some original ideas in that plant which are proving successful. The consumption of power for this mill is not over 2 hp. per stamp of 1000 lb. Mr. Kuns is also the consulting engineer for the New Almaden Quicksilver Mining Company.

Angel's Camp, January 11.

Los Angeles County

(Special Correspondence.)—The annual banquet of the Los Angeles Chamber of Mines and Oil was held on January 24 in the new home of the Sierra Madre Club, on the top floor of the Los Angeles Investment building. The proceedings included formal installation of new officers and directors, interesting discussions on topics concerning mining and oil industries, and a good time generally. The banquet marks the close of the most successful year in the history of the organization.

Los Angeles, January 25.

Modoc County

At High Grade, the Gold Peak and Klondike claims were sold during the past week to B. Lawrence and others for about $10,000. These properties adjoin the Consolidated group.

Nevada County

(Special Correspondence.)—The 2200-ft. shaft of the Pennsylvania Mines Co. is to be sunk deeper, according to recent reports. On the 1700-ft. level excellent ore is exposed. The Pennsylvania mill is treating 70 to 80 tons of ore per day. The property is largely controlled by San Francisco people. Considerable work is under way at the Brunswick mine. Raising the new shaft from the old workings is progressing and it is expected to make connections in a few months. The new vein was sunk from surface several hundred feet, when a heavy flow of water hampered work. The pumps in the old workings are handling the water and the work of raising to meet the shaft is making good headway. It is understood a good reserve of milling ore is exposed. Tributers have worked several blocks of ground with excellent results. C. J. Mallen is superintendent. The Empire Mines Co. is operating along normal lines; 40 stamps are dropping steadily and good ore is being mined from a depth exceeding 2000 ft. It is locally estimated that the output of the property for the year approximated $750,000, although nothing of an official nature has been given out. Leaders in the local miners' union are making desperate efforts to bring delinquent members back into the fold. A large number of the men have become dissatisfied with the numerous assessments levied by the Western Federation of Miners and have refused to pay. Delinquents have been offered an opportunity to be restored

EMPIRE MINE AND MILL, GRASS VALLEY.

to full membership by making a nominal payment, but it is understood that the majority is showing no inclination of acceptance. Many of the miners openly declare they will pay no more assessments, unless local conditions warrant such levies. Grass Valley has long been a Western Federation stronghold, but for years the men have resented the levying of heavy assessments, and the outcome of the disaffection will be watched with considerable interest by the mining fraternity.

Grass Valley, January 7.

It is reported that good ore has been opened in the 2400-ft. level of the Champion mine. The Brunswick Gold Mining Co. is being sued for $20,000 by the widow of H. J. Cornelius, who was killed by fume in a raise from the 1250-ft. level. It is probable that the relatives of W. Nichols, who was killed with the other man, will also sue the company. The men were working on contract, and the company had to supply air at all times. Bad weather has interfered with drilling the gravel beds of Deer creek.

Sierra County

In the trial of A. L. Wisner and J. L. Meyers, at New York, charged with using the mails to defraud in promoting mining companies, it was stated that at the Empire mine it cost $63,000 to mine $20,000 worth of ore, and dividends were paid.

Trinity County

A snowslide at Trinity Center has swept away the stamp-mill of the Bonanza King mine. This cost about $50,000, and nothing remains save the 20 stamps, which are standing in place.

COLORADO

Gilpin County

The main shaft of the Pittsburg Extension is to be sunk several hundred feet below the 150-ft. level, where ore is worth from $80 to $100 per ton. A recent shipment of 6360 lb. of smelting ore yielded 1.49 oz. of gold, 22.24 oz. of silver, and 2.06% of copper, worth $37.09 per ton. A good deal of development and construction will be done at the Pazo

group in Nevadaville, this being the first of the old mines to commence work on the surface since the Newhouse tunnel was completed.

LAKE COUNTY (LEADVILLE)

The cold weather has caused a great deal of inconvenience here and snow has blocked the railroads. The aerial tramway of the Mt. Champion, Lackawana gulch, broke down again last week. The recent ore discovery in the lower adit is being explored, and is opening well. The main adit of the Winthrop Mining Co., English gulch, is being driven in white quartz and porphyry, similar to the upper workings. Lessees at the Belgian, Cucumber, La Plata, Moyer, and Snyder mines are busy, and prospecting is encouraging.

PITKIN COUNTY

This county showed an increase in silver, but a decrease in lead output in 1912. Several cars of zinc carbonate and sulphide concentrate were shipped from Aspen. Shipments of ore and concentrate from Creede showed a decrease for all metals except silver, which increased about 200,000 ounces.

TELLER COUNTY (CRIPPLE CREEK)

One of Cripple Creek's greatest utilities is the electric-power supply of the Arkansas Valley Railway, Light & Power Co., which was formed about a year ago and is controlled by Chicago people. Its combined plants furnish light and power in Pueblo, Canon City, and other towns about the Arkansas valley, and all the Cripple Creek district. About 15,000 hp. is available, generated by a water-power plant at Skagway, near Victor, and a steam plant at Pueblo and Canon City. There are about 100 electric hoists at Cripple Creek, and are much in favor among the smaller mines. All the mills are electrically driven, the Portland using 1400 hp., and Stratton's 1100 hp. The cost of power per ton treated varies from 5 to 10 cents. Two large electric pumps were recently installed at the 1600-ft. level of the Golden Cycle mine. Air is sold in the district for $2.50 per drill-shift for a 2¼-in. machine, while air from electrically-driven compressors will average $1 per shift.

The Vindicator Consolidated Gold Mining Co. will pay a dividend of 3c. per share, totaling $45,000, on January 25, making the amount paid to date $2,497,000, from a gross output of $10,000,000. The annual meeting is to be held shortly. Development of the north and south vein systems on the 1500 and 1600-ft. levels has been satisfactory. The company and lessees ship about 100 cars of ore per month. O. Shatz and Denver associates, leasing on the 1100-ft. level of the No. 1 shaft of the Vindicator, have opened 5 ft. of rich ore on No. 2 south vein. In the vein is a streak of nearly solid sylvanite.

The Kavanagh mill is treating 65 tons of ore per day worth $2 per ton, and a profit of $1000 per month is made. This plant cost about $25,000, the ore being crushed coarse and then leached with cyanide solution. The last pay-day at Cripple Creek meant a distribution of $315,000, and banks kept open for convenience of miners and others.

IDAHO

BEAR LAKE COUNTY

The phosphate industry of this state continues to increase slowly, with an output of 5000 tons from the Waterloo mine at Montpelier. Progress is retarded by high freight rates, litigation, and other troubles. A large supply of the rock is said to exist in the southeastern counties.

BONNER COUNTY

(Special Correspondence.)—Louis Duquette, a promoter and stockholder of the Idaho Gold & Radium Co. of Leonia, Idaho, states that work has been temporarily suspended on his properties on account of some litigation pending, but he expects to be able to resume development work in the spring. This is the company which created a sensation last spring by the discovery of pitchblende.

Leonia, January 12.

SHOSHONE COUNTY

The district court at Wallace, on January 18, gave a decision in favor of the Ontario Mining Co. in the case brought against it by the Stewart Mining Co., as mentioned in these columns last week. In his verdict the judge said, "there may be some little dispute about the apex of that vein, but there is no question in my mind as to its course, and there is no question in my mind as to the law of the case." F. A. Heinze's attorneys gave notice of appeal.

MONTANA

LINCOLN COUNTY

(Special Correspondence.)—It is rumored in Troy that the Banner & Bangle Mining Co., better known as the B. & B. company, has purchased the controlling interest in the Big Eight mine near Troy. The B. & B. mine is owned by the Greenoughs of Spokane, and has been worked steadily since spring. E. McCafferty, of Spokane, has been working the Big Eight under lease, and has had the lease extended for two years more.

Libby, January 12.

MADISON COUNTY

(Special Correspondence.)—The Montana-Illinois Copper Co. expects to have its property on South Boulder creek on a paying basis before long. The property has been recently equipped with a concentrating mill, which will be placed in operation next summer.

Virginia City, January 13.

SILVERBOW COUNTY

Preliminary estimates of the 1912 production of the East Butte mine show 14,765,170 lb. of copper, 361,060 oz. of silver, and 16,852 oz. of gold. By next March the mill should be treating 500 tons of ore per day. An increase of 80% in the furnace capacity has been decided on. The main shaft of the Butte & London is down 1130 ft., and is to be sunk to 1030 ft., and at 1600 ft. a cross-cut will be driven right across the property a distance of 2500 ft. The north cross-cut on the 2800-ft. level of the North Butte has cut the Snowball vein, showing 8 ft. of ore worth 8% of copper. Water is flowing fairly strong. On the 2400-ft. level this vein is nearly 50 ft. wide, 6 ft. of which is high grade.

At the Davis-Daly mine, during the past year, development has been actively carried on in all directions from the Colorado shaft in the eastern half of the ground, and in the western portion by cross-cutting from the West Gagnon workings of Anaconda. The Colorado shaft has been sunk to 2000-ft. depth. No. 12 vein gives the same good ore on the 2000-ft. level as that stoped above. From development on this level, 60 to 80 tons of ore per day has been produced. Lessees on the property have maintained a steady production.

The Tuolumne company is cross-cutting on the 2000-ft. level, and indications are favorable. On the 1600 and 1800-ft. levels development has not been encouraging. About 150 tons of ore containing 10% of copper is shipped daily to the Washoe smelter. During December the output was 2,763,570 lb. of copper, 131,146 oz. of silver, and 259 oz. of gold.

NEVADA

ESMERALDA COUNTY

The Goldfield Merger Mines Co. has shipped its first carload of high-grade ore to the local sampler of the Western Ore Purchasing Co. This ore came from the Velvet claim, and the drift on the 800-ft. level which is being driven from the Polverde mine of the Jumbo Extension Co. Preparations have been made at the Florence to complete sinking to 1270 ft., and cutting out a station at 1200 feet.

HUMBOLDT COUNTY

At a depth of 40 ft., the vein has been cut by an adit in the Weaver claims of George Wingfield at Rochester canyon. This proves a continuation of the rich vein from which J. Nenzel mined his ore in December. An ore-shoot has been uncovered on block 6 of the Crown Hills and traced for 100 ft., with a width of 16 to 30 in. Samples have given by assay 112, 139, 63, 110, and 5160 oz. of silver; and 0.10, 0.20, 0.10, 0.25, and 0.04 oz. of gold, respectively. Roch-

ester ore is similar to that of Tonopah in the proportions of silver to gold. Interest in the new district is unabated. Snow has interfered with operations. Ten mining companies have been incorporated.

The Utah, Nevada & Idaho Telephone Co. is arranging to construct a branch line from Oreana to Rochester canyon. The shaft at the Big Four is down 12 ft., of which 8 ft. is ore assaying up to $131 per ton. Over 1200 sacks of ore is ready for shipment. Work has begun on the adit of the Rochester Mines Co., and will be driven 750 ft., giving a depth of 430 ft. The Lincoln Hill Gold Mining Co. has been incorporated with a capital of $1,500,000. Water for the new field is procured from springs two miles distant, and is selling at $1 per barrel. A new road is to be constructed to Lovelock. A number of well known mining men have visited the district. Two lawsuits in connection with certain claims have already been started. At the Weaver group of claims, in which George Wingfield is interested, three adits are being driven to prospect the country.

Lyon County

All the mills and cyanide plants at Silver City have been closed, owing to the cold weather, and will remain shut down until spring.

Nye County

The mines at Tonopah treated 10,247 tons of ore, worth $215,280, during the week ended January 18. In December the Belmont mill treated 11,740 tons, yielding 318,730 oz. of bullion, the net profit being $172,450; Tonopah, 14,464

PART OF WESTERN NEVADA.

tons, yielding $229,250 from 235,960 oz. of bullion and 81 tons of concentrate, profit being $121,400; and the West End, 4350 tons, yielding a profit of $8.50 per ton, with 93.50% extraction.

The quarterly report of the Tonopah-Belmont Development Co. gives the following particulars:

Bullion production	$1,177,972
Expenditure	653,889
Net earnings	$ 524,083
Available resources November 30, 1912:	
Due from smelters	$ 337,262
Due from others	4,408
Loans on collateral	250,000
Cash in banks	471,617
Total	$ 1,063,287

On the 350-ft. level of the Earl mine, 12 ft. of ore worth $20 per ton has been opened in the east drift at 120 ft. from the shaft, and 6 ft. of $35 ore was cut in a raise being driven 70 ft. from the shaft. Sinking is to be resumed at the White Caps mine from 235 to 300 ft. At the Manhattan Mustang, lessees have cut, in the main shaft, a 15-in. vein in which is a streak of leaf gold about ½ in. thick. Specimens from this are of rare beauty and the best seen in the district.

White Pine County

Notwithstanding the cold weather of late, the Giroux company is producing over 1000 tons of ore per day. There have been no new developments recently.

A report of S. H. Williams, general manager for the Smokey Development Co. at Ely, states that work was started on June 18, 1912, to cut the ore found in No. 3 drill-hole, to cross-cut the porphyry area a width of 1350 ft., and to open at depth the contact of porphyry and limestone. No. 3 drill-hole was reached on October 7, but water has interfered with sinking for the copper ore. The adit is in 475 ft., and at 290 ft. sulphide ore was cut. From 290 to 319 ft. the ore is hard and forms the usual casing for porphyry. From 351 to 392 ft. ore averaged from 0.6 to 2.7% of copper. The dump contains 1100 tons of ore assaying 1.5% copper, and 60c. in gold and silver.

NEW MEXICO

Grant County

During December the Chino mill treated approximately 5000 tons of ore per day, and the production of copper was 3,545,100 lb., a decrease of 500,000 lb. in November.

Socorro County

The Ernestine mine is the largest gold-producer in this state, and has paid dividends for several years. E. A. Wayne recently returned to Mogollon from New York, where a new company was formed to take over the Ernestine and Maud mining companies. The Maud mine will be further developed and the mill of the Ernestine enlarged. Mr. Wayne will be general manager for the new company, with headquarters at Mogollon.

OREGON

Baker County

The Black Butte mine, near Fox valley, has suspended operations for a while. Considerable work was done during the past six months. The financial condition of the company is unsatisfactory, and $6000 is necessary to cover outstanding debts. A roller mill and four stamps are ready for erection. Three shifts of five men each are employed at the sampler of the Oregon-Idaho Investment Co. The Powder River Dev. Co. dredge, at Sumpter, was floated and commenced work on January 7. It has a capacity of 8000 cu. yd. per day, power being supplied by the Eastern Oregon Light & Power Company.

UTAH

Salt Lake County

At Alta, the three-story boarding-house of 200-men capacity, of the Columbus Consolidated and Columbus Extension Mining companies, was destroyed by fire. The loss was $25,000, and insurance covers $10,000.

Summit County

During the week ended January 11, shipments of ore from Park City were 1520 tons; and during the past year, 92,648 tons of ore and concentrate, of which the Silver King Coalition contributed 32,726, Daly West 27,481, Daly-Judge 24,316, Grasselli Chemical Co. 3694, and Ontario 1518 tons.

Weber County

Ogden has two companies which manufacture cement. The mills employ 350 men with a monthly payroll of $15,000, and during 1912 produced about 775,000 bbl., of which 600,000 was produced by the Union Portland Cement Co. and 175,000 by the Ogden Portland Cement Company.

WASHINGTON

Ferry County

A movement is on foot to form a large company to control the principal mines of the Republic district, erect a

large concentrating plant, and supply mines and mills with electric power. The Washington Water Power Co. is said to be behind the scheme, and also it is reported that the West Kootenai Power & Light Co. wishes to compete for power-supply, as it is already erecting a transmission-line from Grand Forks to Republic.

Over 1300 shareholders in the Washington Water Power Co. have received a dividend of 2% on January 2, which totaled $280,000, making a total of $1,120,000 paid in 1912. The outstanding stock of the company is $14,067,900. The International Power & Manufacturing Co. was planning to build a series of power-plants in the Pend d'Oreille river, situated partly in the Kanishu National Forest and partly in a power-site reserve, which would produce 200,000 hp., and the United States Government has held up extensive land patents of the company on the ground that the company was trying to "free itself from all control by the Government by securing patents to lands under the guise of mining claims, or by railroad scrip filings, in combination with a special dam license." The Secretary of the Interior refers to the case as "an example of the methods used to defeat Federal ownership."

CANADA

British Columbia

The British Columbia Copper Co. paid a dividend amounting to $88,756 on January 15, making $355,024 for the past year, and $704,155 to date. A conference between the directors and superintendents and E. F. Voigt has been held in New York in connection with the Voigt mines, which the company has been operating under an option for several months. On December 31 the Hedley Gold Mining Co. paid the usual dividend of 3%, and an extra one of 12%, making $360,000 for the year.

The Consolidated Mining & Smelting Co. has acquired a three-quarter interest in the Silver King, Dandy, and Ollie claims, situated on Toad mountain, four miles south of Nelson. The first-named property has produced ore worth over $5,000,000. Diamond-drilling has shown ore to a depth of 1130 ft., carrying 0.02 oz. of gold, 8.3 oz. of silver, and 2% of copper. The mine is ready for ore production and is supplied with electric power. The Dandy vein is an extension of the Silver King and averages 4½ ft. in width. It has been opened by open-cuts and adits, and ore will be sent to the Trail smelter.

Ontario

Kerr lake is about 50 ft. deep and covers an area of 40 acres. The various companies owning land under the lake, namely, the Crown Reserve, Kerr Lake, and Drummond, which own 23, 11, and 6 acres, respectively, have come to an agreement, and have applied to the Mining Commissioner for permission to pump out the lake. Pumps will be put on a raft on the lake and the water will eventually flow into the Montreal river. The Carson vein of the Crown Reserve mine has produced 8,253,279 oz. of silver, and by draining the lake about 2,781,000 oz. will be recovered, and the Drummond company will be able to prospect its ground better. The case will be heard early in February. The lake had to be lowered 8 ft. before the Crown Reserve could begin operations.

On January 14, 121 bars of silver bullion were shipped from Cobalt, most of which is for England. The shipments were as follows:

Mine.	Ounces.	Value.
Buffalo	54,712	$35,000
Nipissing	63,641	39,777
Townsite	2,770	1,750
Casey-Cobalt	2,394	1,520
Total	123,517	$78,056

During the year ended October 31, 1912, the Coniagas Mines, Ltd., produced 3,508,377 oz. of silver from 53,627 tons of ore, at a cost of 8.51c. per ounce, the average price received being 59.39c. Dividends amounted to $1,448,000, making a total to date of $4,280,000. Development of new orebodies has exceeded shipments by 1,400,000 oz., the reserves now being estimated at 13,953,000 oz. of silver.

Without an explosion occurring, the entire plant of the Dinitrolite Explosives Co. was destroyed by fire in the last week of December 1912. The fire was caused by an incandescent globe exploding above the cartridge filler and igniting the powder. The loss will be over $10,000.

P. A. Robbins, general manager for the Hollinger Gold Mines Co., states that during the five months that the mine was working last year, the revenue amounted to $860,000. The profit from October 27 to November 30 was $94,613. During the strike the mill averaged 226 tons of ore per day. On January 28 another 3% dividend will be paid, making $36,000 to date.

MEXICO

Chihuahua

The annual report of the Batopilas Mining Co. for 1911 states that during the year 515,824 oz. of silver was shipped, realizing an average of 54.29c. per ounce. Accounts show a deficit of $17,409, while that for 1910 was $106,258. Assets are stated as $137,059, and liabilities $97,037. The first six months of 1912 gave a profit of $25,000.

The mining town of Cusihuiriachic was shaken by an earth tremor recently. At Parral, the mill of the Alvarado Mining & Milling Co. has been increased to 400-tons capacity. The company is working the Presena, Las Cruces, and

PALMILLA CYANIDE PLANT, PARRAL DISTRICT.

Palmilla mines. J. I. Long is general manager. The San Patricio mine at Naica has resumed work after several months' idleness, also the Ramon Corona. At both mines a total of 80 men are employed.

It is reported that the Venture Corporation, of London, has secured control of the Naica company's property in the Naica district, for $6,000,000. The Venture company has had an option for some time on this mine, which is one of the richest in the district.

Jalisco

The volcano of Colima broke into violent eruption on January 20. Little lava has been ejected from the crater, which, however, emitted vast quantities of smoke and sand, while deadly gases formed an unusual feature of the eruption. The last eruption occurred in 1903, and recently the people of the city of Guadalajara were warned that there was likely to be trouble. Inhabitants are fleeing from the vicinity, and railroads have been covered several feet with sand.

Sonora

The Moctezuma-Arizpe Mining Co. has sent to its property, 18 miles northeast of Cananea, four Wilfley tables and four Callow tanks, which will bring the capacity of the mill up to 100 tons per day. The company is also shipping ore to smelters regularly. The Arizona-Sonora Mines Co. is to erect a 50-stamp mill on its Juan Cabral property, near Magdalena. La Flora company, operating the Nopalera mine, near the San Miguel river, will also erect a mill.

Zacatecas

The Mezquital Mining Co., which has taken over the Mezquital de Oro properties in this state, is to start milling operations, the 50-stamp mill and cyanide plant having been overhauled and improved. About 200 tons per day will be treated for a while. M. F. Slattery is in charge of the properties.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

RALPH ARNOLD is here.

ROBERT MCSHANE is visiting Arkansas.

SUMNER S. SMITH is in San Francisco.

JUAN FELIX BRANDES is in San Francisco.

N. B. KNOX is returning to London from Peru.

R. T. SILL is in Sonora, Mexico, upon professional work.

C. R. CORNING is expected back from France during the week.

ALBERT BURCH has returned from spending the holidays in Berlin.

C. F. RAND has gone to Cuba but will return early in February.

F. LYNWOOD GARRISON will leave for Colombia the first of February.

J. W. MATHER has gone to New York and from there will go to Ecuador.

D'ARCY WEATHERBE was expected in London from Peru early in January.

JOHN P. CHADWICK is now with the Braden Copper Co., at Rancagua, Chile.

JAMES S. WRATH is now with the Chile Exploration Co. at Autafogasta, Chile.

ALF WELHAVEN is returning to San Francisco by way of London and New York.

BERTRAM HUNT is metallurgist at the Broomassie mine, Tarkwa, Gold Coast Colony.

J. A. L. HENDERSON has returned to London from Canada, expecting to remain about three months.

F. H. PROBERT is engaged upon professional work in the Montezuma district of Sonora, and will visit Arizona before returning to Los Angeles at the end of this month.

GEORGE E. FARISH is representing the John McMartin and allied interests in British Columbia, and is also general manager of the Mother Lode mine at Sheep Creek. He will make his headquarters at Nelson, B. C.

FREDERICK BURRIDGE, formerly manager of the Bunker Hill & Sullivan mine and later superintendent and manager for the Federal Mining Co., has been elected president of the Nipsic Mining Co. and will take charge of operations.

The following committees of the CALIFORNIA MINERS' ASSOCIATION have been appointed by the president, W. C. RALSTON. Committee on Legislation, E. C. VOORHIES, chairman, H. FOSTER BAIN, WAKEFIELD BAKER, C. M. BELSHAW, E. B. BRADEN, F. W. BRADLEY, NEWTON CLEAVELAND, C. H. DUNTON, E. C. HUTCHINSON, H. T. POWER, J. R. TYRRELL, F. R. WEHE. Executive Committee, B. M. NEWCOMB, chairman, E. H. BENJAMIN, C. M. BELSHAW, S. B. CHRISTY, NEWTON CLEAVELAND, LOUIS ROSENFELD, E. C. VOORHEIS. Committee on California Debris Commission, W. W. WAGGONER, Chairman, R. L. DUNN, W. F. ENGLERRIGHT, H. T. POWER, A. A. TREDGIDOE.

Obituary

GEORGE AUGUSTUS KOENIG died in Phialdelphia recently, at the age of 68. Born at Willstaett, Germany, in 1844, he was educated at Karlsruhe, Berlin, Heidelberg, and Freiberg, and came to this country in 1869, as chemist for the Tacony Chemical Works. Later he became a member of the staff of the chemical department of the University of Pennsylvania, and in 1874 began the development of a department of mining and metallurgy, much as Thomas Egleston at Columbia, and G. J. Brush at Yale had earlier done. In 1892 he became professor of chemistry at the Michigan College of Mines, being the senior member of that institution at the time of his death.

Market Reports

LOCAL METAL PRICES

San Francisco, January 23.

Antimony	12—12½c	Quicksilver (flask)	39
Electrolytic Copper	18—18¼c	Tin	53¼—54c
Pig Lead	4 60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, January 23.—Copper prices are firm. Offers have been very generally absorbed and consumers are disposed to take hold. Lead is quiet and spelter weak. Average daily prices for the past week, in cents per pound, based on wholesale transactions. standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter.	Silver, per oz.
Jan. 9	17.20	4.33	7.03	63⅛
" 10	17 05	4 33	7.03	63⅛
" 11	16 95	4.33	7.03	63⅛
" 12	Sunday.	No market.		
" 13	16.60	4.31	7.07	63⅛
" 14	16.60	4.31	7.07	63⅛
" 15	16 30	4.31	7.07	63⅛
" 16	16.25	4.31	6.90	63⅛
" 17	16.25	4.31	6.90	63
" 18	16 05	4.31	6.85	63
" 19	Sunday.	No market.		
" 20	15.70	4 31	6.85	63⅛
" 21	15.85	4.31	6.80	63
" 22	16 05	4.31	6.80	62⅞

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	January 23.
Camp Bird Ltd	$ 5½
El Oro	4½
Esperanza	9
Oroville Dredging	1⅛
Santa Gertrudis	6½
Tomboy	6⅞

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. January 23.		Closing Prices. January 23.
Adventure	$ 4⅛	Mohawk	$ 54
Allouez	29⅛	North Butte	31
Calumet & Arizona	67	Old Dominion	48½
Calumet & Hecla	495	Osceola	96½
Centennial	16⅛	Quincy	73
Copper Range	48⅛	Shannon	12½
East Butte	13⅜	Superior & Boston	2⅛
Franklin	7⅛	Tamarack	32
Granby	69⅛	U. S. Smelting	41⅛
Greene Cananea, ctf	8⅛	Utah Con	10¼
Isle-Royale	28⅛	Victoria	1⅛
La Salle	4⅛	Winona	3
Mass Copper	4⅛	Wolverine	67½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 23.

Atlanta	$ .17	Montana-Tonopah	$1.75
Belmont	8.00	Nevada Hills	1.47
Big Four	.81	North Star	.20
Buckhorn	.90	Ophir	.20
Con. Virginia	.11	Pittsburg Silver Peak	.60
Crown Point	.20	Round Mountain	.25
Florence	.40	Sierra Nevada	.09
Goldfield Con	2.05	Tonopah Extension	2.00
Halifax	1.35	Tonopah Merger	.87
Jim Butler	.69	Tonopah of Nevada	6.00
Jumbo Extension	.32	Union	.15
MacNamara	.22	Vernal	.11
Mexican	.82	West End	1.32
Midway	.33	Yellow Jacket	.18

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. January 23.		Closing Prices. January 23.
Alaska Mexican	$13⅜	McKinley-Darragh	$ 2
Alaska Treadwell	42⅜	Miami Copper	25
Alaska United	23	Mines Co. of America	3¼
Amalgamated Copper	74⅛	Nevada Con	18⅛
A. S. & R. Co	73	Nipissing	8¼
Braden Copper	9⅛	Ohio Copper	1
B. C. Copper Co	4⅜	Ray Con	19⅜
Chino	14	Tenn. Copper	35
First National	2⅜	Tonopah Belmont	8
Giroux	3⅜	Tonopah Ex	1⅜
Goldfield Con	2	Tonopah Mining	5⅛
Greene-Cananea	8⅜	Trinity	5
Hollinger	15⅛	Tuolumne Copper	3⅛
Inspiration	17	Utah Copper	56⅛
Kerr Lake	3	West End	1⅛
La Rose	2⅜	Yukon Gold	3
Mason Valley	8⅛		

World's Production and Consumption of Copper and Lead

L. Vogelstein & Co. present the following preliminary estimate of the world's production and consumption of copper in 1912 and comparisons with previous years.

PRODUCTION (TONS OF 2240 LB. EACH)

	1912.*	1911.	1910.	1909.
Germany	32,000	30,500	28,800	23,500
Austria-Hungary	3,000	2,539	2,250	1,750
Italy	3,000	3,000	3,000	3,200
Russia	29,000	25,500	22,300	18,450
Sweden and Norway	10,000	9,500	7,000	12,500
Spain and Potugal	58,000	55,000	53,000	53,000
United States	558,000	487,300	482,200	487,020
Mexico	72,000	54,050	58,800	56,250
Canada	33,000	24,000	22,500	21,420
Chile	37,000	29,600	35,800	35,800
Peru	27,000	26,000	26,000	19,000
Bolivia	5,000	2,500	2,500	2,600
Cape Colony	7,000	7,000	7,000	7,000
Australia	47,000	44,600	43,400	38,350
Japan	58,000	55,000	50,000	45,000
Other countries	25,000	13,300	12,600	10,100
	1,004,000	869,370	857,150	834,940

CONSUMPTION (TONS OF 2240 LB. EACH)

	1912.*	1911.	1910.	1909.
Germany	250,000	234,985	208,826	194,449
France	106,000	106,408	92,838	85,688
England	152,000	159,736	148,187	110,648
Austria-Hungary	40,000	41,101	37,150	34,605
Russia	35,000	31,830	28,237	21,705
Italy	42,000	40,949	32,487	25,189
Other Europe	25,000	25,000	26,000	22,200
Far East	30,000	26,500	22,000	17,000
United States	365,000	316,791	334,565	314,755
	1,045,000	983,300	930,290	826,239

*Estimated.

Consumption of copper includes old metal in all countries except the United States, and the figures have only a relative value.

Stocks of copper in England, France, Hamburg, and Rotterdam, as per foreign statistics, were:

	Tons.	Decrease, tons.
December 31, 1910	94,800	.....
December 31, 1911	60,750	34,050
December 31, 1912	35,041	25,702

Price fluctuations have been as follows:

	Standard spot (London), £	s.	d.	Electrolytic (New York), cents.
Opening	63	8	9	14.05
Highest	79	15	0	17.5875
Lowest	60	16	3	13.80
Closing	76	12	6	17.45
Average	72	18	9	16.341
Average, 1911	57	1	1	12.376

The following table of lead production and consumption is compiled from figures of the U. S. Geological Survey.

Production from domestic ore:	1912.	1911.	1910.	1909.
Desilverized	229,765	201,223	192,583	194,033
Soft lead	169,551	191,619	169,244	151,222
Total	399,316	392,842	361,827	345,255
Production from foreign and base bullion	81,649	94,134	108,553	102,857
Total U. S. smelter prod.	480,965	486,976	470,380	448,112
Consumption (est.)	401,088	399,472	376,021	370,013

In submitting these figures, however, L. Vogelstein & Co. call attention to the fact that so far as consumption is concerned, no importance should be attached to the estimate of 401,088 tons, an increase of but ¼ of 1% over 1911. An examination of the pig iron, copper, spelter, and tin figures shows that the consumption of pig iron increased 26%; copper, 16%; spelter, 21%, and tin, 12%, or an average increase of 19%. It is probable that the consumption of lead increased at least 15%, and amounted to fully 460,000 tons. The production from domestic sources being approximately 400,00 tons, the difference has been drawn from stocks, and the quantity on hand is now the smallest since 1906-7. There are the best of reasons for stating that stocks at the present time constitute no more than a working balance with the exception of small quantities held in Missouri. Motives of enlightened self-interest as well as sound public policy should dictate to the lead smelters the wisdom of again reporting stocks.

Company Reports

MT. LYELL MINING & RAILWAY CO., LTD.

This well known company has had an unfortunate time of late with a fire, and a fall of rock which killed over 40 men. The half-yearly report, submitted to the shareholders on December 13, 1912, states that the output of ore from the Mt. Lyell and North Mt. Lyell mines amounted to 155,160 tons, of which the former produced 74,724 tons from underground, and 21,523 tons from the open-cut. The ore reserves in this property total 2,361,182 tons, containing 0.532% copper, 1.96 oz. of silver, and 0.027 oz. of gold per ton. Very little development was required during the period under review. The North mine produced 58,913 tons. The principal development undertaken consisted of diamond-drilling. At the 850 and 1000-ft. levels, bore-holes have proved the continuation of the North Lyell orebodies into the recently purchased Comstock property. A vertical bore from the 1100-ft. level proved the downward continuation of the orebody. Ore reserves are estimated at 1,083,752 tons, carrying 6% of copper, 1.33 oz. of silver, and 0.005 oz. of gold per ton. From the Chester mine 6748 tons of pyrite was extracted for acid-making at the Yarraville, Victoria, and Port Adelaide, South Australia, chemical works. The Mt. Lyell Comstock Copper Co.'s property has been purchased outright at a cost of $90,000. The North mine's orebodies dip toward the Comstock leases, and it is thought that another lode may become of considerable value to the parent company. Development in all the mines covered 1455 ft., including 707 ft. of drilling. At the smelting plant an average of 2½ blast-furnaces were continuously in operation, and treated 157,296 tons of dry ore averaging 1.62% copper, 0.27 oz. of silver, and a trace of gold per ton producing 3124 tons of copper, 213,285 oz. of silver, and 4316 oz. of gold. The cost of producing blister copper was $4.80 per ton. Since August 1903, 3,458,645 tons of ore and fluxes have been smelted, yielding 72,275 tons of copper, 5,991,072 oz. of silver, and 154,538 oz. of gold; while, with the former Mt. Lyell company, the total is swelled to 120,852 tons of copper, 10,112,473 oz. of silver, and 310,290 oz. of gold. Good progress is being made with the preliminary work in connection with the Lake Margaret hydro-electric power scheme. The chemical and superphosphate works at Yarraville, Port Adelaide, and Fremantle maintained a full output of high-grade fertilizers. At Mt. Lyell the rainfall on 118 days was 61 inches. During the half-year 2128 tons of copper was sold, at an average price of £81 2s. 11d. per ton. Total revenue from blister copper, chemical products, and the railroad was $1,620,000, and net profits, after writing off development and depreciation, were $520,000, out of which $360,000 was paid in dividends, making a total of $8,496,000 from this company, and $13,278,800 including the old Mt. Lyell company. Assets total $3,300,000, including $960,000 in blister copper and $1,000,000 in stocks, while liabilities total $570,000. This interesting report is accompanied by a plan of the North Lyell mine.

Recent Publications

Mine Fires and How to Fight Them. By J. W. Paul. 14 pp. Miner's Circular No. 10, U. S. Bureau of Mines. Washington, 1912.

The Mineral Resources of the Philippine Islands in 1911. By Warren D. Smith. 99 pp.; ill.; map. Bureau of Science. Manila, 1912.

Tungsten Mining in Nova Scotia. By V. G. Hills. Reprint from 'Proceedings of the Colorado Scientific Society.' 8 pp.; ill. Denver, 1912.

Mineral Production of Oklahoma from 1901 to 1911. By D. W. Ohern. 47 pp.; chart. Bulletin No. 15, Oklahoma State Geol. Survey. Norman, 1912.

Thirteenth Census of the United States, 1910. Agriculture Statistics. Department of Commerce and Labor Bulletin. 16 pp. Washington, 1912.

General Summary of the Mineral Production of Canada in 1911. By J. McLeish. 38 pp. Department of Mines Publication, No. 183. Ottawa, 1912.

Bibliography of North American Geology for 1911. With subject index. By J. M. Nickles. 162 pp. Bulletin 524, U. S. Geol. Survey. Washington, 1912.

The Gros Ventre Slide, an Active Earth-Flow. By Eliot Blackwelder. P. 8., ill. Reprint from Bulletin of the Geological Society of America, October 1912.

Production of Gold and Silver in 1911. By H. D. McCaskey. Advance chapter from 'Mineral Resources of the United States, 1911.' U. S. Geol. Survey Bulletin. 48 pp. Washington, 1912.

Proceedings of the Lake Superior Mining Institute at the Seventeenth Annual Meeting at Houghton, August 28-30, 1912. 294 pp.; maps, plans, table. Ishpeming, Michigan, 1912.

The Stone Industry in 1911. By Ernest F. Burchard. Advance chapter from 'Mineral Resources of the United States, 1911.' P. 96, maps. U. S. Geol. Survey, Washington, 1912.

Second Annual Report of the Director of the Bureau of Mines, to the Secretary of the Interior, for the Year Ended June 30, 1912. J. A. Holmes, Director. P. 88. Washington, 1912.

Report of the Fisheries Convention Held at New Bern, North Carolina, December 13, 1911. By Joseph Hyde Pratt. Economic Paper No. 29. P. 302. North Carolina Geol. & Econ. Surv., Raleigh, 1912.

Surface Water Supply of the United States, 1910. Part I. North Atlantic Coast. By C. C. Babb, C. C. Covert, and R. H. Bolster. 305 pp.; ill., index. Water-Supply Paper 281, U. S. G. S. Washington, 1912.

Summary of the Mineral Production of the United States in 1911. By W. T. Thom. Advance chapter from 'Mineral Resources of the United States, 1911.' P. 24, chart. U. S. Geol. Survey, Washington, 1912.

Tapir Remains from Late Cenozoic Beds of the Pacific Coast Region. By John C. Merriam. Bulletin of the Department of Geology, Vol. 7, No. 9. P. 169-175. University of California Publications, Berkeley, 1912.

Summary of the Mineral Production of the United States in 1911. By W. T. Thom. 24 pp. Advance chapter from 'Mineral Resources of the United States, 1911.' U. S. Geol. Survey Bulletin. Washington, 1912.

An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries. By L. P. Breckenridge and G. A. Goodenough. 117 pp.; index. Bulletin, University of Illinois. Urbana, November 1912.

Proceedings of the Annual Convention of the North Carolina Good Roads Association. By Joseph Hyde Pratt and Miss H. M. Berry. Economic Paper No. 30. P. 110. North Carolina Geological & Economic Survey, Raleigh, 1912.

Index to the Stratigraphy of North America. Accompanied by a geologic map of North America. By B. Willis. 894 pp.; tables, maps, index. Compiled in coöperation with the Geol. Surveys of Canada and Mexico, under the supervision of B. Willis and G. W. Stose. Professional Paper 71, U. S. G. S. Washington, 1912.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the Mining and Scientific Press.

Hazell's Annual for 1913. By Hammond Hall. 592 pp., index. Hazell, Watson & Viney, London, 1913. For sale by the *Mining and Scientific Press*. Price $1.50.

Hazell's is one of the best of European annuals, and it is to be regretted that no similar volume covers the American field. Though it appears before the end of the year, it covers the whole field up to the end of November, and to American readers is of especial service in presenting in concise form an impartial review of European progress for the year, as well as serving as a general reference volume.

Explosives. By H. Brunswig. Translated and annotated by L. E. Monroe and A. L. Kibler. 350 pp., ill. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price $3 net.

This is an admirably condensed, non-mathematical, critical résumé of present knowledge of the theory of explosives, and is unusual in that the author not only states that all the material has been compiled from easily available literature, but intimates that considerations of private employment have induced him to refrain from critical remarks where a contradiction exists between the literature and his own knowledge of the facts. Books in which there is little that is new are common, but one in which the author maintains there is nothing original is decidedly unusual. Possibly this is why he has been able to expound, summarize, and condense with unusual skill. The advance of physical chemistry has been so rapid that few have been able to keep conversant with the fundamental changes it has made in the concepts of technology. All those who have to do with the use or manufacture of explosives will be correspondingly grateful to Dr. Brunswig for gathering together the facts in regard to explosives and arranging them in accord with modern physical chemical views in so lucid a manner. The translator likewise deserves gratitude for rendering it into the vernacular, for it is but seldom that the work of a master of an art is translated by another of equal rank.

Refractories and Furnaces. By F. T. Havard. 335 pp., ill. The McGraw-Hill Book Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $4 net.

This is the day of treatise upon special topics, and the library of a well read engineer grows rapidly, since he must now purchase, and read if he finds time, numerous treatises on all the allied phases of his field of work, instead of relying upon a few general books covering the whole field. This volume complements and supplements Damour's 'Industrial Furnaces,' translated by A. L. Queneau a few years ago, as it deals with practice, while Damour's treatise is chiefly theoretical. Mr. Havard is now associate professor of metallurgy at the University of Wisconsin, after having won his spurs in the practice of the metallurgical profession, and writes, therefore, from a comprehensive knowledge of the art. He has gone into the subject with commendable thoroughness, from the preparation of refractory materials to the construction of furnaces and the testing of refractories. The appearance of the book is somewhat marred by the use of threadbare illustrations, and the diagram of a long-hand roaster, on p. 167, is in a fair way to become as much a classic as the engravings from Agricola, without which the historical chapter of any recent book on mining topics would be as bare as a front parlor without Countess Potocka and Baby Stuart upon its walls. Nearly every engineer and all metallurgists have to deal with refractory materials, in one way or another, and will find much of interest and value in this book.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

VENTILATION at the Robinson Deep mine has been improved by installing a fan on the 1900-ft. level. It is of the Sirocco type, 84-in. diam. and has a capacity of 178,400 cu. ft. of air per minute, at 4000 ft. above sea-level.

NEITHER an extremely dictatorial nor a lax management results in efficient operation in any mine, and harmonious relations between heads of departments are impossible under either of these two conditions.

PRICES of merchandise from foreign countries, imported into the United States, show a continued advance, and in October 1912, out of 75 articles listed, 45 showed higher prices than in the corresponding month of 1911.

TO CALCULATE water-power quickly: $\frac{\text{sec-ft.} \times \text{fall in feet}}{11}$ = net horse-power on water-wheel realizing 80% of theoretical power.

FEED-WATER HEATERS and economizers serve the same purpose, but it is not desirable to install both. A saving of over 10% of coal has been shown by using the latter; but when the draught is already poor, the economizer is inadmissible.

DIAMOND-DRILL RECORDS have shown that time efficiency in drilling varies from 60 to 76%. If too great a pressure is applied to the 'bit' in the effort to accomplish faster work, the probability of deflection in the hole and consumption of carbons are much increased.

STAMP duty at the Nickel Plate mill, British Columbia, was increased during 1912 by the use of warmed water, instead of icy-cold water from the penstock; a magnet was fixed over conveyors to pick out pieces of steel from the ore; and the use of coarser screens.

BUCKET ELEVATORS, for lifting 350 tons of crushed ore per day from a jaw-crusher to the mill-bin, of the Yuanmi mine, in Western Australia, is 18 in. wide, of 8-ply canvas, rubber-faced. The buckets are 16 in. wide, spaced 12 in. centres, and the speed of the belt is 190 ft. per minute.

AUXILIARIES in a power-plant generating 500 kw. absorbed 12.9% of the power, as follows: accumulator pump, 1.25%; dry-air pump, 1.75%; boiler-feed pump, 3.4%; and circulating pump, 6.5%; while in a 5000-kw. turbine plant they absorbed from 3.4 to 2.1% of the power, according to load.

IRON-ORE SUPPLY of southern Sweden has been estimated at 157,553,000 tons, divided into three groups according to the amount of phosphorus present. The total amount of iron ore mined in all Sweden from 1301 to 1910 is estimated at 122,554,593 tons, and pig iron production 37,871,623 tons.

MERCURY may be purified by streaming small quantities through $HNO_3 + HgNO_3$. Larger quantities may be treated by passing air through, and afterward shaking up with powdered charcoal, which has been allowed to absorb oxygen. The charcoal will rise to the surface, carrying a scum of oxid s with it.

PUMPS used for filling clean-up presses should be run direct by a small variable-speed engine, preferably driven by compressed air. A fairly heavy fly-wheel is essential on the crank-shaft of the pump, so that the slowest speed may be maintained for 'hardening-up' without an unnecessarily high pressure resulting.

SAMPLING ground may be done after a little practice with any good air-hammer, weighing about 10 lb. A rose bit may be used, the rock cut away varying in size from lumps to dust. The hammer strikes from 1500 to 2000 blows per minute, is easily regulated by a trigger, and by holding the drill well up against the face, chips do not fly as when a hammer and moil are used. In ten minutes a clean cut 2 in. wide, ½ in. deep, and 2 in. long can be made.

PRELIMINARY load of balls in a ball-mill, as regards size, is often arranged to correspond, as nearly as possible, with the normal load under working conditions. This corresponds to about 45% by weight of large balls, each about 18 lb.; 20% of medium sized balls, each about 9 lb.; and 35% of small balls, each about 5 lb. Tests at several Kalgoorlie mills have proved that this is not absolutely necessary, there being little difference in starting a mill this way or with large balls. It has been suggested that the preliminary load of a tube-mill should be similarly arranged. In any case the fracture and abrasion of the poorer portions of the load would soon supply the mill with the normal quantity of smaller pebbles.

COPPER smelting in the electric furnace has been tried by the manager of the Ugine smelting works. He used as reducing agents charcoal, coke, and anthracite, all of which proved suitable; limestone served as flux. The electrodes consisted of carbon and soft steel poles and water-cooled copper poles were employed. The ores contained from 10 to 20% oxide of copper, 30% SiO_2, 10% Al_2O_3, from 3 to 5% oxide of cobalt, and from 7 to 32% moisture. The product obtained was never anything better than black copper, spoiled by the presence of considerable quantities of cobalt, iron, and silicon. From 1000 to 1200 kw. current and 8 kg. of electrodes were consumed per ton of ore, and the consumption of the reducing agents averaged 25% of the copper content of the charge. As a result of these experiments, it may be concluded that for producing copper the electric furnace is not by any means an unqualified success.

LITTLE information in regard to the extraction of lithium from its ores in the United States is available. Numerous electrolytic methods are known. A process has also been proposed by Hugo Muller and is outlined in Roscoe and Schorlemmer's 'Treatise of Chemistry.' It consists of dissolving the mineral acid with a ferric salt. The solution is evaporated and the chloride of lithium removed by dissolving in water. Manganese can be removed from the solution by treatment with barium sulphide and the excess of barium removed with sulphuric acid. The lithium is finally evaporated with oxalic acid and ignited to convert to the carbonate. Another method employed in a Paris refinery is by using acid sodium sulphate, pulverising the acid sulphate and the ore, then mixing them in exactly determined proportions, gradually heating this mixture to redness, lixiviating the roasted mass to obtain a solution of lithium sulphate, and after purification, precipitating the lithium as the carbonate (Li_2CO_3) by the addition of sodium carbonate.

GOLD LEAF industry of Russia is centred at Moscow, where there are five large establishments and a number of smaller ones producing about $500,000 per annum. There are employed 600 men, 300 boys, and 100 women, whose wages range from $20 to $25, $5 to $10, and $8 to $10 per month respectively. In the United States there are over 80 establishments producing gold and silver leaf and foil, employing over 1500 persons who average $460 per year in wages. In Russia the gold and apparatus comes from Germany, while molds and skins for the United States come from England, the output of the United States factories being worth about $2,630,000. Gold-beater's skin is a delicate membrane prepared from the large intestine of the ox, and may be beaten continuously for several months with a 12-lb. hammer without much injury. Gold is first cast into oblong ingots ¾ in. wide, weighing 2 oz., and then rolled into a ribbon 1/800 in. thick, cut into pieces 1 in. square, placed between leaves of vellum and beaten with a 16-lb. hammer until the final leaf is 1/200,000 in. thick. Nearly all the product is made by hand.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

GRANT OF MINERAL RIGHTS—USE OF SURFACE

The grantee of coal under land, with general mining rights and the free right to use the surface so far as necessary for mining, may dump the waste or refuse of the mine at its entrance, and use as much of the surface for that purpose as is strictly necessary and reasonable, without liability to the grantor in damages for such use.

Dewey *v.* Great Lakes Coal Co., (Pennsylvania) 84 Atlantic 913. May 13, 1912.

RESUMPTION OF ASSESSMENT WORK PREVENTS FORFEITURE

Two locators, having failed to do their assessment work for two years on certain mining claims, at the beginning of the third year made an attempted re-location of the same claims, adopting the same corners, boundaries, and discovery work, and thereafter proceeded with diligence and large expenditures of money to develop the property. Subsequent to the attempted re-location and while the re-locators were at work, third parties attempted to locate the ground, claiming that the original locations were forfeited for non-performance of assessment work and that the attempted re-location was void because the requirements of Arizona law as to discovery work on re-located claims had not been complied with. It was held that regardless of the invalidity of the re-location, assessment work had been resumed under the original locations before the rights of third parties had attached and that hence no forfeiture under these locations had taken place.

Peachy *v.* Gaddis (Arizona), 127 Pacific, 739. September 28, 1912.

LIEN DOES NOT ATTACH TO OIL WELL PRODUCT

Under Kansas and Oklahoma statutes giving laborers liens upon oil wells and appliances, buildings, and appurtenances for operating them, and upon the leasehold right thereto, no lien attaches to the product of the well, after it has been separated therefrom.

Black *v.* Giarth (Kansas), 128 Pacific, 183. December 7, 1912.

OIL LOCATIONS MADE PRIOR TO MARCH 2, 1911

The Secretary of the Interior has instructed the registers and receivers that the chiefs of field division should make such field examinations as are advisable and necessary, particularly of lands embraced in a withdrawal, with a view to determining the time when development work was begun and the extent and character thereof and the continuousness and diligence exhibited in prosecuting the same. The Act of March 2, 1911, being retrospective only in its operation, upon receiving an application for patent of lands located prior to its passage, the local officers should communicate at once with the proper chief of field division with a view to ascertaining the foregoing facts. Reports of the results of the examination made by the chief of field division will be submitted to the Commissioner of the General Land Office, upon receipt of which the local officers will be advised as to the action to be taken.

Instructions, approved July 11, 1912. 41 Land Decisions, 91.

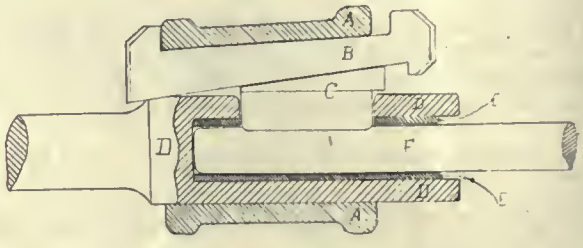
INSUFFICIENT DISCOVERY

Country rock in which it is claimed 'kidneys' of copper ore may be expected to be found, is not itself a lode within the meaning of the mining laws, and the exposure of such rock within the limits of a lode claim, which may or may not contain mineral, does not constitute the discovery of a vein or lode within the meaning of the law and is not a sufficient basis to support a lode location.

Rough Rider and other lode claims (on rehearing before Secretary of Interior), 41 Land Decisions, 255. September 5, 1912.

Schorlemmer Drill Chuck

A new chuck to hold drill steel in the reciprocating type of rock-drilling machines, has been invented by a Canadian, H. W. Schorlemmer of Rossland, B. C., and is now about to be made available to the users of rock-drilling machines in the United States. This chuck can be fitted on any of the reciprocating type of rock-drilling machines by turning down the end of the piston rod, so as to make a shank about 7 in. long and 2¼ to 2⅞ in. diameter, according to the size of the machine. This shank must be slotted, longitudinally, like the slot in a bushing, to take a key which ohlds the drill. Tht same standard bushings are used with this as with the U-bolt chuck.



A, COLLAR; *B*, WEDGE KEY; *C*, DRILL KEY; *D*, PISTON; *E*, BUSHING; *F*, DRILL-SHANK

The collar, *A*, is adapted to slide freely on the turned end of the piston rod *D*, and has an extension on one side which holds the wedging key *B*; this key also slides freely in the collar. The drill shank *F*, being inserted in the socket or bushing *E*, the drill-key *C* loosely engaging it, the collar and wedging-key, as the drill bit strikes the ground in the first blow, will be carried forward by their own momentum and the inclined surfaces of the two keys will cause the inner or drill-key *C* to move inwardly with considerable force, thereby crowding the drill shank *F* against the opposite wall of the bushing and gripping it with great firmness. Subsequent blows of the drill bit serve only to make the engagement still tighter. The construction and arrangement of the collar so as to slide forward with the wedging-key, in the tightening operation, is an important feature, as the momentum of the heavy collar, added to that of the wedging-key, is sufficient to insure the drill-key being driven against the drill-shank with such force as to prevent any possible loosening of the drill in the operation of the machine, and to prevent the drill from being pulled out of the bushing in case it should stick in the hole.

To release a drill from this chuck, the forward end of the wedge-key *B* is struck with a hammer, driving the key backward and thereby loosening the drill-key, which allows the drill shank to be removed from the bushing with ease. Owing to the arrangement of the keys this operation is very simple, requiring not more than one or two blows with the hammer to release it.

The collar and keys are easily removed from the piston-rod, when the drill shank is not in the bushing, by allowing the drill-key to drop down in its slot as far as permitted by the shoulders on it; then hold the wedge-key up against the top of the collar. With the parts in this position the collar and the wedge-key can be slid backward past the drill-key, the lower gib on the wedge-key can be lifted out of its slot and the collar and wedge-key be drawn forward over the end of the piston-rod. It is practically impossible for the operation of taking the chuck apart to be done accidentally, as the large key will always follow the movements of the small key, thus preventing any displacement of the collar or keys.

This chuck has been tested in the mines at Rossland, B. C., for three years, and has proved practical, it is also claimed to be more economical of operation than the U-bolt chuck, besides cutting down the cost of drilling, owing to the time saved in changing drills. The Consolidated Mining & Smelting Co., of Canada, Ltd., is using it exclusively on all drilling machines. The Le Roi, Le Roi No. 2, Josie, and other mines in the Rossland district have been using it with success for the past year and a half.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

DISMISSAL of Mr. Whitman Symmes by the Comstock Pumping Association suggests that any engineer doing good work on the Comstock is bound to get into hot water.

FORECLOSURE proceedings have been directed by the United States District Court, under a trust deed and mortgage held by the Continental & Commercial Trust & Savings Bank of Chicago, and thus the properties of the Penn-Wyoming Copper Company pass to new owners. This ends a long fight and clears the way for sale of the properties.

A HOLDING company, it is announced, is to be formed to take over and operate the properties of the St. Joseph Lead Company, the Doe Run Lead Company, the Mississippi River & Bonne Terre Railroad Company, and affiliated concerns. With resulting economies these excellent properties may be expected to improve even upon their present good records.

WALL STREET is disturbed not only by the 'money trust' investigation and the "antagonistic" attitude of the Governor of New York, but most seriously of all by the continual loss of patronage. Recent inquiry developed the fact that traffic handled by elevators in representative office buildings in the New York financial district is now about one-third the normal. One of the humors of the present situation is the hailing of the election of Mr. Bernard M. Baruch to a position on the Law Committee as an evidence of reform from within.

FIXED ideas are hard to change. The Alaska Treadwell mine became famous for its low costs while working an open pit. For some years all mining on Douglas island has been done underground, and most of the ore now stamped comes from about 1600 feet in depth. Nevertheless, so well informed a periodical as the *South African Mining Journal*, placing the Alaska Treadwell at the head of the list of great mines with low working costs, says it "scarcely can be fairly contrasted with other mines where quarrying or open-cast working is not practicable." In fact the low costs are due to the large size of the orebody, its simple character, and the excellent management the mine has always enjoyed.

DURING the past few weeks a decided public interest has been manifested in Cobalt, and as a consequence the majority of the stocks have been ruling at higher prices. The appreciation of value is entirely legitimate and is induced by the high price of silver and the favorable developments on

the various properties. This interest has been particularly noticeable in England, where several flotations have recently been made. Following the striking success of the English-held Townsite and Casey Cobalt mines, a leasing company was formed to work the old Silver Queen mine. The shares of this company are selling at a premium of over 100 per cent on the London market, although the venture is a rather doubtful one. A few weeks ago, Sir Henry Pellatt negotiated a deal for the purchase of the Cobalt Lake mine, and the stock is now being sent in for transfer. The latest venture for English capital in Cobalt is the purchase of control of the Chambers-Ferland. No public announcement has as yet been made, but the money is ready, and it seems assured that the deal will go through. Several other Cobalt mines are being prepared for introduction on the London market, and in this connection it would be well to exercise caution. If the shares of the companies already floated are in receipt of public favor, there is no doubt but that every effort will be made to float all sorts of undesirable properties. All new companies should be subjected to the fullest investigation, and every effort should be made to stamp out 'wild-cat' flotation, which, in a district as well known as Cobalt, would have a markedly harmful effect upon the mining industry of Canada.

Smelter Fume Control

Experimental work with the Thiogen process for the reduction of SO_2 of smelter fume to elemental sulphur by the actions of hydrocarbons, aided by the use of a catalyser, was described in some detail in our issue of April 6 last. As outlined at that time it was found in practice that reduction of the SO_2 by this means was feasible, but, as is usual in the development of new methods, it was necessary to overcome a number of mechanical difficulties in order to adapt the methods to the requirements of the conduct of smelting operations. Chief among these are the freeing of the gases from dust, which would contaminate the sulphur, decreasing of the free oxygen content of the gas as much as is consistent with the successful conduct of roasting operations, obtaining of uncontaminated sulphur, and the collection of the reduced product. During the past year these problems have been the subject of study by capable mechanical and chemical engineers, and while no formal announcement has been made, encouraging progress has resulted. The roasters employed are of the usual multiple hearth type and by means of a by-pass and fan a portion of the escaping gases is returned to the lowest hearth, thus raising the sulphur content of the portion escaping to the reduction chamber to 8 or 9 per cent of SO_2. This gas, from which the dust has been allowed to settle, is mixed with producer gas made from crude oil, at a temperature of 700 to 800°C., and is passed through masses of the catalytic material, earlier described. This reduction was formerly accomplished by the use of a spray of crude petroleum, with the result that the sulphur produced was mixed with petroleum. Experiments were accordingly made with gas made from oil, also with unsatisfactory results, as the gas still contained appreciable quantities of liquid and tarry products. Experiments are now in progress with a type of producer, made by the Western Gas Engine Company, in which the producer gas is drawn through a bed of glowing coke before escaping from the producer, with reported excellent results. The sulphur thus reduced is allowed to escape into a cooling chamber, where it is cooled by a water spray to below the temperature of ignition. The problem of the collection of the resulting mixture of flowers of sulphur, milk of sulphur, and liquid material has not as yet received extensive study.

In our issue of January 4, Mr. S. S. Sorensen described the use of pressure blast air-cooling of the McDougall roasters at the Steptoe Valley smelter, by means of which the tonnage handled has been raised to 90 per furnace day, with an elimination of 60 per cent of the sulphur content, while at the Great Falls plant, Mr. A. E. Wheeler has raised the daily tonnage of similar roasters to 75 tons per day, with a sulphur elimination of 75 per cent, the output in this case being chiefly limited by the mechanical strength of the mechanism. The present tendency of roasting practice thus being toward increased tonnage, the Thiogen process, in which roaster output is limited by the necessarily high sulphur content of the gases, will be obliged to exhibit compensating advantages to the managerial eye to secure adoption. The inventor and his associates deserve high commendation for the large amount of careful research they have devoted to the solution of a pressing metallurgical problem.

Wanted: A New Deal

As a further contribution to the discussion regarding the California State Mining Bureau, we present this week the full report of the State Board of Control, the reply of the Trustees of the Mining Bureau, and a careful review of the situation by Messrs. C. W. Merrill, Albert Burch, M. L. Requa, John H. Mackenzie, and F. W. Bradley. This review leaves little to be said concerning the removal of Mr. W. H. Storms from the position of State Mineralogist. Mr. Storms is fortunate both in his facts and his friends, and with this complete vindication the personal side of the matter may well be dropped. A capable officer and a well intentioned state administration came to a parting of the ways because of a bad system and impossible conditions. Experience has made abundantly clear the fact that it is impossible to make the Mining Bureau fulfil the expectation of the mining men of the state under present conditions. There is entirely too much point in the criticism made by the Board of Control; our objection is to the use made of that report. It is always more important, however, to change a wrong system than to assess blame among individuals. As it now stands the state is in the position of a man who owns an expensive automobile, refuses to furnish gasoline, and then blames the chauffeur for failure to progress. We are willing to believe that the Trustees on the Board have done what they could and that the new State Mineralogist will serve the state to the best of

his ability, but there is hopeless confusion of authority and lamentable lack of funds for certain most important purposes. The sensible course is to abolish the present institution and create a new non-political board of small membership, giving it full charge of the work with definite authority and responsibilities. Such a board, with a moderate increase in funds, could more than double the useful work of the present bureau. Field studies are what is most needed, and in the reorganized bureau should be centred all the geological work of the state. The Water Commissioners in the oilfields, the Highway Commission, the State Engineer, the proposed new State Water Commission, all these and many other state officers need the advice and help of a competent geologist, and in aiding existing bureaus, as well as in direct stimulation of the mining industry, there is a large field for usefulness. California has been put to shame too long by maintaining a simulacrum of a mining bureau. It is time to entirely reorganize or abolish the institution.

To Voters of the Institute

Members of the American Institute of Mining Engineers have been so bombarded with letters and circulars this year that many have become hopelessly confused as to the issues involved. For the benefit of those who have not had time to study the situation independently, it seems worth while to present in the briefest possible space the results of our own study.

As is generally understood, the Institute was found by the Committee of Five to be living beyond its income, and its business to have been conducted somewhat loosely. Happily, attention was called to the situation in time, and, thanks to the active work of Mr. James Douglas in soliciting contributions to the land fund and the good work of the present Board of Directors, the Institute entered 1913 in excellent financial condition. A continuance of vigilant care and a reasonable participation by members in its responsibility as well as its benefits will assure sound financial conditions in the future. Another result of the investigation was the proposal to change the articles of incorporation, the constitution, and by-laws, to the end of securing more general participation of the members and better business methods in the routine work of the Institute. The articles of incorporation have already been changed and, whatever may be done with the new constitution, an enlarged Board of Directors must be elected in February. Since the new constitution, if adopted, will abolish the Council and centre all responsibility on the new Board of Directors, it is desirable to change the order of business at the annual meeting so as not to elect a Council that is immediately to be abolished. We urge all members to execute proxies in favor of the new constitution and the new order of business.

In addition to the constitution itself, a separate amendment has been proposed providing for a class of Fellows of the Institute, to include the older and more experienced members. As it stands we believe this should be defeated. There is no good purpose to be served by decorating a select circle with an honorary title, and 'Fellows' can do no good unless given specific duties and powers. If the men properly entitled to the rank were to be permitted to consider matters and formulate expressions of opinion on professional matters, the body could be made an extremely useful adjunct to the work of the Institute. This, however, is not now proposed and any other basis for fellowship would, we think, result badly. A second reason for opposing the amendment is that the real work of a body of Fellows would be the same as that now attempted by the Mining and Metallurgical Society. Negotiations for affiliation of the Institute and the Society are now being conducted, with every prospect of a successful conclusion. With such affiliation and the resulting enlargement of the society the field for a class of Fellows will disappear.

The other amendments proposed relate to details of business conduct. Many consider it better to leave such matters to the Directors, but the fact that the proposals come from Messrs. C. R. Corning and George C. Stone, after their thorough study of conditions and with their large business experience, throws the burden of proof on those who would oppose them. It is certainly important that the Assistant Treasurer, who in practice has heretofore paid most of the bills, should not hold any other office. Any plan which permits the man who incurs an expense to approve his own bill, draw the check, and receipt the account, is open to grave objections. This has happened in the past, and the proposed change would make it impossible in the future, though there are other ways to meet the situation.

Men as well as methods are important in the conduct of any business, and therefore the nominations for office should be scrutinized with great care. The official ballot prepared by the nominating committee has our entire approval. It includes representatives of the profession from all parts of the country, and, we are permitted to say, no name was placed on the ballot until after it had been made sure that, if elected, the new officer would devote adequate time and real attention to the service of the Institute. An opposition ticket has been nominated by petition. It proposes for re-election the present secretary and all the present members of the Council and Board of Directors who are eligible to reëlection, adding to the list enough to fill out the new Board. For reasons given in full in our issue of last week, we are opposed to the reëlection of the present Secretary, and with the friendliest possible feeling for the retiring members of the Board of Directors and Council, many of whom we count among our personal friends, we think it will be easier for new officers to make changes than for old ones. The nominating committee has provided that more than half of the new Board of Directors shall be drawn from among those now serving the Institute as Director or member of the Council, and a number of others nominated have previously so served. No nominating committee in years has taken so much pains to select men to represent the entire membership of the Institute, and our advice to members is to vote the official ticket, and vote it straight.

Treatment of Concentrate at the Goldfield Consolidated Mill

By J. W. Hutchinson

*By means of iron goose-neck flues, the gases from the roasters at a temperature of 450°F. are delivered to a concrete dust-flue 264 ft. long, having a cross-section of 50 sq. ft. From this flue, 20,700 cu. ft. of gases per minute escape through a vertical steel stack, 100 ft. high and 54 in. diam., having a temperature at the base of the stack of 325°F. The velocity of the gases in the dust-flue has been determined with a Hiram anemometer to be 7½ ft. per second. The escaping gases are white, and no dust is visible to the eye. Measured quantities filtered through woolen bags indicate a stock loss of less than ½%. This figure is taken as a total loss in handling, roasting, conveying, etc., and added to the tailing loss. One per cent of the material roasted is collected in the dust-flue and has a value of 20% more than the material roasted. Apparently, all the dust is made in the feed-end of the furnace, since this dust contains 15% sulphur. Approximately 80% of the dust recovered settles in the first 150 ft. of the flue. The flue is built on the slope of a hill and at the top it is 79 ft. above the hearth. As can be seen from the drawing, a drag-chain conveys this dust down the flue, from which it is discharged through wrought-iron gates into a sump. Water is added and the resultant pulp elevated back to the Kelly press storage tank for filtration and mixing with the regular feed. The loss and inconvenience through handling this fine material dry is thus avoided.

Analysis of Roasted Product

Mesh.	Per cent.
+100	12.5
+150	15.5
+200	25.5
−200	46.0
Composition.	
SiO_2	54.60
Fe_2O_3	32.20
S (as sulphide)	0.15
S (as sulphate)	0.75
Al_2O_3	3.00
CaO	0.20
MgO	0.13
Cu	0.60
Te and Se	0.19
Sb	0.07

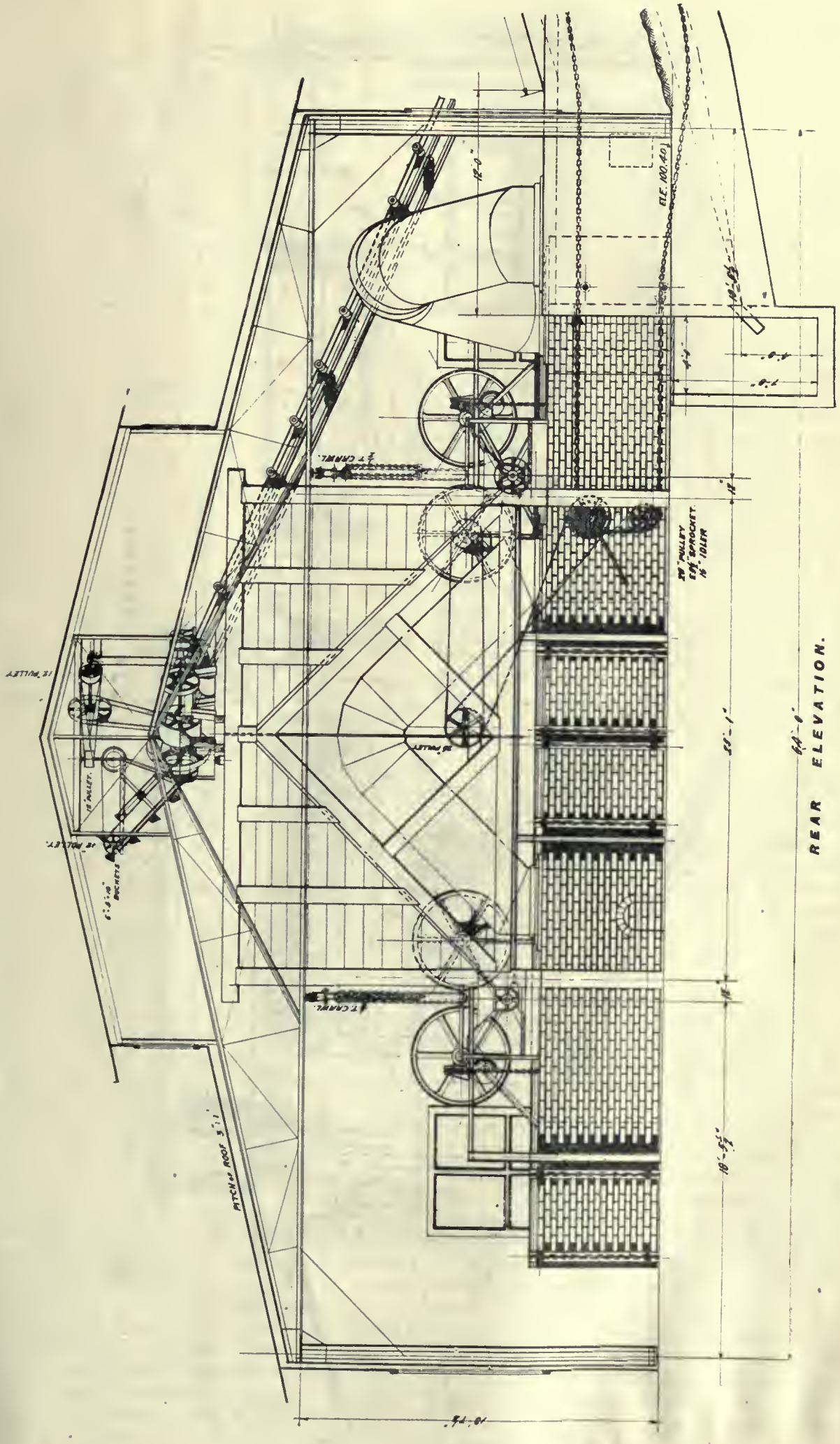
In line with the last rabble on each furnace there is a cast-iron discharge chute on one side of the furnace only, set at an angle of 45°, through which the roasted material is delivered to a drag-chain conveyor. This conveyor runs at a speed of 45 ft. per minute and elevates the material up an incline of 15° to the feed spout of a Baker cooler. As can be seen from the drawing, the original device for conveying the hot concentrate was a water cooled screw-conveyor. This was decidedly unsatisfactory and was discarded in favor of the drag-chain. This chain does good work, requires no repairs, and is very satisfactory. The drag-chain, sprockets, and all movable parts are housed in a brick conveyor-way built up 2 ft. above the floor line and covered with ¼-in. plate, and no dust escapes into the building.

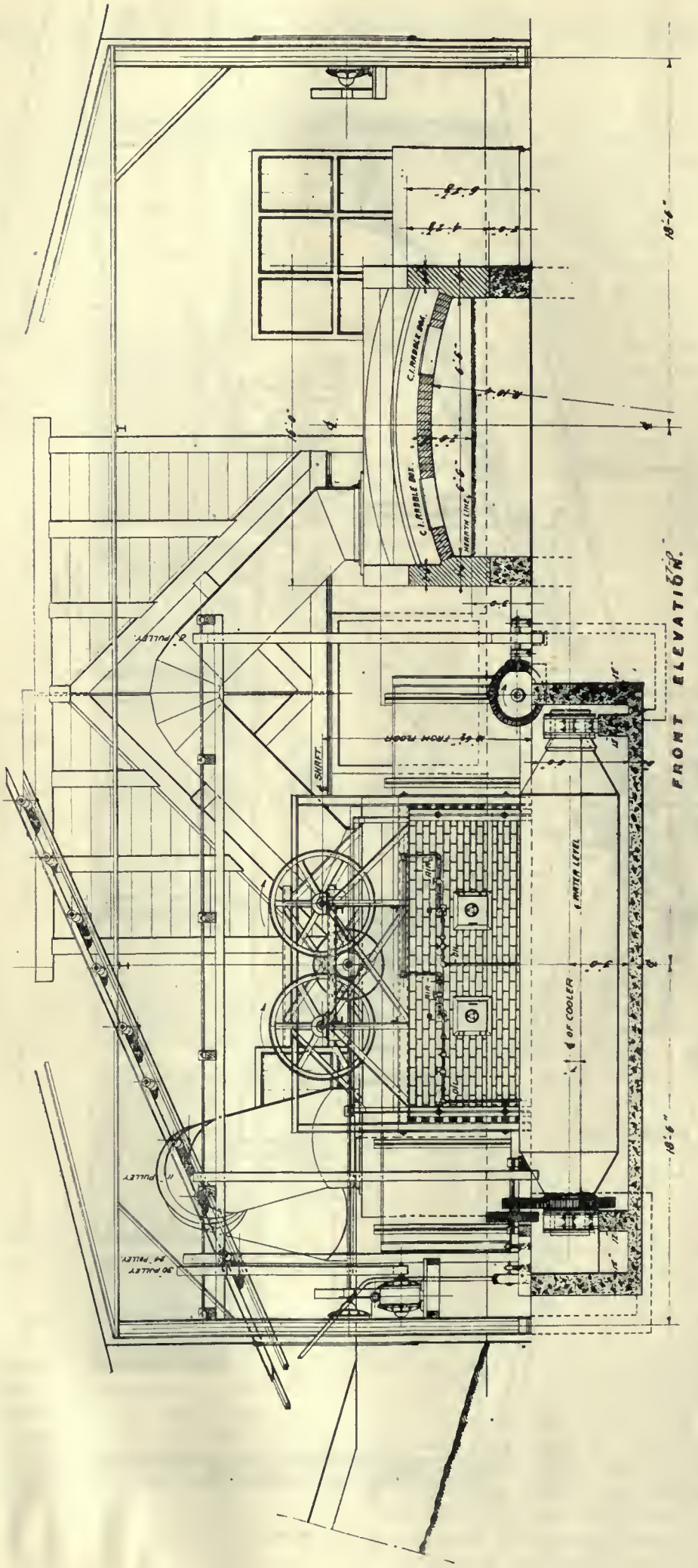
The Baker cooler is a sheet iron cylinder, 5 ft. diam. and 22 ft. long, carried at each end on a hollow trunnion bearing, through which the ore is fed and discharged. It revolves with about 40° submergence in a water-tight concrete sump, to which the cooling water is added. Cooling is accomplished through the evaporation of water on the surface of the shell. The cooled ore is discharged dry at about 100°F. into a small concrete sump, over which there is a tight cover, where water is added to wash it to the boot of a 14-in. belt and bucket elevator with 12-ft. centres. Much difficulty was experienced in elevating the material after wetting, due to the soluble copper compounds in the roasted product. Cast-iron centrifugal pumps would not last for this reason. Phosphor bronze pumps were too soft to resist the abrasive action of the pulp. A temporary belt and bucket elevator with steel parts lasted a couple of weeks. Finally, by using brass pulleys, shafting, cups, bolts, and a canvas belt, the elevators have been made fairly satisfactory. The small elevator in the roaster building delivers the pulp to the boot of a second elevator of similar construction placed in the treatment plant, which delivers it to three 20 by 12-ft. combined collecting and agitating-tanks, fitted with the adjustable square shaft agitator. The sole plates, holding bolts for these agitators, are made of brass, and the shaft is protected from the corrosive action of the washes by means of a lead covering. The tank connections in these tanks are brass.

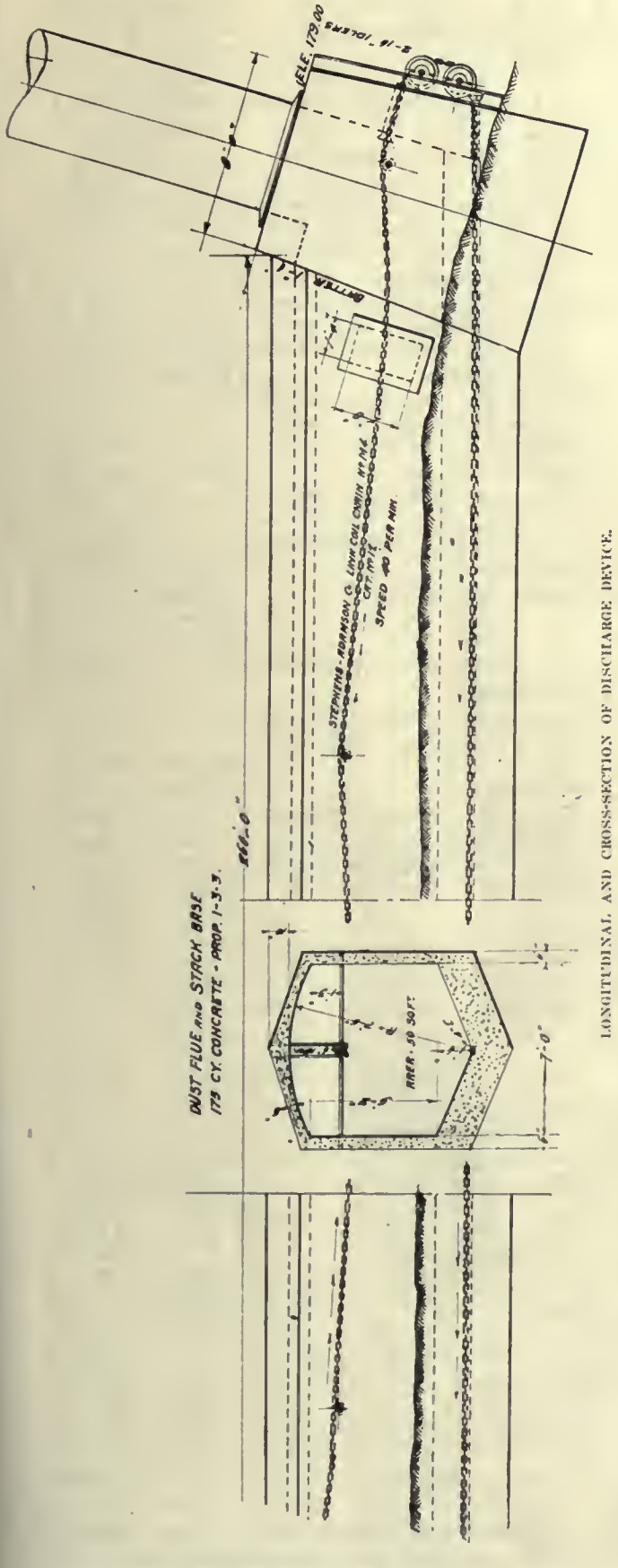
The roasted concentrate is delivered to one tank for 24 hours. The collected charge is then settled and decanted to a consistence of 1 to 1 and sulphuric acid added in the proportion of 20 lb. per ton of concentrate. Agitation with the sulphuric acid is continued for eight hours. Water is then added to fill the tank and the charge allowed to settle. When clear, the wash is decanted and the tank re-filled with fresh water. Four water washes are given, equivalent to eight tons of wash water per ton of concentrate. All washes are passed through two redwood tanks filled with excelsior for clarifying, and overflow from these tanks to six redwood tanks, 10 ft. diam. and 5 ft. high, arranged in series for recovering the copper. These tanks are kept filled with cyanide tins and all kinds of scrap from the mill. The average copper content of the washes is 0.4 lb. per ton, and 70% is recovered.

The thoroughly washed charge is neutralized with lime, and by means of centrifugal pumps elevated to one of four Pachuca agitators, 14 ft. diam. by 25 ft. 6 in. high. Experimental work showed that only 10% of the gold of the roasted concentrate could be recovered by amalgamation, but that no increase in final extraction could be obtained by this step, and for this reason amalgamation was not deemed necessary. The only explanation known for this peculiar

*Continued from p. 170.


REAR ELEVATION.
CROSS-SECTION OF FURNACE SHOWING DISCHARGE END.
PITCH OF ROOF 5:1
ELE. 100.40
54'-0"
64'-0"


FRONT ELEVATION.
CROSS-SECTION OF FURNACE SHOWING FIRE-BOX.
C.I. MARBLE RIB.
C.I. MARBLE RIB.
HEARTH LINE
SHAFT
WATER LEVEL
OF COOLER
PULLEY
PULLEY
PULLEY
PULLEY
18'-6"
18'-6"



LONGITUDINAL AND CROSS-SECTION OF DISCHARGE DEVICE.

action of the gold is that the antimony, bismuth, tellurium, and selenium (though present in minute quantities only) with which the gold is so intimately associated, are not completely volatilized in the furnace, and form a film of their oxides on the surface of the gold particles. The same explanation will account for the failure of the rich roasted concentrate to yield so high a percentage of its gold to cyanidation, as can be recovered from the two-stage treatment. The following comparison is interesting:

	Au, oz.
Assay before roasting	12.25
Assay after roasting	15.35
Assay after 64 hr. treatment	0.66
Percentage recovered	95.7
Assay of raw concentrate	11.60
Assay after 48 hr. treatment	0.96
Percentage recovered	91.7
Assay before roasting	0.96
Assay after roasting	1.17
Assay after 32 hr. treatment	0.107
Percentage recovered	92.6
Percentage of original gold recovered by raw treatment	91.7
Percentage of original gold recovered after roasting	7.6
Total percentage recovered	99.3

It is a fact proved by repeated experiments and by working tests that no more gold can be amalgamated from a 10-oz. roasted concentrate than can be amalgamated from the same material in its raw state, and that roasting the rich concentrate does not materially expedite the dissolution of the gold. It seems probable that some of the gold is partly encased in the sulphides of the volatile metals, but presents some surface to which the cyanide solution has access. After roasting, it is probable that the gold may be entirely covered with a film of the oxide of such metals, which must be removed before dissolution can proceed. Since these metals do not interact with alkaline cyanide, their removal is doubtless accomplished slowly by the alkali of the solution, and this may account for the prolonged treatment which the roasted material requires. This theory is offered merely as an explanation and the ideas of others would be appreciated.

In the above mentioned Paehuea tanks the roasted charge is agitated for eight hours in a 2-lb. solution of cyanide, containing 1.2 lb. CaO as protective alkali. At the end of eight hours, agitation is discontinued, the charge settled, decanted, and reagitated with a freshly precipitated solution in the same manner as described above in the treatment of the raw concentrate. Five periods of agitation followed by decantation are given, and a total of three tons of solution per ton of concentrate is decanted. Consumption of chemicals amounts to 4½ lb. cyanide and 2 lb. lead acetate per ton of concentrate. After agitation is completed, the settled charge is delivered to a storage tank 18 ft. diam. by 8 ft. high, fitted with the adjustable square-shaft agitator. Placed centrally in the bottom of this tank is a 4-ft. cone with pipe connections through which the thickened pulp is fed to a 5 by 18-ft. tube-mill. The pulp issuing from the tube-mill is elevated by means of a belt and bucket elevator back to the above mentioned storage tank. This circulation grinding is continued for 16 hours, at the end of which time 95% of the material will pass a 200-mesh screen. From 80c. to $1.25 per ton is removed in this circuit. Regrinding before agitation with cyanide was the original plan, but had to be discontinued on account of the inability to settle and decant the finely pulverized ore. Since the change of solution increases extraction and since the final tailing is sent to the mill proper for filtration, it was decided to re-grind after the greater part of the gold had been removed.

After re-grinding, the pulp is delivered by means of a centrifugal pump to the filter storage tank in the mill proper, mixed with the mill pulp, filtered, and sent to waste.

Since precipitation and refining are accomplished in the manner described in the former article, it is not necessary to give the details of these operations here. Extraction and costs are shown below:

COST PER TON

Labor		$1.02
Power		0.78
Cyanide	$1.37	
Zinc	0.06	
Lime	0.25	
Lead acetate	0.16	
Water	0.70	
Belting	0.02	
Lubrication	0.01	
Borax	0.01	
Litharge	0.02	
Pig lead	0.01	
Pebbles	0.04	
Tube-mill lining	0.00	
Filter cloth	0.03	
Assaying	0.13	
Acid	0.48	
Fuel oil	0.40	
Roaster parts	0.01	
Bromo-cyanide	0.00	
Sodium peroxide	0.00	
General stores	0.18	
Total supplies		3.88
Total costs		$5.68
First agitation		$0.73
Filtering and conveying		0.30
Roasting		0.82
Acid wash		0.77
Tube-milling		0.33
Second agitation		1.61
Assaying		0.15
Precipitation		0.10
Refining		0.08
Disposal of residue		0.03
General expense		0.02
Re-handling dump		0.04
Water		0.70
Total		$5.68*

*This may be divided into: operation, $5.32; repairs $0.36.

EXTRACTION FOR YEAR

	Au, oz.	Per cent.
Value of raw concentrate	6.58	
Value after treatment	1.23	
Recovery		81.3
Value of tailing after roasting and treating	0.097*	
Recovery		92.16
Total recovered from roasted material		17.23
Recovered from both treatments		98.53

*Based on weight before roasting.

COST OF ROASTER PLANT

Contract for:		
2 Edwards duplex 54-spindle roasting furnaces, 112 by 13 ft. inside, erected on side walls furnished by the Goldfield Con. M. & T. Co., which side walls extend to within one foot of hearth line	$33,485.17	
1 Baker cooler, 5 by 22 ft., erected on foundations furnished by the Goldfield Con. M. & T. Co., complete with driving mechanism, etc.	3,400.00	
Excavations for foundations	1,897.00	
Concrete in foundations, 218 cu. yd. at $14.25	3,106.50	
Total cost of furnaces and cooler erected		$41,888.67
Dust-flues and stack:		
Dust-flue of concrete, 264 ft. long, 6 ft. high, 7 ft. wide; walls 7 in. thick, bottom 10 in. thick with 24° slope to centre; roof 8 in. thick, arc of 10 ft. circle; concrete reinforced with ¼-in. rods, spaced 1 ft. apart both horizontally and vertically, and with a steel cable laced through these rods; total cost	$ 5,500.00	
Stack of American ingot iron, 100 ft. high by 54 ft. in diam., weight 10,620 lb., invoice $573.60, freight $519.60; total cost	1,093.20	
2 goosenecks, 60-in. diam. and 42-in. diam., weight 4480 lb., invoice, $416.00, freight $248.49; total cost	664.49	
Supplies used in erection	375.20	
Labor	311.48	
Total cost of dust-flues and stack		$ 7,944.37
Steel building:		
65 by 158 ft., containing 10,270 sq. ft., at $7398.23 erected in Goldfield	$ 7,398.23	
Foundations	1,213.87	
Covering of 'asbestos protected metal,' weight 1¾ lb. per sq. ft.	3,538.84	
Labor for laying asbestos covering	700.00	
45 windows in place at $10 each	450.00	
		$13,300.94
Ore-bins:		
2 wooden ore-bins, 1620 cu. ft. cap.:		
Supplies	$ 721.26	
Incidentals	55.93	
Labor, erection	311.70	
Total cost of ore-bins		$ 1,088.89
Transmission, elevating, and conveying machinery:		
Line shafting, etc.	$ 2,069.87	
Labor, erection	1,858.55	
Total cost		$ 3,928.42
Miscellaneous expense:		
Labor	$ 530.50	
Supplies	1,086.81	
Total miscellaneous expense		$ 1,617.31
Electrical work:		
Labor	$ 163.00	
Supplies	527.56	
Total electrical work		$ 690.56
Total roasting plant proper		$70,459.16

COST OF TREATMENT PLANT

Superstructure:		
Wooden building, 44 by 48 ft., including lumber, concrete, and covering	$ 3,109.13	
Labor (erection), excavating, moving dumps, etc	2,447.48	
Total cost of superstructure		$ 5,556.61
Pachuca agitation:		
2 steel Pachuca agitators, 14 by 25½ ft., weight 32,860 lb.:		
Invoice	$ 1,225.00	

Freight	384.46	
Labor (erection)	1,316.65	
Power (erection)	200.00	
Labor (foundations)	477.70	
Supplies (foundations)	283.87	
Other materials	533.61	
Total costs		$ 4,421.29
Redwood collector and agitation tanks:		
2 redwood tanks, 20 ft. diameter by 12 ft., weight 36,000 lb.:		
Invoice	$ 402.00	
Freight	265.00	
Labor (erection)	505.30	
Stirrers and other supplies	1,084.11	
Labor (foundations)	496.40	
Supplies (foundations)	197.27	
Total		$ 2,950.08
Tube-bills:		
5 by 18-ft. Gates tube-mill, weight 25,287 lb.:		
Invoice (including chain drive)	$ 1,910.00	
Freight	650.73	
Labor (erection)	297.55	
Supplies (erection)	114.13	
Labor (foundation)	298.45	
Supplies (foundation)	258.94	
Labor (lining)	111.35	
Supplies (lining)	301.64	
Total		$ 3,942.79
Miscellaneous:		
Labor	$ 530.50	
Supplies	1,086.81	
Total		$ 1,617.31
Total cost of treatment plant		$18,488.08
Total cost of roasting plant		70,459.16
Total cost of treatment and roasting plants		$88,947.24

Suspension Colloids

At a recent meeting of the Faraday Society, in London, Ruisdale Ellis read a paper entitled 'A Neutral Oil Emulsion as a Model of a Suspension Colloid.' The interface potential at the surface of the oil globules of an emulsion was measured by means of a mircoscope slide apparatus. The interface potential was found to be little affected by organic impurities in the oil, but to be altered enormously by acids, and to a lesser degree by alkalies. The maximum interface potential was found to correspond to a concentration of about 0.001 N alkali, and this was found to be the point of maximum stability of the emulsion. Surface tension measurements showed that the stability did not depend on the surface tension, but on the interface potential.

Determinations were made of the concentrations of salts with mono-, di-, and tri-valent kations required to just neutralize the charge on the oil globules. The ratio of these concentrations was found to form a geometrical series agreeing with that obtained by coagulation experiments. The coagulation of oil emulsions by colloidal ferric hydroxide was next tried, and it was found that the oil was completely precipitated within two well defined limits on either side of the iso-electric point of the oil emulsion. The coagulation appears to be due to surface precipitation effects taking place between the oil globules somewhat analogous to the condensation of water-vapor on surfaces of various curvatures.

In the subsequent discussion E. Hatschek stated that the size of the oil globules in Mr. Ellis's experiments was about 2 η, which was of course very much larger than anything in suspension colloids. It is difficult to realize how the electrical 'double-layer' would prevent collision between the globules; the theory is useful mathematically but very obscure physically. Whetham's theory with regard to the ratio of concentrations of salts with mono-, di-, and tri-valent kations required to neutralize the charge on the oil globules is untenable, as, for one thing, it is based on the assumption that the particles are stationary.

A. W. Porter controverted a number of the remarks of the previous speaker. Whetham's theory merely depends on relative motion taking place. The coming together of two globules with 'double layers' would have the effect of mutually disturbing the perfect uniformity of their electric charges, and then the particles would repel one another. F. G. Donnan, in a written communication which was read to the meeting, pointed out that no distinction could be made between suspensions and emulsions if based merely on the liquid or solid state of the disperse medium. The oil emulsions behaved as typical suspensions, forming a very striking model of a suspension colloid. Bredig's 'Lippmann Effect' theory of the stability of suspensions was not borne out by Mr. Ellis's results. Further work on emulsions is being carried out in the Muspratt laboratory.

The great interest of the subject in connection with the theory of oil flotation processes now largely in use for ore separation was remarked by H. M. Ridge. G. Senter referred to some recent work of Freundlich in which geometrical ratios in the coagulating effects of mono-, di-, and tri-valent kations were not observed. He agreed that the author's work did away with any real distinction between suspension and emulsion colloids. E. Feilmann said it had long been known that slightly alkaline media favored the formation of stable suspensions, but he gave instances where slightly acid media had the same effect. He criticized the author's suggestion that dyeing might be due to capillary coagulation of the colloidal dye.

Ore of the Braden mine, in Chile, consists of chalcopyrite, bornite, secondary chalcocite, cuprite, metallic copper, and carbonates and silicates of copper. It had proved difficult to treat by ordinary wet concentration methods, the recovery being only about 60%. Tests by the Minerals Separation flotation process resulted as follows:

	Tons treated.	Cu, %.	CuS, %.
Heads	2726.2	2.61	....
Concentrate	274.1	20.82	....
Tailing	2452.1	0.56	....
Calculated recovery		80.00	87.40
Actual recovery		80.20	87.65

Consumption of reagents was: Sulphuric acid, 3.57 lb. per ton; Texas and wood-tar oils, 2.33 lb. per ton.

Labor in the Mines of Western America

By H. F. Davis

If a mining engineer were asked to classify the miners of America, he would probably do so with reference to the mining district from which they come, probably beginning with Cornishmen, then naming the other districts that have furnished us with so many of our present miners, such as Michigan, New York, the New Jersey iron and copper mines, the Pennsylvania anthracite mines, lead and zinc mines of Missouri, the silver and gold mines of Virginia City, etc. An old-time Western quartz miner would probably nickname the same men 'Cousin Jacks,' 'Peerless men,' 'Shads,' 'Jersey plugs,' 'slate-pickers,' 'Missourians,' and 'hot-water plugs.' This does not, by any means, include all the districts that have furnished miners for the Western mines, for every country has its representatives: but it includes the most famous among them. Of course, the ubiquitous Irishman is found in every delegation of English-speaking miners, and many of the best are Irish.

Cornish Miners

It is but natural that many of our best miners should come from Cornwall, as that country has been engaged in deep mining from prehistoric times to the present day. Generation after generation went into the mines when mere children, and with them mining was a permanent occupation. As their mines began to be worked out the Cornishmen sought other mines, because they knew no calling but mining, and this search has taken them into every country where any considerable amount of rock-mining is done. They are seldom found in the coal mines. They were not, as many of our American miners are, inclined to seek temporary employment in the mines on account of high wages, with the expectation of engaging in other lines when they had made a 'stake.' (A Cornishman's idea of a 'stake' is a job in a mine that employs other Cornishmen for bosses.) The fact that Cornishmen go into the mines so young, usually working with the father or older brother, accounts for their proficiency as miners, since mining is a matter of experience and practice. A knowledge of it is never inherited, and the miner direct from Cornwall is not nearly so proficient as his brother who has spent no more time underground but has worked in several districts. The Cornishman's reputation is not what it was twenty or thirty years ago. He follows too closely in the footsteps of his father and often stubbornly refuses to recognize the merit of other than Cornish methods.

Among the principal American mining districts none has furnished so many good miners as the iron and copper districts of Michigan. The descendants of the foreign miners of that locality are widely scattered over America, play an important part in many mining communities, and are usually equally good at hammer and machine work. The reason for this versatility of the 'Peerless men' is found in the many different conditions that obtain in the Michigan mines. They have both hard and soft iron ore as well as copper and some gold and silver, and the methods include both hammer and drill and machine work. Further, the young Michigan miner of the past usually hoped to emigrate to the mining districts of the Rocky Mountain region in order to obtain higher wages, and, learning from those who had preceded him that it would be of advantage to him to be able to do either hammer or machine work, he usually endeavored to perfect himself in both while at home. (The name 'Peerless' has no reference to the ability of the Michigan men. It is the name of a tobacco largely used by them; which, by the way, is not manufactured in Michigan, but is another of the products which has added to the fame of Milwaukee.)

What has been said with reference to the Michigan miners applies largely to those from New York and New Jersey also, though being farther away and fewer in number, fewer of them having emigrated westward. The miners from the lead and zinc districts of Missouri are not as proficient as those from the other localities mentioned, because their methods of mining differ and the inducements in the way of wages have not been, in the past, such as to attract miners from other localities with new methods and ideas. However, in more recent years, this fault has been recognized and is being corrected by the importation of bosses and miners from other fields.

Hand Men and Machine Workers

The miners of Western North America are derived from many sources, but they are all largely influenced by the methods of other districts. All European countries are represented among them, and, owing to the varied character of the substances mined, practically all methods are used. The miner of the Rocky Mountain regions must be proficient in many methods to be classed as an 'all-round' miner, and is never classed as such by the veteran unless he can drill single and double-hand and with a machine, as well as do all ordinary timbering. However, with the decadence of hammer and drill work in the past twenty years, there are many good machine miners who cannot do it. There are still 'old-timers' who cannot do machine work, though they are few and usually are men who work at mining only to make a 'grub stake' and not as a permanent employment, or men who prefer the small isolated mining districts to the larger ones.

The Cornishmen are always good hammer men, at both single and double-hand work. They are not, as a rule, good machine men. Some of the best single-hand men are Italians, but I have never seen a good machine-man among them. Hammer work is a matter of practice; machine work is a matter of resourcefulness, skill, and strength. The more intelligent miners always make the better machine-

men. However, it is useless to attempt to judge miners by nationality or birthplace. The best miners are those restless mortals who spend their lives traveling from one place to another, seldom spending more than two or three months in any one mine, though this type may not be the most desirable. It frequently happens that the 'home guard,' as the traveling miner contemptuously calls the fellow who stays in one place, is more satisfactory than the 'hobo' miner, as the traveler is called. This is especially true in those mines where the duties of the miner require a relatively small amount of drilling and more pick, shovel, and timber work, because proficiency in such mines is more easily acquired. In such cases the timbering is usually done by a man more experienced than the average miner.

Mixed Crews

No mine foreman ever got the best results possible by employing men of one class only, as a mixed crew always gives better results, because each is quick to appropriate any practice of the others that can be used to advantage, and a spirit of rivalry more often obtains than where one class only is employed. Then, too, labor troubles are less likely to occur. The introduction of southern European laborers, except Italians, into the Western mines, is of comparatively recent date. Twenty years ago it was unusual to find one among the crews of a mine, while today some mines employ them in large numbers chiefly as shovelers and carmen, or in such places where it is difficult to get the more intelligent miners to work.

They seldom make good miners, and it is doubtful policy to employ them in any considerable number, if at all. The management that employs them because they will work for lower wages follows a short-sighted policy, as they are very inefficient, unless distributed among the better men in such manner that they can be directed to some extent by those with whom they work, and this always causes dissatisfaction among the better men. Besides, where it is necessary to pair men, as it frequently is, two good miners will always do better work together than if each has a poor partner. This is especially true on machine work, where two men are required for the operation of one machine. In such cases it is customary for a certain amount of work to be required of each crew such as, for example, to drill a round of 5-ft. holes in a drift, and with an experienced man and a greenhorn it usually devolves upon the experienced man to do much more than his part of the work. This he will do for a few shifts, but it usually results in the experienced man 'pitching' his job, for it is a kind of unwritten law among miners to never complain of a partner or the place in which one is put to work. The good miner, when dissatisfied with either, will enter his complaint by quitting. In districts where a large supply of miners is available, it is unnecessary to pair experienced and inexperienced men, and it is seldom done by the experienced shift-boss. When it becomes necessary, on account of the scarcity of men, great care should be used or it will result in the good men quitting. The plan of working one experienced man and a helper at a different rate of pay has never proved satisfactory from the miner's standpoint, and only in those cases where good machine men are scarce has it proved satisfactory to the management. It is now customary in nearly all mines where two-man machines are used, to pay both men the same wages.

Some Things Which Make for Efficiency of Labor

Labor is always more efficient in those districts where there are more miners than jobs, because there the foreman can pick his men and can quickly replace any inefficient ones. In such cases, one can but be impressed by the extreme youth of the men employed in most of the large mines. Underground work is a young man's occupation, and the miner past forty is seldom wanted. In very exceptional cases only is such a man able to keep the pace set by the younger miners in the larger mines, especially where machine work is the rule.

The most important factor in labor efficiency is a plentiful supply of young miners, preferably of different origin. To secure this supply, three things are essential: good wages, good board and lodgings, recreation for the men when off shift. The lack of any one of these is fatal, and the district that supplies them always has an abundant supply of labor regardless of everything else. It has been demonstrated time and again that the superintendent who tries to operate a mine and pay less than the regular wage scale of his region does not increase the efficiency of his labor thereby, yet there are still some who think they can do it. In his admirable work, 'The Cost of Mining,' J. R. Finlay gives some figures relative to this feature that might be studied with advantage by all such. It is refreshing to a miner to find a writer who so thoroughly appreciates this phase of the labor question and who so fairly expresses it. It is the opinion of all those best able to judge that cheap labor means poor labor.

Boarding-Houses and Lunch Buckets

One of the serious questions that confronts every superintendent of an isolated mine is that of the boarding-house. No company boarding-house ever satisfied the miner, and none ever satisfied the superintendent unless he had a financial interest therein. They should be abolished in every case possible, and it is nearly always possible on permanent operations. Where it is absolutely necessary to run a company boarding-house, it is of first importance that the miners' lunch pail be given proper attention. No other feature of the boarding-house is so prolific of complaint from the miner as the 'lunch can.' The lunch is nearly always eaten underground, frequently in foul air, dust, and powder smoke, and often, far in the night, when the 'super' is dreaming of low costs and large dividends, the miners are grouped in some evil-smelling cross-cut, their lunch-cans between their knees, eating from grimy fingers the lunch for which too frequently too much is deducted from the monthly check. That lunch is the fuel which must develop the energy for the remainder of the shift, and, with the management, it is a matter of policy, not sentiment, to see that that fuel

is provided in quantity and quality which shall be satisfactory to the engine that consumes it. Here, too, over the lunch-cans are discussed questions of policy that frequently have an important bearing on those low costs and large dividends of which the 'super' sweetly dreams, and the views expressed would often be illuminating to him. Those operations that depend upon the company boarding-house and store for their dividends usually come to grief.

Recreation and Quarters

The problem of recreation is only solved satisfactorily in the larger districts. However, at the small isolated 'bunk-house' mines, some kind of a recreation room should be provided where the miners can congregate when off shift. This should be separate from the bunk-house, but may be used as a 'change-room' where the miners can dry their clothes and wash them, if necessary, without disturbing others. Newspapers should be furnished when possible and such magazines as are available. Even the advertising literature that comes to the office is acceptable, and anything of the kind, if taken to the miners by the superintendent in person, will do much to break down the feeling of antagonism that too frequently prevails between miner and manager.

Quarters for the mine bosses should always be distinct from those of the men, for familiarity when off shift leads to familiarity in the mine which is not conducive to the best results and too frequently the boss of the mine is looked upon as the boss of the bunk-house. This should be so only so far as generalities are concerned. The management should recognize that the miner's time belongs to the miner when 'off shift', even though that time is spent in the company's property, and no rules for his conduct should be promulgated. In a case which occurred in my experience, a New York City manager of a California mine twenty-five miles from a railroad attempted to prevent the miners from indulging in a favorite card game in the company bunk-house. He broke up the card game, but he lost a crew of good miners in an area where good miners were scarce, and also lost the best foreman in that district. The foreman quit because he said he had practically every good miner of that district in his crew, could not get another crew like it, and hence could not get good results. The manager found that with a new crew it cost him about 25% more to keep his mill supplied with ore.

A Day's Work

Another frequent cause of discontent among miners is the boss who does not know his business. To one who does not understand the eccentricities of a miner it might appear that it should make no difference how the work is done, as the miner is paid per shift. This is true to a limited extent only. The miner prefers to have his work judged by the shift rather than by any part thereof. He resents being shown by the boss how to do those things which a miner should know how to do without being shown, such as the proper manner in which to place the drill-holes. An experienced miner will nearly always quit immediately if a boss attempts to 'point his holes for him' or to measure them when drilled. The miner quickly learns when a boss is not a good miner, and his inefficiency is a favorite topic in the bunk-house or at lunch. The report is rapidly circulated that 'he don't know a shift's work when he sees it', and then the miners 'throw off' on him and do less work. The shift-boss more than any mine official should know every possible detail of mining practice.

The expression 'to handle labor' means to direct men at their work, and in my opinion to do that requires a thorough knowledge of both men and the work. A man's success at handling labor will be directly proportionate to his combined knowledge of the men and the work required of them. This knowledge is absolutely necessary to the successful shift-boss, and of but minor importance to the superintendent. The chief duty of a shift-boss is to meet emergencies. He should be able to locate quickly any cause of disturbance of the regular routine of the mine work and to apply a prompt remedy for it. Should a bad 'fall of ground' occur he should be able to handle it in such a manner that the regular progress of the mine will not be impeded; should a machine 'buck' he should be able to quickly determine the cause and apply a remedy so promptly that the round will be drilled by blasting time; should a man get injured he is the one to direct the operations of getting him out of the mine. The young college graduate who tries to break into the mining game as a shift-boss usually imagines that shift-bossing consists of walking through the mine in a pair of laced boots with a time-book in his hip pocket. Fortunately for him this belief is not generally shared by those who hire shift-bosses, with the result that he usually lands in the superintendent's office, sooner or later, dependent upon the intimacy of the relation existing between him and some wealthy member of the board of directors.

I have worked in the mines of some thirty or forty superintendents and for a hundred or more shift-bosses and, with the exception of a few whose duties were more of the nature of general foreman than of superintendent, the percentage of them who graduated from shift-boss to 'super' is so small as to be negligible, while the number of 'school of mines' graduated shift-bosses was still smaller.

College Men and Miners

A word regarding the college man and the miner. One fact usually overlooked by those who argue that, due to the superior advantages of education, a 'school of mines' man, as the miner terms him, should learn to be an expert miner, or a good miner, much quicker than a boy without education is this: the boy with 'no education' usually has an education that is overlooked. It is a physical education acquired by trying to handle tools of various descriptions. His vacations are more often than not spent under the guidance of those who see to it that he works, usually at some kind of arduous labor. When the time comes that he can 'get a job' underground, he usually possesses a physical development different from that of the graduate and also has a better knowledge of tools and their uses. There is nothing more painful to a miner than to watch a young college man try to shovel on a 'rough bottom'; yet there

comes a time to every miner when he has to do just that kind of thing and unless he can do it, he is not a miner and cannot do a miner's work.

It is neither necessary nor desirable that the graduate should learn to be a practical miner. It is unnecessary because the duties of superintendent or manager, for which he has prepared himself at the expense of several years' work and some thousands of dollars, do not require it; undesirable because to learn 'practical mining' well enough to properly do the work of a shift-boss in any kind of a mine it will require not less than from four to five years actual underground work in several different mines. The principles of mining work he is supposed to get at school and in the few trips underground in connection therewith. That is sufficient for his needs. The most valuable education he can get in this connection is one that will enable him to select a good foreman. Some superintendents have been tremendously successful in just this way.

Avoid Conflicting Orders

The superintendent should manage the mine through his foreman and should never hire men for any class of work under his foreman without consulting him. Neither should he give orders to shift-bosses or men except through his foreman, as it causes confusion. The foreman in turn deals with the miner chiefly through the shift-boss. On his daily trips through the mine he will usually avoid giving any orders that will conflict with those of the shift-boss, and if possible the two should make the 'rounds' together. Wherever the miner is concerned confusion of orders is to be avoided with the utmost care. He is usually over-sensitive on this point and 'too many bosses' is a frequent complaint.

By far the best results are obtained by clearly defining each man's duties and holding him responsible for results only. This is especially true as applied to the miner (always supposing that the miner is a capable one), as it puts him on his mettle and allows him to exercise his judgment to an extent that he takes a more personal interest in his work. No other occupation employing many men is so strenuous and dangerous as that of the American miner. The statistics showing the mortality among them are seldom if ever complete, owing to the difficulty of determining the mortality directly attributable to the occupation. Miners consumption and pneumonia cause far more deaths than falls of rock and 'negligence' notwithstanding the fact that the Mine Inspector's report and the verdict of the coroner's jury show that the latter is about the only cause of a miner's decease.

Miners and Strikes

Much has been said derogatory to the miner in connection with the strikes of the past twenty years. It is not the intention here to attempt to justify those deplorable occurrences which have resulted in the loss of life or property. They are indefensible and should have been prevented, as they could have been had there been a proper understanding between manager and miner. It is my contention that the fault has been almost entirely with the management of those operations where trouble has occurred. A superintendent is supposed to be an intelligent, educated, and experienced man, and it does seem as though such a one should not have allowed such small differences as those which led to some strikes to be the ultimate cause of such large loss of life and property. To those who contend that such demands as have been made for increased pay were unreasonable, the miner points to the figures of those who have closely studied costs and says, "increased pay means increased efficiency." To those who say they object to dictation, the miner calls attention to conditions at Butte, the home of the union, and where the dictation of the miner in its broadest sense is recognized by the management and asks, "What questions have ever arisen there that have not been speedily settled to the mutual satisfaction of all parties concerned?" To those who argue that much of the underground labor is unskilled, the miner replies that the duties of these unskilled laborers are extremely arduous. In all of these arguments the miner has a powerful ally in the size of the graveyard on 'the flat'.

Those of us who understand the miner have learned to appreciate him though recognizing his faults. He is a generous, resourceful, and skillful fellow, who, when his work is carefully watched and he is kept 'broke', will turn out work, under disagreeable conditions, in a manner that is truly surprising. Fortunate is the shift-boss who has a crew of experienced miners, for then his work is so simplified that even a 'school of mines man' could almost do it. Fortunate is the foreman of such a crew, for he shall be warmly congratulated by the 'super'; and fortunate is the superintendent, for at the end of the year as he casts up results he will say, "Well done, good and faithful servants. On the results of this year's work shall the Board of Directors be induced to raise my salary."

Costa Rica, according to official statistics, exported $1,190,406 worth of gold and silver during 1911. This was an increase of $379,220 over the previous year. The principal producers were the Abangarez Gold Fields of Costa Rica and La Union Mining Co. Large shipments have been made by other mines, and this branch of Costa Rica's industrial development is progressing steadily. The hydro-electric plant of the Abangarez company was in course of construction during 1911 and was completed in March 1912. This plant, constructed by an American firm, makes 2000 hp. available, and will materially extend and cheapen the operations of the Abangarez company. La Union Mining Co. has been crushing steadily and has increased its cyanide plant. The export of gold and silver during each of the past five years is as follows (nearly all shipped to the United States): 1907, $520,056; 1908, $673,188; 1909, $792,847; 1910, $811,186; 1911, $1,190,406.

Rich placer deposits are being worked about 100 miles from Sansing, in central Manchuria, at Hua-pi-kou, Tai-ping-kou, Tiao-tze-kou, and Hei-pei-kou. Native methods are employed, and only the coarse gold is saved. About 400 people are employed.

Electrical Equipment at the Ohio Mill

By An Occasional Contributor

The new unit of the Lark mill of the Ohio Copper Co. will bring the total capacity up to 3000 tons per day. The selection of motors in the new unit was given more careful consideration than is usual in milling plants. The idea was to have as many motors duplicates of one another as possible and still choose motors fitted in type and capacity to the duty to be performed. Power for the mill is obtained from the Telluride Power Co.'s system and is stepped down from approximately 44,000 volts to 460 volts by three 500-kva. water-cooled transformers.

MOTOR FOR CRUSHER AND ROLLS. MOTOR DRIVE OF CHILEAN MILLS.

On entering the mill the ore is passed through two Blake jaw crushers. These are driven from a special 100-hp. mill-type motor known as the Westinghouse type 'MS'. This motor, which is of heavy, rugged, mechanical design, is similar to the motors used in steel-mill service, and is shown in one of the illustrations, in the immediate foreground on the right-hand side. In addition to its heavy construction, the motor has a high maximum torque compared to its rating; in fact, it will pull about 250 hp. momentarily. It is designed with a flat efficiency curve, with the highest efficiency at 100 hp., so that it will have good efficiency over its entire range, and its best efficiency at its average instead of at its maximum load. This fits ore-crushing service much better than the ordinary type of motor. Among the other equipment are four 50-hp. type 'CCL' motors, two of which drive a set of Gates rolls each. The other two drive elevators and trommels. Two 100-hp. motors of the same type each drive two Gates rolls. Eight 75-hp. motors each drive a 6-ft. Chilean mill. One of these is shown in the illustration.

This completes the crushing end of the mill. All motors are supplied with standard auto-starters, equipped with no-voltage releases and automatic overload relays, so that either in case of overload or failure of power the handles used to operate the auto-starters are automatically returned to the starting position. It is therefore impossible for any of these motors to be damaged by the power going off suddenly and then suddenly coming on again. The overload relays have a time element dash, so that momentary overloads within the capacity of the motor will not throw the circuit off. This is, of course, particularly desirable on crushing machinery. The Wilfley and Deister concentrating tables are driven by belting from small 20-hp. General Electric standard motors.

ALDRICH PUMP MOTORS. MOTOR-GENERATOR SET.

A pumping plant in connection with the mill is supplied with power from three 100-kva. Westinghouse transformers similar to those used for supplying power to the mill, except as to capacity. The pumping plant consists of three triplex Aldrich

plunger-pumps, gear-driven by a 100-hp. type 'CCL' motor. This plant is shown in the illustration. Ore is brought to the mill over an electric railway running through the famous Mascot adit. This is operated with General Electric locomotives, and power is supplied by two Westinghouse motor-generator sets, each consisting of a 225-hp. motor driving a 150-kw., 600-volt generator. These are shown in the illustration. The generators are interpole and operate at 1150 r.p.m. They are situated in the mill and are subject to much dust, but nevertheless have been handling the very variable load due to the railway, and including overloads as high as 200%, without any sign of distress.

Base Metal Production of Colorado

By P. H. Argall

The Arkansas Valley smelting plant at Leadville has four furnaces operating at full capacity, treating an average of 600 tons per day. The only mechanical improvement of note has been the installation of two 100-ton Dwight-Lloyd sintering machines which operate successfully. The ore supply has been more abundant than in any year since 1907, and huge stock piles have been built up in the yards awaiting treatment. There is now enough ore coming into the plant to supply five furnaces, but the fifth has not been blown in owing to the fact that there is an appreciable shortage of labor which prevents any increase at this time. Owing to the sailing of a large number of Greeks, Bulgarians, and southern European natives of belligerent tendencies, there is a scarcity in the labor market.

The Ohio & Colorado smelter at Salida had in 1912 the most successful year in its history. The plant is now treating 400 tons of ore per day. The chief mechanical change consists in the substitution of electricity for steam power, the plant having been electrified throughout. The large zinc separating and concentrating plant of the American Zinc Extraction Co. at Leadville, closed down early in 1910, has lately been purchased by the interests of the Sutton, Steele & Steele Dry Concentrating Co. It is rumored that the new owners will remodel the plant and make it available for treating low-grade mixed sulphides of the Leadville district.

Leadville has produced its usual quota of mixed sulphide ores during the past year, shipping them to the mills at Canon City and the Western Chemical Co. at Denver for treatment. Owing to the increased production of zinc carbonate, the zinc output of Leadville has been the greatest in many a year. The zinc smelters now take oxidized ores containing as low as 18% zinc, and large shipments of this material have gone forward. At Redcliffe the Eagle River Mining & Milling Co. has developed an immense shoot of low-grade sphalerite ore in Battle mountain. This ore is being treated at the rate of 100 tons per day at a magnetic mill in Eagle river canyon, which turns out about 30 tons per day of 45% zinc concentrate.

The Pueblo smelter operated at nearly full capacity throughout the year, but was somewhat hampered by lack of suitable silicious ores to offset the increasing receipts of concentrate. The Colorado Fuel & Iron Co. steel works at Pueblo had a very successful year, the output being valued at $15,000,000, as against $13,700,000 for 1911. The following table, compiled by the *Rocky Mountain News* from the various mill and smelter reports, gives an idea of the metal output of the chief lead and spelter producers of Colorado.

In total operations, including ores from British Columbia, Ontario, Arizona, Idaho, Montana, New Mexico, South Dakota, Utah, Wyoming, as well as the Colorado mines, the ore-treatment plants included in the metallurgy of Colorado gained $13,698,691 over the total returned for 1911.

	Gold.	Silver.	Lead.	Copper.	Spelter.	Total.
American Smelting, lead smelting	$ 6,192,856	$7,436,312	$6,406,798	$1,126,525	.....	$21,162,491
*United States Zinc, zinc smelting	.....	.....	.....	.....	$1,199,041	1,247,179
Ohio-Colorado, lead smelting	979,958	1,174,476	1,386,774	1,701,363	.....	5,242,571
Various zinc smelters	.....	.....	.....	.....	4,882,616	4,882,616
United States Mint, Denver	36,596,076	775,595	.....	.....	.....	37,371,671
Western Chemical, Denver, zinc	.....	.....	.....	.....	823,440	823,440
Wellington, Breckenridge, zinc	.....	.....	.....	.....	985,500	985,500
Iron Mask, Eagle county, zinc	.....	.....	.....	.....	460,224	460,224
Forester, Ouray, zinc	.....	.....	.....	.....	10,000	10,000

*United States Zinc plant at Pueblo produced $48,138 in zinc dust used at the cyanide mills.

Goldfields of considerable promise have been discovered not far from Tanga in German East Africa, according to *Koloniale Korrespondenz*. These are the first gold deposits as yet discovered in the immediate neighborhood of the coast, but in the interior of German East Africa the occurrence of gold has been proved in several places by more or less thorough development work. Two gold properties are now exploited with fairly remunerative results, one at Sekenke, on the western border of the Isamba Downs, about 475 miles inland, and the other at Nyasamo, east of Mpanza, near Lake Victoria. At the former property gold has been recovered with constantly growing profits since 1900, the gold contents of the quartz averaging about 1.6 oz. per ton. At the end of 1910 a 10-stamp mill was erected, and since has been uninterruptedly working. At present twenty Europeans and 700 native 'boys' are employed on the property. At Nyasamo a 5-stamp mill has been crushing at the rate of 10 tons per day since 1910. The ore reserves of the property are said to be ample, and the gold content satisfactory. The gold exports from German East Africa totaled, in 1909, $60,000; in 1910, $215,000; in 1911, $260,000. The gold production of the two mines is somewhat higher. The ore reduction methods are similar to those used in the Transvaal.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The State Mineralogist

The Editor:

Sir—Believing that for the good of the State Mining Bureau your readers will be interested in learning, as we have done, both sides of the controversy which resulted in the removal of W. H. Storms from the office of State Mineralogist, we have obtained, and are asking you to publish with this letter, the report of the State Board of Control dated July 25, 1912, but issued last month, and the statement of the Board of Trustees of the State Mining Bureau made January 17, immediately after the receipt of the Board of Control's printed report.

Referring to the first-named document, we are convinced of the truth of the statement contained therein, "that the annual appropriation of $20,000, set aside for the support of the bureau, brings very little return either to the mining industry or to the state at large." A perusal of both documents shows that this condition on July 25, 1912, was not properly chargeable to Mr. Storms, but to the legacy of loose methods and political favoritism left him by his predecessors. The Trustees' report of January 17 shows that Mr. Storms was doing his best to correct the system of abuses, and it seems probable that if he had been content to permit the continuance of the previous loose methods, the controversy would not have arisen and Mr. Storms would still be the State Mineralogist.

There was a time in the bureau's history when it was of real benefit to the mining industry of California, and we, in common with many others interested in that industry, have obtained information of value from its records and publications. But for many years it has been a political football, and it was this condition that we hoped to see remedied by the appointment of Mr. Storms, whose candidacy for the position we supported. We believe that if he had been given time and friendly, instead of unfriendly, criticism he would have brought about the necessary reforms in the Mining Bureau; but as support from the state administration was withheld, we believe he acted for the best interests of the bureau in giving up the fight to retain his position.

Referring briefly to the accusations of the State Board of Control, we find a statement that the funds of the bureau "have been handled in a loose manner." This charge has been quite fully discussed in the report of the Board of Trustees, which board, by the way, is responsible for the handling of funds. The State Mineralogist is not responsible for the handling of these funds. It is interesting to note, in the general report of the State Board of Control, that a page is devoted to the discussion of 'revolving funds' which are allowed 24 state institutions. There seems to be no logical reason for denying a similar fund to the State Mining Bureau. It is stated by Mr. Storms, and we believe it to be true, that not one cent of salary was ever paid to any employee in advance; and that the sums advanced were for legitimate contingent expenses, such as are provided for in the revolving funds of other state institutions.

The accusations regarding the donation of bureau publications to various institutions and persons, the alleged failure to catalog the contents of the museum, and the circumstances of Mr. Prutzman's employment by a previous board and retention by the present one, have been fully covered by the letter of January 17. This brings us to the charge that "Mr. Storms was frequently absent on trips to different sections of the state." On this point we conceive it to be one of the most important functions of a properly constituted mining bureau to collect and disseminate information regarding the mining resources of the state, and with this object in view, it is not only entirely proper for the State Mineralogist to spend a portion of his time visiting the mining regions, but it is absolutely necessary that he do so, if the bureau is to be properly conducted. He should not examine privately owned mining property for a fee, and it is not charged that Mr. Storms has done so; but, as most mining property in the state is privately owned, he cannot collect information without visiting mines so owned. Unfortunately, the financial limitations of the bureau prevent the maintenance of an organization for a systematic study of the state's resources, and it is therefore possible that little public good resulted from some of Mr. Storms' trips; but in one instance which we have in mind, we believe that his visit to a mining district with the timely publication of his conclusions regarding it, saved many times the year's cost of the Mining Bureau to the people of this and other states, and added materially to the honor of California as a field for legitimate mining investment.

In another instance Mr. Storms was in Bakersfield in consultation with the oil men regarding the water situation in the Midway field. This work was eminently practical and desirable, and was of more benefit to the state than any mere routine office work.

In conclusion, we wish to express our confidence in the honesty and integrity of Mr. Storms and in his ability as a mining engineer.

C. W. MERRILL,
ALBERT BURCH,
M. L. REQUA,
JOHN H. MACKENZIE,
F. W. BRADLEY.

San Francisco, January 24.

REPORT OF THE BOARD OF CONTROL

July 25, 1912.

His Excellency, Hiram W. Johnson,
Governor of California.

Sir—Through its accounting department the State Board of Control has completed an audit of the accounts and an examination of the affairs of the State Mining Bureau. At this time it is deemed proper to call your attention to certain matters and practices disclosed by the examination.

A general survey of the work of the State Mining Bureau

as conducted at present convinces the State Board of Control that the annual appropriation of $20,000, set aside for the support of the bureau, brings very little return either to the mining industry or to the State at large. It is also apparent from an examination of conditions at the bureau that radical changes in its conduct are necessary to bring about any beneficial results. The funds of the bureau have been handled in a very loose manner and without regard to legal restrictions; the aims to accomplish which the bureau was created have been lost sight of; employees who under an aggressive management could devote their time to accomplishing work of value to the mining industry, are busy only a small part of each day; and the result is that nothing of value is accomplished.

The manner in which the funds of the bureau have been handled can best be illustrated by the fact that when C. L. Avery, superintendent of accounts for the State Board of Control, arrived at the Mining Bureau to begin his audit he found cash on hand and in the bank amounting to $539.36, whereas there should have been $2,982.10. This discrepancy was represented by memoranda and tags recording loans and advances to the State Mineralogist and employees, payment of salaries and other expenses, none of which, with the possible exception of one, could be legally paid out of these funds. These funds on hand at the Mining Bureau represent, (1) the publication fund, which is made up of receipts from the sale of publications of the bureau, and this fund cannot be legally used for any other purpose than defraying the expense of printing and publishing publications; (2) a so-called 'revolving fund,' which has accumulated in the course of years, and should long ago have been deposited in the state treasury, as it was made up in large part of overcharges on payrolls, etc.; (3) a library fund of a small amount received from the sale of books from the library of the bureau, which also should have been deposited in the state treasury. These funds have no relation to the annual appropriation of $20,000 for the support of the bureau. These three funds were held in one account in a San Francisco bank. They were all checked upon for advances on salaries, loans, payment of salaries and other purposes. One of the tags, signed by W. W. Thayer, the bookkeeper and cashier of the bureau, was more than a year old. It was for the sum of $50 and was advanced ostensibly for the payment of freight on shipments of specimens to the bureau. No freight was paid out of it, and Mr. Thayer was required to return the $50 to the fund. Mr. Thayer also had other memoranda of advances to himself in the cash drawer.

Cash tags in the sum of $490.75 were deposited in the cash drawer in the name of Paul W. Prutzman, a mining engineer, who was supposed to be giving his entire time to the preparation of a bulletin on the oil industry of California. Mr. Prutzman's employment on this oil bulletin began during the incumbency of L. E. Aubury as State Mineralogist but has continued for seven months during the incumbency of W. H. Storms, the present State Mineralogist. Up to the present time there has been no result of this employment shown. The employment of Mr. Prutzman is of interest for several reasons. In the first place, the employment of Mr. Prutzman was illegal, because of the fact that there were no funds from which he could be legally paid; secondly, it had come to the knowledge of the State Board of Control that Mr. Prutzman, during the time that he has been drawing a salary and traveling expenses from the State Mining Bureau, and while he was supposed to be engaged in gathering data for an oil bulletin, was in the employ of another department of the state government for three months and collected fees for services rendered which took a large part of his time—this employment undoubtedly accounts for the fact that the oil bulletin has been long delayed; thirdly, the payment of Prutzman's salary and expenses out of the funds on hand was illegal, for the reason that two of the funds should have been deposited in the state treasury long ago, and the other could only be used legally to defray the cost of printing pamphlets and other publications. Mr. Storms showed little knowledge of what time Mr. Prutzman has devoted to the service of the Mining Bureau. The preparation of the bulletin has dragged along, Mr. Prutzman apparently being the sole person to determine what time he should give to the Mining Bureau for the salary and expenses paid. For the reasons above set forth, the State Board of Control has notified the State Mining Bureau that it will audit no further demands for salary or expenses for Mr. Prutzman.

Cash tags for various small amounts, signed by H. F. Williams, janitor, were carried against the funds for several months, but were taken up at the direction of Mr. Avery. Cash tags signed by Mr. Storms were also found in the cash drawer. They were not offset by any expense vouchers. Mr. Storms has been notified to take these up. The records of the bureau for traveling expenses show that Mr. Storms was frequently absent on trips to different sections of the State. Several of these trips, Mr. Storms explained, were made to visit mining properties owned by individuals on which he rendered expert opinions. It is plain that if the State were to maintain a department and pay the expenses for the investigation of mining properties for individuals, the demands would be such that many thousands of dollars would have to be appropriated annually for this one purpose. The absence of the State Mineralogist on these trips unquestionably accounts for the lack of aggressive action in the bureau.

As a department of the Mining Bureau, a museum is maintained in which have been collected thousands of specimens of valuable ores and minerals, together with a collection of relics of early mining days. This property is valued at many thousands of dollars. There is no record or catalog of the contents of this museum and no attempt has been made, either by Mr. Aubury or Mr. Storms, to take an inventory of this valuable property. The necessity of such a record is apparent from statements made by Mr. Storms to the effect that persons who had donated valuable specimens to the museum have complained that the gifts are not there. Because of the lack of records, there is no way to trace these missing articles. P. K. Swain and C. C. Selbie were successively employed as curator of the museum, but it is extremely difficult to ascertain what they accomplished in this position. Neither one made any attempt to catalog the exhibit.

Another department of the bureau in which matters have been handled in a loose fashion is that of the publications. Provision is made by law for the publication of pamphlets and bulletins which will be of value to the mining industry, and in order to provide funds the statute creating the State Mining Bureau requires that these publications shall be sold at the actual cost of printing them. By this means a revolving fund is established. A practice arose under the administration of Mr. Aubury, and has been continued under Mr. Storms, of giving away free of charge these publications to certain individuals and making charges for them to others. Many copies have been distributed to other mining bureaus and departments in exchange for similar works. To this there can be but little objection, but in many other cases these publications have been given to friends or acquaintances of the State Mineralogist, while the general public is required to pay.

In extenuation of the fact that many illegal charges were recorded against the funds of the bureau, Mr. Storms complained that the $20,000 annual appropriation was inadequate to the needs of the bureau. This board, however, respectfully advises your Excellency that the fault lies not in the amount of money appropriated, but in the manner in which it is expended.

The sole results of the activities of the Mining Bureau, so far as this board can learn, have been: the dissemination of some incomplete statistics, the making of determinations by the chemist employed, and the preparations of an oil bulletin by Mr. Prutzman, which has been heretofore referred to. If these are the objects of the maintenance of the State Mining Bureau, they can be attained in much more economical fashion. Complete and accurate statistics can be secured from the Federal Mining Bureau on request, the determining characters of ores is only sufficient

to keep one man busy, and it is apparent from the manner in which Mr. Prutzman has handled the assignment that the compilation of an oil bulletin does not require very close application. If these were the only objects to be attained, they could be accomplished for approximately $4000 or $5000, and there would be no need of maintaining a big establishment. As it is, the payroll alone of the State Mining Bureau is $15,540 per year, and the employees are only busy for a fraction of each day. It is apparent that there is no definite work outlined, and the employees simply put in time each day. The wide field of stimulating the mining, oil, and building material industries of the State receives only perfunctory attention. This work could be carried on with big results by an elimination of certain positions in the bureau, the reassignment of the work among the remaining employees, and the devotion of the salary money saved to a proper study and exploration of the particular resources of the State which fall within the jurisdiction of the bureau. The carrying out of these suggestions would tend to reduce the overhead cost in the office of the bureau to a reasonable basis and afford means of putting men in the field to prosecute the work of gathering accurate information, data and statistics. Absolutely no attention is being paid to this feature of the work at the present time outside of the employment of Mr. Prutzman.

Mr. Storms' complaint of the lack of funds is not strengthened by the record, which shows that the salary of Mr. Thayer was increased in June by $25 per month; the salary of the janitor was also increased; legal charges for publication were waived; Mr. Storms has felt that there were sufficient funds to warrant him in traveling from which the State received no benefit; Mr. Prutzman has been paid a monthly salary and expenses while devoting his time to other work.

Many of the practices which still obtain have gone on in the department for years, and the records show that the bureau has gradually been settling into a rut in which it is of little or no use to the State. This board has notified the Mining Bureau that the funds which have been illegally used in the past must be forthwith deposited in the state treasury, and that in the future all claims and expenditures will have to be made in accordance with the law and the regulations governing all departments of the state government. This board feels that such action will result in a proper restriction of expenditures, but that the matter of increasing the efficiency of the department is one which should engage the attention of your Excellency.

This report is respectfully submitted this 26th day of July, 1912.

JOHN FRANCIS NEYLAN,
Chairman State Board of Control.

REPORT OF BOARD OF TRUSTEES

January 17, 1913.

Hon. Hiram W. Johnson,
Governor of California.

Sir—We are in receipt of a copy of the first biennial report of the State Board of Control, in which we find a communication to your Excellency dated July 25, 1912, which contains various severe strictures upon the management of the State Mining Bureau. In another part of the work we find the following:

"Heretofore in this report reference has been made to the work which was necessary to eliminate graft, extravagance and wasteful methods in those state institutions and departments where these evils existed."

Then follows the name of the State Mining Bureau, among other institutions. There is nothing in this communication of July 25 making any direct accusation of any misappropriation of funds, or of graft, in the management of the affairs of the bureau, but the whole report taken together would have a tendency to create in the mind of a casual reader the impression that such accusations and charges had been made. This report to you is dated July 25, 1912, but as it is contained in a report bearing a much later date and which is published to the world on the first day of January 1913 it seems to speak as of the time of the publication of the report and consequently brings its criticisms and reflections down to date. With these considerations in mind, namely, that a false impression may not be created of the work of the Bureau, and as to the fidelity and integrity of its management, and that the facts may be presented as they exist today, we wish respectfully to make this statement to you so that the position of the bureau may be a matter of record as well as these charges against it.

At the outset we wish to say that it seems a remarkable thing to us that a letter dated July 25, 1912, should be published in a report issued on the first day of January 1913, when many of the matters contained in that letter have been the subject of official communcation and harmonious arrangement between the Board of Control and this Bureau since the date of that letter, especially with reference to the subject of payments out of funds in the hands of the bureau prior to the allowance of claims by the Board of Control and the receipt of the money from the State Treasurer's office. This was a custom of years standing, and while perhaps technically open to argument, seemed to be almost a matter of necessity if the work of the bureau was to be conducted. This was the subject of communication in a letter from the State Board of Control to our Bureau dated September 25, 1912, which we believe was the first official notification that we had that there was any objection to this practice, and in our reply to that, dated October 11, 1912, we advised the Board of Control that "though it may result in the crippling of the bureau and in the serious limitation of its work, we have to advise that the practice will be discontinued." Since the date of this communication no moneys have been paid out except as the same have been received from the State Treasurer on vouchers properly allowed by our bureau and the State Board of Control. The practice grew up under old administrations because it seemed for the best interest of the bureau. The State Board of Control, in discharge of its duties, called attention to its alleged illegality, and this bureau, having thus had the matter called to its attention, at once undertook to conform our system of handling our funds to the requirements of the Board of Control except as to the use by us of our donation fund, which we consider subject to our own control. We take it that the function of the Board of Control is to see that the law is observed and to correct abuses, and if it is aided in this regard by a cheerful acquiescence on the part of other boards and officers, we do not see why past acts which have been the result of custom, should be the subject of animadversion, criticism and even accusation.

Answering the seventh paragraph of the report, it states "that a tag signed by W. W. Thayer, the bookkeeper of the bureau, was more than a year old, that it was for the sum of $50 and was advanced ostensibly for the payment of freight on shipments of specimens to the bureau, and that no freight was paid out of it, and Mr. Thayer was required to return the $50 to the fund." This is a practical accusation of a diversion of State funds, and if it has that intention, it is untrue. It is true that Mr. Thayer did receive from the funds of the State Mining Bureau $50 and that the $50 was represented by his voucher therefor. The reason for his receiving this was that there had been in process of construction, in the quarters of the bureau, an exhibit of the structural materials produced in the State of California, to which exhibit Mr. Thayer devoted a good deal of time. All of the materials composing this exhibit were donated by the producers of the material. From time to time as these materials would arrive, draymen would come to the bureau building with the material, and the draymen had to be paid, or we could not receive the material for the exhibit. Realizing the awkwardness of this position, created largely by the fact that the State does not give us advance funds to use, this $50 was taken out of our donation fund, which has been in the bureau for over fifteen years. It is true that Mr. Thayer replaced this $50, but the replacement came from moneys sent to the bureau by donators of this building material, who in addition to

donating the material, had agreed to pay all freight and drayage charges as well as the cost of installation. This money was not used by Mr. Thayer for his personal use and was not returned from his personal funds.

It is alleged that loans were made from our funds to the State Mineralogist and employees, which is not a correct statement of facts. In no instance was money ever advanced except for uses of the bureau, and these were always made up by allowances by the Board of Control. The advances to the janitor, H. F. Williams, of which the Board of Control makes so much, at no time exceeded $2, and were advanced for carfare while running errands for the Mining Bureau.

In one respect this report seems peculiarly unjust to the present administration, because if an illegal employment was entered into, it was during a former administration of the bureau, and the present administration, unless it were to lose the fruits of the money already expended, was compelled to continue the work. We refer to the employment of Mr. Prutzman in the preparation of an oil bulletin. We fail to see, however, how his employment can be said to have been illegal. He was regularly employed at a monthly salary and engaged in scientific work for which the bureau was created. The question of the results obtained by his employment is not here involved. The proof that his employment, as a matter of fact, was not regarded as illegal by the Board of Control is evidenced by the fact that demands approved by the trustees of this bureau for Mr. Prutzman's salary for the months of May, June, July 1911, and February, March, April, May, June 1912, were approved and paid by the Board of Control. Furthermore, the Board of Control now has in its hands additional demands which it has not passed upon, and we have no record of any objection to these claims except some dispute as to the amount of time Mr. Prutzman was employed in the service of the Fish and Game Commission. In this report of July 25 it is stated that he was employed for some three months of time. This bureau knew of employment aggregating four days, and a deduction was made for that length of time. In our letter of October 11, 1912, to the State Board of Control we advised that we would take the matter up with the Fish and Game Commission, which was done. Mr. Prutzman subsequently went over his books and under a liberal allowance against himself figured out that he had been employed five days and one-half hour by the Fish and Game Commission, and that body was able to give us no different figures. We have repeatedly written the Board of Control asking for action upon this claim, and on December 14, 1912, we have a letter from this board stating that the matter would be taken up speedily now that the preparation of the budget was off their hands. Thus we see that while the Board of Control in its report of July 25 claims that Mr. Prutzman's employment was illegal, it has audited his demands and now has before it additional demands which are only disputed because of the uncertainty of his employment by the Fish and Game Commission. Does it seem quite fair that this should be included in the biennial report of the Board of Control in view of its own action subsequent to the date of its report?

In regard to the charge that the employees of the bureau merely mark time, we call your attention to the letter of the Board of Control to our bureau of September 25, 1912, in which it states that "it is known that the stenographer and at least one other employee of the bureau have a great deal of leisure time", so you can see that at this time the charge was limited to these two employees alone. In our letter of October 11, 1912, in answer to this, we wrote as follows:

"We have carefully gone over the list of our employees and have not been able to see how any member of the force could be dispensed with or how the duties which are assigned to the different members could be advantageously performed by other members." * * * "The members of the Board of Trustees of the State Mining Bureau devote as much time as possible to the supervision of its affairs, as is well known, without compensation, but as you are fully aware our sole desire is to get the best possible results from the expenditure of the State funds. If you have any information showing that our employees are not rendering value for their salaries, it will be of great assistance to us, and we would greatly appreciate it, if you would give us the benefit of this information." To this we never received any reply. Comment on this seems scarcely necessary. If the Board of Control had any such information, was not our bureau entitled to it? If the board had been actuated by the spirit of helpfulness, which all public officials should have, were we not entitled rather to friendly aid and suggestion than to hostile criticism in a public report which becomes a permanent record in the State archives?

The quarters of this bureau are always open on business days from 9 A.M. to 5 P.M., and all our employees are constantly busy. The bureau is used very extensively by the citizens of the State. We have a voluminous correspondence to attend to, and to accomplish the work assigned us by law keeps our present employees busy. The service rendered seems to meet the demands of the people and to fulfil one of the functions for which the bureau was created.

In regard to the trips which Mr. Storms, State Mineralogist, has taken for the examination of properties, in every instance, except one, these trips were previously authorized by this board. We have always endeavored to confine this work of the bureau to matters of general interest, but necessarily an examination of mining districts sometimes involves the examination of private property.

It is charged "that there is no catalogue or inventory of the museum and no attempt has been made by Mr. Aubury, former State Mineralogist, or Mr. Storms, to take an inventory of this valuable property." This is incorrect, for there is a catalogue of the museum in five volumes, and such catalogue has been exhibited to the chairman of the Board of Control. It is true that there is no inventory of this museum, any mining man knows that an inventory of a museum consisting of mineral specimens cannot be made, as there is no fixed market price for mineral specimens. The State is fully protected by the existence of the catalogue. This catalogue is kept up from day to day by the present curator of the museum, and each specimen is numbered and labeled to date. It is charged that the bureau gives away its publications when the same should have been sold. It is true to this extent, that this bureau has given copies of its publications to other institutions in exchange, and to prominent mining publications and newspapers; but the Board has always considered that while it has not received actual cash for these books, it has received many times their value by the publicity given by these journals to the mineral resources of the State, based upon information derived from these publications. Some copies have been furnished, free of charge, to public libraries, universities and schools of the State, but this bureau has not given away any publications to any person not giving to this bureau full value therefor.

The conclusions reached by the Board of Control as to the result of the activities of the Mining Bureau are so much a matter of opinion that it is difficult to answer this. We beg to say, however, that judging from the reception which the work of the bureau has always received, there is apparent uniform appreciation on the part of the public which would naturally be interested. Our bulletins and publications are eagerly sought for, and many, on account of the demand, are now out of print. The oil bulletin prepared by Mr. Prutzman, which is particularly mentioned, since the date of this report, as the Board of Control is fully aware, is now in type, and the last proofs are now in our hands for correction. It will make a publication of about 400 pages, and we have every reason to believe that it will be of great value to the State and a credit to the Mining Bureau. A very cursory examination of the bureau will show that there is a very small surplus left for general outside work after the regular expenses of maintenance are provided for.

Beginning with the month of July of 1912, a reduction was effected in the regular expenses of maintenance by dispensing with the services of two employees for whom there

was found to be no immediate use, thus making a monthly saving netting $175. Beyond this we have not found it possible to reduce the regular expenses of the bureau without crippling its efficiency. For some months we have not been engaged in any outside work, as we had hoped to undertake the preparation of a report on the iron deposits of the State. We now have on hand an accumulation approximating $2250 which we propose to use for this purpose. Finally, as to the work of the bureau, we wish to add that we have always sought to expend the State's money for the purpose for which it was appropriated. We believe that the existence of the bureau has been justified by the work which it has accomplished and that the great State of California would not be satisfied to rely upon the Federal Mining Bureau or other sources for information which it should furnish to its own people.

In conclusion, we would say that this report of July 25, first known to us through publications in the daily press in January 1913, was the more surprising to us as we have to bear testimony to a past uniformly courteous and considerate treatment by the Board of Control, as all of our relations, in the past, have been apparently most cordial. The differences of opinion between the two boards have been discussed most impartially and with entire good feeling on both sides. Where legal questions have been involved, we have always expressed a willingness to leave the matter to the authorized legal advisor of the State Boards, and on the other hand the Board of Control has urged its views with an unexceptionable fairness. As to the feeling of the board toward this bureau, we have its own assurances, for on October 18, 1912, in a communication to us, the State Board of Control, over Mr. Neylan's own signature, states, "In conclusion, we beg to assure you that the Board of Control has not indulged and does not now indulge in any criticism of the members of your board, knowing that you gentlemen have had the sole desire of obtaining the best results possible for the State." With this presentation of the facts and with this expression of opinion by Mr. Neylan, the writer of the report of July 25, this board is content to go on record.

We believe in justice to the State Mineralogist and the employees of the bureau, that this answer should be transmitted to the Senate and Assembly of California.

Respectfully yours,

A. H. Ward, President;
Henry E. Monroe, Secretary;
E. C. Hutchinson,
Calvert Wilson,

Sorting Out Waste

At the Schoenherr-Walton mine, Webb City, Missouri, it has been found profitable to pick out the waste rock before it goes through the crusher. After being hoisted the ore is dumped into a hopper and passes over a grizzly. Here the first picking is done, this being the common practice in all the mills of the district. After leaving the hopper, however, the ore is again picked before it goes to the shaking-screen, through which the undersize passes to the crusher. At first a wheelbarrow was used to remove the waste, then a tramway over which was operated a car, but as the quantity of the waste taken from the screen exceeded expectations, it was deemed advisable to construct an extra hopper into which the waste material is thrown direct from the screen. From the hopper it is removed by an inclined tramway that leads to the waste pile. Two men are employed in picking out waste. Each saves on an average of 25 tons of barren rock daily from going through the mill. The wage of each is $2.25 per day. The cost-sheets of different mines for running a ton of ore through the mill after leaving the hopper vary, but 24c. per ton may be said to be a fair average. The saving in dollars and cents is comparatively small, being slightly under $4 for each workman, but considering the wear and tear on machinery, and the fact that the finer ore is milled much more rapidly than would be the case where larger particles are permitted to enter, the saving is much greater.

Special Correspondence

LONDON

Dressing of Tin Ores.—New Methods.

Some of the meetings of the Institution of Mining and Metallurgy have an unfortunate tendency to be dull and unprofitable. This is usually the case when a carefully prepared paper in the form of a treatise is presented by a past master. For instance, A. J. Clark and W. J. Sharwood's valuable record of metallurgy at the Homestake suffered from neglect in this way a month ago. As a contrast, the paper presented by W. Fischer Wilkinson this month was as a spark to tinder. A vast crowd was there and tongues were generously unloosened. The title of the paper was, 'On the Dressing of Tin Ores in Cornwall.' During his two years tenancy of the principalship of the Camborne Mining School, Mr. Wilkinson learned a good deal himself. His previous chief work, as a member of the engineering staff of the Consolidated Gold Fields of South Africa, naturally did not afford him much scope for obtaining experience in the dressing of tin ores. His paper showed signs of gaps in his acquaintance with his subject, and included a large amount of matter which makes the reader exclaim, *Connu!* For instance, his disquisition on the faults of the vanning-shovel and on the necessity of making a real chemical test of tin ores, reminded his hearers of the proverbial killing of the dead dog; and in his bibliography on this department of his subject he failed to make mention of the famous article by Richard Pearce, which is in fact the classic. However, the whole of the paper was not valueless, for a useful service was done to metallurgical practice when Mr. Wilkinson commenced to study extraction and classification. The most vital item in the paper was the result obtained by coarse crushing. Mr. Wilkinson crushed with stamps having a 4-mesh screen, and obtained as a first concentrate on a Buss table 42% of the cassiterite in the ore, in a concentrate assaying 32% metal. The screen employed was made of wire of less diameter than the width of the hole, and the aperture was probably $^3/_{16}$ in. The Buss table acted as a classifier as well as a concentrator, and it was possible to obtain three other products. His scheme for subsequent treatment involved sizing, classifying, and re-grinding, and one of the ultimate products, part of the coarse sand, could be rejected as too poor to re-treat. Owing to limited resources in the way of plant, he was unable to obtain satisfactory results, but the experiments should eventually lead to something useful. It has commonly been supposed that Cornish ores require fine grinding because the particles of cassiterite are fine, and Mr. Wilkinson's recovery with so coarse a mesh is notable. Other mine managers in Cornwall have discovered that past practice is not infallible, and notable among them is Josiah Paull, of South Crofty, who uses 14-mesh. At the Geevor mine, stage-crushing with Hardinge mills instead of stamps is being tried, and the results are most promising. Details will be forthcoming for publication before long.

CRIPPLE CREEK, COLORADO

Milling of Ores.—The Clancy Process.

Of the 530,000 tons of ore shipped out of the Cripple Creek district last year, approximately 70% was treated at the Golden Cycle mill at Colorado City, 20% at the Portland mill, and 10% by the smelters. The open rates under which ore is now shipped to these mills are as follows: Under ½ oz., $4 per ton; ½ to ¾ oz., $5; ¾ to 1 oz., $6; 1 to 1¼ oz., $6.25; smelter, 1¼ to 1½ oz., $6.50; 1½ to 2 oz., $7; 2 oz. and over, $8. On account of a surplus of concentrate the smelter grade ore begins at 1.25 oz., and a considerable tonnage of ore of this grade, or a little better, was smelted. In the district the method of treatment worked out originally at Stratton's Independence, Ltd., has become the standard of practice, the new Port-

land mill having accepted the last step, reconcentration, during the past year. No more is heard of secret processes or patent nostrums, and steady work is the order of the day. The new Portland mill treated 170,000 tons of ore during the year, and Stratton's Independence treated 117,500 tons, all material regarded as worthless a few years ago and averaging about $3.10 per ton.

The big excitement promised for last year, the Clancy process, has nothing to report. Owing to poor construction, the crushing plant had to be torn down and rebuilt, and various parts of the mill proper overhauled, while the fact that there is nothing to make public after 8 months run is a good criterion of the metallurgy attempted. It is but fair to say that Mr. Clancy did not have charge of the work at the Ajax, hence it is not certain that it was the Clancy process that was standing trial.

Of the lesser mills, those treating oxidized ores chiefly, the Kavanaugh at the Joe Dandy mine has had a most successful year and is reported to have returned its cost to its owners in 10 months operation. The Blue Flag mill of the Blue Flag Mining Co. has handled about 4000 tons during the year and is apparently successful, while the Wild Horse mill has maintained its regular rate of 50 tons per day, at a profit. An increase in the amount of low-grade ore handled in the district may be expected, and, in all probability, more mills along the lines of the Stratton's Independence and new Portland will be erected. Some sort of showing will probably be made by the Ajax mill with the Clancy process, so that, metallurgically, the outlook is bright.

JOHANNESBURG, TRANSVAAL

COAL-MINING INDUSTRY.—TIN MINING.

It is not generally recognized that the coal-mining industry of the Transvaal has become second only to gold in importance and total value, having now passed the diamond-mining industry. This is entirely due to the steady growth of the business transacted, for the selling price per ton of Transvaal coal has continued to decline. In October, 426,277 tons of coal was sold at prices at the collieries ranging from 3s. 9d. to 5s. 2d. per ton in the different districts.

Tin has had an unexpected setback in the Transvaal, for in October the value of the concentrate shipped was only £28,940, which, as a matter of fact, despite the higher prices now ruling for tin, is little more than half the highest total monthly value of concentrate shipped a year ago. For the past two years it has been confidently expected that the tin-mining industry of the Transvaal was in for some good times; in fact, nothing short of a 'boom' was at one time predicted, and large tin-mining areas in the Northern Transvaal were in consequence secured. Tin-mining in the north has, however, fared badly, largely due to the erratic manner in which the metal occurs. Several mines have started under what seemed at first promising conditions, only to find that the tin deposits were very irregular, and 'ore in sight' could only be considered tantamount to 'ore at grass.' There are only two mines of any importance now producing tin in the Transvaal; one, the Rooiberg, is a fairly consistent producer, while the other mine, at Zaaiplaats, by far the richer of the two, is quite the reverse. Some time ago the consulting engineer, in consultation with the acting manager, estimated the ore reserve as 114,000 tons of 4.5% tin, but a year's milling has shown that this calculation of the consulting engineer was overestimated to the extent of 69,670 tons. It was the same consulting engineer who, in reporting upon the prospects of the first discovery of tin in the Transvaal, ten years ago, at Vlaklaagte, made the astounding assertion that the Vlaklaagte tinfields would more than rival in importance the goldfields of the Rand. After a few months' prospecting, the tin gave out at Vlaklaagte and the field is now completely deserted. At the present time, owing to the erroneous estimate of the tin reserves at Zaaiplaats, the shares have fallen from £4 to about £1, and considerable injury has been inflicted upon what promised at one time to become an important tin-mining field in the Transvaal. Whether the field will recover from the effects of this mistake will depend to a large extent on future discoveries, but today's experience is that, where so many disappointments have occurred, there is little disposition to supply the capital needed to make such discoveries.

MEXICO

PETROLEUM PRODUCTION.—SALE OF THE PALOMA AND CABRILLAS.

The petroleum production of Mexico in 1912 is estimated by Thomas H. Bevan, vice-consul at Tampico, at 20,000,000 bbl. He reports that in the first 9 months of the year the exports of Mexican oil to the United States totaled 4,237,307 bbl., with an invoice value of $2,632,911. The big wells of the Tampico territory show no signs of diminishing supply, and as new wells are being brought in and the facilities for marketing oil abroad are being increased, the output during the present year is certain to be much greater than in the year just closed. The gross sales of the Doheny interests in November amounted to $451,349, as against $353,887 in October and $324,759 in September. These companies expect to increase their exports to the United States this year, and to make important shipments to Brazil and other South American countries. It is authoritatively reported that the British Government has made a contract with the Pearson interests for the delivery of 1,000,000 bbl. of oil for the British navy, and that 29 oil-tank steamers are now building in British shipyards for the Mexican trade. The majority of the steamers are for the Pearson's Eagle Oil Transport Co., which has just placed two of nineteen new tank steamers in commission. The Anglo-Mexican Petroleum Products Co., the export selling concern of the Pearson interests, has just secured from the Barbadoes Government an exclusive privilege, for 25 years, of maintaining a ship fueling station at Bridgetown, and it is stated that this will be the first of a chain of stations extending through the West Indies and along the east coast of South America. The report of Pearsons' Mexican Eagle Oil Co., the operating concern in Mexico, for the year ended June 30 last, shows a balance at the credit of the profit and loss account of $4,264,942.57. During the year the company acquired, by purchase and lease, over 20,000,000 acres additional.

POTRERO GUSHER, VERACRUZ.

The recent purchases of the Paloma and Cabrillas mines in the state of Coahuila were made directly by the American Metal Co., Ltd., which is closely associated with the

Peñoles Mining Co., the concern operating the principal mines and the smelter at Mapimi, Durango. The price paid for the Paloma was ₱2,000,000, and for the Cabrillas $1,200,000. The same company has taken working leases on the property of J. J. Murphy at Cedral, Coahuila, and on the Florida mine in the Bajan district of that state. Much interest attaches to the working option on the Noria mine in the Sombrerete district of Zacatecas, granted by the Noria Development Co. to the Camp Bird interests of London, which control the big Santa Gertrudis enterprise in the Pachuca district of Hidalgo. If the purchase is made it will mean heavy expenditures for extensive development and for mine and mill equipment. The completion of the Durango-Cañitas line of the National Railways, now under construction, will give a great impetus to mining operations in the Sombrerete district.

In December the El Favor Mining Co. shipped from the El Favor mine in the Hostotipaquillo district of Jalisco 386 tons of high-grade ore, having a value of ₱62,635, and milled 1143 tons of ore that produced ₱17,418 in bullion and concentrate. The total profit on the month's operations was ₱51,070. The company's 20-stamp mill ran 87% of the possible time, crushing a total of 1967 tons of mixed ores from the El Favor, Mololoa, and Mirador mines, all Makeever properties. The value of the bullion and concentrate produced was ₱43,874. The Amparo Mining Co., operating in the Etzatlan district of Jalisco, is putting in two additional Krupp tube-mills, making four in all. It is expected that the new tube-mills will make it possible to increase the tonnage handled from 7000 to at least 7600 per month. In 1912 the Amparo company earned a big surplus over its dividend disbursements of $240,000.

NEW YORK

COPPER METAL SITUATION.—COPPER PRODUCERS AND BUYERS. —GRANBY AND HIDDEN CREEK.

As a striking instance of a retreat by the strongest of financial powers, the recent movements in copper metal stand out. During 1906 and the early part of 1907, when copper metal climbed to record prices, the consumers for the most part helped the movement. The 'right about, face' in the attitude of the consumer exemplifies typically the general change in temper. The movement in copper which carried the metal, broadly speaking, from around 12c. to a recent high mark of 17¾c., has been fought stubbornly and almost universally by consumers, and this unyielding attitude is emphasized by the fact that recent concessions which have brought quotations down to 16c. have signally failed to enlist any but the most grudging support. It is hard to imagine how a situation could have been more frequently or more thoroughly analyzed, and it seems wonderful, even at this time, after an incomplete but decided retreat has been made, that the stand taken by the consumer could have to this extent triumphed over an organization so strongly entrenched and commanding such limitless resources. It is quite evident that a common meeting ground for the opposing forces in copperdom has not been reached, and the peg will have to be moved still lower before the buyers will come into the market in anything like their wonted numbers.

The Shattuck-Arizona has made itself a feature of the Boston market by officially announcing the opening of a very rich body of copper ore on its 300-ft. level, the ore carrying a high content of silver. To make the news really worth while, the company is paying a dividend of 50c. per share and will soon be increasing its earnings by added shipments when the enlargement of the Calumet & Arizona smelter is completed. The Chino dividend is still a matter of rumor. There has been some talk of a quarterly payment of $1 per share, but the market action of the stock would seem to indicate a smaller disbursement. The figures of the U. S. Geological Survey covering copper production for the year 1912 estimate copper output for the year at considerably above any record in the history of the industry, being 1,249,000,000 lb., as compared with 1,097,232,749 lb. in 1911.

The Granby has been so successful in its 'coming back' that it would seem that the last word had several times been written. In December 1910 Granby paid a dividend of 1%, since which time the shareholders have been without returns upon the investment, and in addition have had to go through some rather nerve-racking experiences. After several meetings and some lengthy considerations, the directors have declared a dividend of 1½%, and what is of even greater importance, have issued a call for a special meeting to ratify the issuing of $5,000,000 in 6% ten-year convertible bonds. It has been a much-discussed question as to whether the Granby's new developments at the Hidden Creek property should be paid for out of earnings and the stockholders be deprived of all revenue, or whether there should be some new financing. It is now stated that this latter course has been decided upon, only because of the magnitude of the showing at the Hidden Creek mines. The statement is made that the ore developed at the Hidden Creek mine has a value greater than that of the ore mined from the Granby property since the beginning of operations. Granby's production has ranged from 14,000,000 to 21,000,000 lb. per year since 1905. On this basis there would have to be developed in the new property ore that would produce some 150,000,000 lb. of copper to make good this statement. Taking into consideration the comparatively short time which has so far been spent in the development of the Hidden Creek, this property will have to be immediately recognized as one of the potential big producers of new copper. Granby's new bond issue has been underwritten, and only $1,500,000 will be issued at this time, the remainder to be used as needed. These bonds are to be convertible into common stock at par.

Of especial importance to mining interests in the larger sense is the outlook for silver. The consensus of opinion seems to be that silver producers may expect a continuance of present prices and possibly some slight enhancement rather than otherwise. Purchases by the Indian Government in 1912 amounted to £6,000,000, this being the first silver bought for coinage into rupees since 1907, and, notwithstanding the recently developed tendency of the Indian Empire to hoard gold, the commercially prosperous conditions of the Empire point to the necessity of further purchases for coinage during the coming year. An equally important, but possibly more uncertain element, is the situation in China. The recent unrest in that country has had its effect upon the volume of commerce, but with restored tranquillity the needs of the country are certain to be greatly augmented, as for some time to come it will be impossible for China to get on any kind of an organized credit basis.

Comment has been made in this column from time to time on the development of hydro-electric power, and the measures put into effect to create a new and greater demand for the product. Along this line it is interesting to note that the Washington Water Power Co., the headquarters of which are in New York, is making negotiations looking to a revival of the Republic mining district, Washington. The present plan includes the purchase of one or more of the larger mines and the erection of a concentrating plant large enough to treat the ores of the district. The Washington Water Power Co. is one of the organizations of White, Weld & Co. and controls the public utilities of Spokane, furnishing power from three power-stations on the Spokane river, having a capacity of about 70,000 hp. at present.

It is announced that the merger which was to take in the Giroux and the ground of the Copper Mines Co. has been declared off. This is something of a disappointment to Ely, as it was hoped that the new concern would build another smelter and fill a larger place as an independent producer of copper. The litigation brought by the Stewart Mining Co. against the Ontario has ended adversely for the Heinze company. Shareholders who got in on the recent rise in the stock have been disappointed in the failure of the company to take any definite action in regard to dividends. The Stewart company has been operating a

mill owned by the Federal Mining & Smelting Co., and it is now stated that as the Federal is likely to need greater milling capacity, the Stewart may be compelled to erect a new mill of its own.

SEWARD, ALASKA

Willow Creek.—Road Construction.—Power and Fuel Supply.

Willow creek, in the Susitna River district, was first prospected by the Barthoff brothers about seven years ago, who discovered the claims which now comprise the property known as the Gold Bullion Mining Co. This discovery was shortly followed by others made by Robert Hatcher, and other prospectors, of claims now owned by the Alaska Free Gold Co. and the Alaska Gold Quartz Co., on Fishook creek, a tributary of the Little Susitna river. Later discoveries were made on Arcnangel and Fairangel creeks, which really form the headwaters of the Little Susitna river. Willow creek is a tributary of the Big Susitna river, emptying into that river from the east.

This district covers an area of about ten miles east and west and about two miles north and south. It is one of the most mountainous in southwestern Alaska, the ranges being extremely rugged and precipitous. The prevailing country rock is a variety of granite, and the orebodies occur in fissures of varying widths from a foot to about two feet. These can be traced by their outcroppings for very long distances without a break. On Willow creek and Fishook creek the dip of these veins, so far as it has been exposed by working, is quite flat, but on Archangel and Fairangel creeks the dip varies from 36 to 70 degrees.

The first gold produced from the quartz in this part of Alaska came from Willow creek, where the surface ores were so extremely rich that in 1909 there was quite a stampede to secure properties. Small stamp-mills were erected on the Gold Quartz and Free Gold properties so that during the season of 1912 they, in addition to the Gold Bullion, were regular producers. These properties were recently examined, but owing to the fact that the Free Gold had been leased for a term of years and that satisfactory arrangements could not be perfected with the lessee, it is reported that the deal has fallen through. From the best information obtainable, production to date from these three properties is in the neighborhood of $150,000.

Until last year the only means of transportation to any of these properties was by pack train, and the fact that they are all six or seven miles from any timber as well as the fact that the mills are run by water-power furnished by small streams, is the principal reason why operations have never been conducted except during the summer months, which of course is a serious handicap. During the summer of 1912 the Alaska Road Commission constructed a first-class wagon-road to connect these properties with tidewater at Knik, some 35 miles distant, and it was the expressed intention of Milo Kelly, the manager of the Alaska Gold Quartz Co. to construct permanent buildings during the coming season and make arrangements to operate in future during the winter. The three companies, it is understood, are endeavoring to come to some arrangement to develop hydro-electric power on the Little Susitna river for the generation of electricity and a transmission system not only to their own properties but also to any others in the district, as the flow of the stream to be developed is ample to furnish motive power for the entire district.

Although development work on the claims on Fairangel and Archangel creeks has been almost insignificant in quantity, yet the outcrops of good-grade gold-bearing quartz, worth $15 to $100 per ton, are sufficiently extensive and persistent to warrant the owners in carrying on much more extensive and systematic development. During last summer an orebody was discovered on a property near Fairangel creek that is apparently an extension of a narrow vein that had already been prospected on an adjoining claim about 1800 ft. distant. But an enormous rock slide that in places reaches a depth of 100 ft. prevents any prospecting to determine whether the latest discovery is an extension of the earlier one. During last season considerable prospecting was done by old timers and several locations were recorded on which gold-bearing quartz was discovered. Assay returns from samples invariably showed the ore to be high grade, but the extent of the bodies so far as at present known indicate a number of small mines rather than large bodies of ore.

The fact that the Matanuska coalfields are situated only about 20 miles east of the headwaters of the Little Susitna river is another reason why not only this district but the entire Kenai peninsula from Seward to the Talkeetna should receive attention from prospectors and capitalists. Of course the withdrawal of coal lands and the cancellation of entries has worked a hardship, especially in this district, so as to cause capital in the past to be averse to making investments, but everybody hopes that this policy will soon be changed. When that is done and mine owners can procure the necessary fuel at reasonable cost, the fact that a quartz mine is seven or eight miles from timber will be immaterial.

BUTTE, MONTANA

Butte & Superior.—Electrifying the Milwaukee.

The zinc concentrator of the Butte & Superior Copper Co. is now treating about 500 tons per day of ore averaging close to 20% zinc. The extraction, independent of the flotation plant, averages 70% of the zinc content, and 50% concentrate is being shipped to Bartlesville, Oklahoma. As it is generally conceded that the mine has in the neighborhood of 2,000,000 tons of ore which will average 18% zinc, the property gives promise of soon entering the dividend class.

As the plans for electrification of the Chicago, Milwaukee & St. Paul railway become matured, it is evident that they represent some big advances in transportation ideas and power economy. The system is being evolved by capable experts, and success is probably beyond question. It is apparent that the present work is only preliminary to the final electrification of all the Milwaukee lines throughout the West, and no doubt the other railways will follow suit just as soon as they realize the success of the system, and as soon as they can make the necessary arrangements for power. Of course, the hydraulic power available is not sufficient to operate all the railways, but the railways will probably be electrified just the same, additional electric power being furnished by power-plants at the coal mines. These changes herald the way for the use of Western coals in gas-engines in place of the present wasteful steam-engines. For the time being, however, railway electrification will mean curtailing Western coal production.

Some features in the Milwaukee plans are worthy of mention. The braking of trains on the down grade is to be accomplished by running the motors on the engines as dynamos, feeding the current thus generated back into the transmission systems. This will mean smoother movement than with the present friction-brake system, and will be a factor in power economy. The 3-phase alternating current from power-plants will be transmitted at 100,000 volts to numerous rotary transformers along the railway lines. From the transformers direct current will issue to the feeding lines at 2400 volts. Overhead trolley wires have been selected in preference to the third-rail system, which would be troublesome to operate in the deep snows of winter, and is more dangerous. The change to electricity over the 450 miles of main line from Harlowtown, Montana, to Avery, Idaho, will be completed in three years at an estimated cost of $8,000,000. A standard type of locomotive will be in use for both passenger and freight trains. These locomotives will be able to handle the regular trainloads of 2200 tons on a 1% grade, using an additional engine for steeper grades.

Several important economies are claimed for the new system. The present steam locomotives require inspection and overhauling after each 125 miles run; the new electric locomotives can run more than twice as far without inspection. While waiting for trains, steam locomotives consume 80% as much coal as they do when pulling a train; electric locomotives consume power only when in operation.

General Mining News

ALASKA

Valdez

The Fidalgo Alaska Copper Co. recently made a shipment to the Tacoma smelter and will probably continue to make regular shipments from this time.

The George W. Sals Syndicate, of Boston, has made a payment of $147,000 on 14 claims on Valdez creek, bonded some time ago. The same people have an option on 20 bench claims near the same creek, $10,000 on each claim being due on January 1, 1914. Competent engineers report that the extensive gravel deposits on Valdez creek will average 50c. per yard. So far work has only been done in a desultory manner.

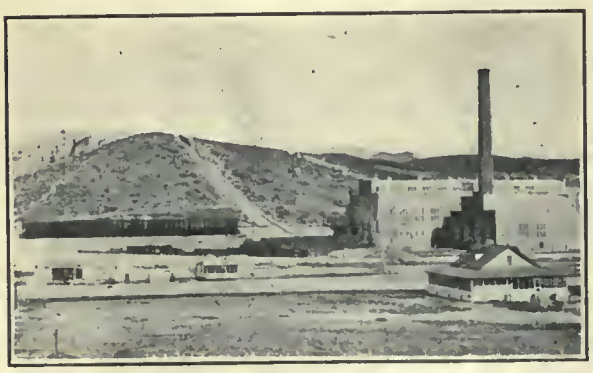
ARIZONA

Cochise County

The Shattuck mine produced 1,105,526 lb. of copper, 9538 oz. of silver, and 16 oz. of gold in December, and shipments to the Calumet & Arizona smelter at Douglas total 250 tons per day. When the new plant of the Calumet & Arizona is finished, the output will be 500 tons per day, under a five-year contract. Lead ore is being sent to El Paso from the 300, 400, 500, and 600-ft. levels, and it returns 40% lead, 3% copper, and $7 per ton in gold and silver. About 500 tons per month will be shipped. The mine employs 225 men, 190 being underground, and development covers 900 ft. per month. On the 300-ft. level a rich ore-shoot was recently opened, yielding 30% copper and $25 per ton in gold and silver.

Gila County

(Special Correspondence.)—At present the Inspiration Consolidated Copper Co. is employing 270 men underground



MIAMI POWER-PLANT.

and 40 on surface work. This force is merely employed at the preparatory mining work, the hundreds of men engaged in the mill construction and railroad grading being employees of contractors. The last measurement taken in the inclined shaft showed it to have reached its objective point, the 3480-ft. or upper tram level. It has been decided to continue the inclined shaft to a depth of 100 ft. below the upper tram level for the purpose of permitting a raise from that depth to the 3480-ft. level, where a 180-ton waste-pocket will be cut, the waste to be dropped through the raise and lifted through the inclined shaft to an npper level, through which it will be conveyed to the surface. At the millsite the steam-shoveling and blasting already have made heavy inroads on the 300,000 cu. yd. of earth which must be removed before H. Kenyon Burch can hegin construction on the 7500-ton mill. Fourteen draftsmen are engaged in the task of designing the plan and details of the concentrator. Because of the similarity of ores in the Inspiration and Miami properties, the Inspiration will be modeled to a great extent upon the plan of the Miami concentrator.

The completion of the new 500-ton unit of the Old Dominion concentrator depends on when the shipments of steel come through from the East, but if there is no delay the concentrator will be running in the late fall of this year. Excavation for the crusher plant is completed, and the forms are in place for the concrete. Excavation work is proceeding at the site of the sampling mill and concrete ore-bins. The foundation for the new Nordberg compound-geared hoist at the 'A' shaft was completed early this month, and is ready for the hoist, which has been delayed in shipment. There are no new important developments underground to report, although work has been started cutting pockets on the 800 and 1200-ft. levels. The ore-bins at the Kingdon shaft consist of four 100-ton capacity pockets, or 400 tons in all. A new air-line will be laid from the O. D. smelter power-plant to the Kingdon shaft, and the air will be reheated before use in the hoist.

Miami, January 25.

During December, development at the Inspiration Consolidated mines covered 3780 ft. in the Inspiration and 470 ft. in the Live Oak area. The drifts being driven to connect the Joe Bush and Scorpion shafts have made connection. Under 1100 ft. remains to be driven to connect the drifts between the Colorado and Scorpion shafts. Surface work for the railroad construction, grading of millsite, and erection of buildings continues with much energy. At the Miami, Chilean mills are being replaced by Hardinge conical mills. In the Superior & Boston mine, development is being done on the 600, 800, and 1000-ft. levels. The Gibson Copper Co. shipped 262 tons of 18% copper ore to the Old Dominion smelter at Globe in December. The raise for the 600 to 400-ft. level is finished. The Summit adit is in 800 ft., and will be driven to connect with the Summit shaft, from which the Pasquale vein will be opened.

In December the Iron Cap produced about 450 tons of ore averaging 6.5% of copper and 4.5% of iron, and sent it to the Old Dominion smelter. The Williams shaft is 800 ft. deep, and 35 men are employed. The shaft of the Arizona Commercial Co. has been repaired to 800-ft. depth. A large steel head-frame has been removed from the Eureka to the Copper Hill shaft. In a north drift from the adit, the new Dominion mine has opened 12 in. of chalcopyrite assaying 23% of copper. The Magma Copper Co. is opening rich bornite ore on the 800-ft. level.

Mohave County

The United States Smelting, Refining & Mining Co., which owns the Gold Road mine, is employing 200 men, and the monthly yield is over $70,000. The mine shows an ore-shoot 300 ft. long, and during the current year the company expects to make good profits.

Pima County

C. A. Schrader, who has recently visited the Ajo district, 80 miles southwest of Tucson, states that 400 men are working there. The Calumet & Arizona company has six diamond-drills working, while other companies are prospecting claims.

Santa Cruz County

At the Chiefs mine, in the Patagonia district, an adit was driven to cut the World's Fair vein, and at 411 ft. 5 ft. of ore averaging 48% of lead and 1600 oz. of silver was opened. A winze sunk 28 ft. is still in ore, and at 75 ft. stoping will be started and ore sent to El Paso. The present workings are about 280 ft. above the World's Fair. The latter's owner, F. Powers, has let a contract for 500 cords of wood.

Yuma County

At the Swansea smelter a reverberatory furnace, 19 by 108 ft., is being built, and the monthly production of copper is 600,000 lb., mostly from custom ores.

CALIFORNIA

Amador County

During the six months ended December 31, 1912, the Bunker Hill mill crushed 34,941 tons of ore in 176 days. The condition of the mine is satisfactory, and dividend No. 79, of 5c. per share, was paid on January 15.

Inyo County

The 20-stamp mill of the Skidoo mine has been shut down

owing to the 29-mile pipe-line bursting in several places, due to the reecnt cold weather. The water for the Skidoo district comes from Jail canyon at the foot of Telescope creek, across the desert, at a high pressure.

HUMBOLDT COUNTY

(Special Correspondence.)—The Oro Water, Light & Power Co. has taken 15,000 acres of gravel land under lease from the Orleans Mining & Development Co., and is arranging to prospect with a Keystone drill. The larger portion of this area has been worked by hydraulic methods by the Orleans company, but large deposits of the gravel are at a depth unsuitable for extraction by this method. About 1000 acres comprises virgin ground, and has been extensively hand-drilled. If prospects prove sufficiently good, the Oro people plan the erection of a bucket-elevator dredge, costing approximately $75,000. It is understood the company is contemplating the building of an electric-power plant, as abundant water is available. This marks the first practical attempt to dredge gold placers in this county, and the project is arousing considerable interest. The property is situated near Orleans, at a point close to the Siskiyou county line.

Eureka, January 18.

KERN COUNTY

(Special Correspondence.)—Andrew Nixon reports the discovery of a rich vein of white scheelite in his recently acquired White Flower property. A shaft is being sunk. The Atella Mining Co. is developing the Churchill and East Union claims. The former has been opened to a depth of 600 ft., and the latter about 250 ft., by shafts. The mill is operating steadily with three shifts. It is reported the Yellow Aster Mining Co. is contemplating a further increase in its working force. The company has paid $1,111,879 in dividends, of which $50,000 was disbursed in 1912.

Randsburg, January 19.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—J. C. Bell & Co., owners of the Josephine mine on Kelso mountain, are considering the construction of a small blast-furnace to treat the lead ore exposed. It is stated that a force of 30 men will be at work by March 1. Connors & Co., leasing on the La Plata mine on Democrat mountain, started a shipment of 15 tons of first-class ore this week. Returns of 400 oz. of silver per ton are expected. S. L. Work, operating the Pioneer mine on Covode mountain, is operating the new 10-stamp mill on one 12-hour shift. A high saving of metals is reported.

Georgetown, January 20.

At the Capital mine both the company and lessees are busy on development, and mining ore. Three cars of ore worth $20 per ton have been shipped from the Gold Fissure mine on Covode mountain. The new mill of the Pioneer mine has been started. The Josephine mine at West Argentine has 3 ft. of ore averaging 60% of lead, and shipments have been sent out.

DENVER COUNTY

(Special Correspondence.)—The annual meeting of the Colorado chapter of the American Mining Congress was held at the rooms of the Colorado Scientific Society, Denver, on January 21. The retiring president, D. W. Brunton, delivered an instructive address. The following officers were elected for the current year: Governor, S. D. Nicholson, of Leadville; first, second, and third lieutenant-governors, respectively, J. M. McClave of Denver, A. L. Burris of Cripple Creek, and Bulkeley Wells of Telluride; executive committee, V. C. Alderson of Golden, R. L. Martin of Central City, and Thomas Tonge of Denver; secretary and treasurer, E. L. Wolcott of Denver; directors, D. H. Brunton of Denver, F. W. Bosco of Creede, E. A. Colburn of Denver, R. D. George, State Geologist, of Boulder, A. W. Harrison of Silverton, R. M. Henderson of Breckenridge, Irving Howbert of Colorado Springs, W. E. Renshaw of Idaho Springs, J. T. Roberts, Jr., of Ouray, and G. S. Wood of Cripple Creek. A resolution was adopted to the effect that the mining industry, dating from 1860, had done more to build up Colorado and Denver than any other industry, and the people of the state and city are urged to take a more intelligent and unprejudiced interest in legitimate mining. The executive committee is to arrange for monthly luncheons, to which all mining men will be invited.

Denver, January 22.

LAKE COUNTY (LEADVILLE)

The Sharver-Cullen lease at No. 2 shaft of the Ibex, has cut about 18 ft. of zinc carbonate ore averaging 18% of zinc. Several cars of ore from the recent development of the Mt. Champion group, Lackawanna gulch, returned $135 per ton at the Arkansas valley plant. This ore is 6 ft. wide, and a cross-cut is now in 15 ft. The orebody in the upper adit has been opened for 400 ft., and with the opening of this vein in the lower adit, there is 120 ft. of stoping to be done.

SAN MIGUEL COUNTY

The Tomboy mill treated 11,000 tons of ore during December yielding $15,500 and $75,500 from 1650 tons of concentrate, a total of $91,000. Expenses were $50,500, leaving a profit of $40,500. Construction costs were $1033, and expense on aerial tramway, $5400.

TELLER COUNTY (CRIPPLE CREEK)

To drive a fourth drainage tunnel, 500 ft. below the Roosevelt tunnel, will cost about $450,000, and toward this the different railroad companies operating in the district have subscribed $100,000, and the Cresson Consolidated company $50,000. The Elkton and El Paso companies are considering the question, while the Portland company will not contribute until its ore-shoots are developed to the level of the present drainage tunnel.

During 1912 the Isabella company sank its shaft 200 ft. and cross-cut 300 ft., and depended upon royalties from lessees to pay for development. Development of the rich shoot opened on the 1500-ft. level of the American Eagles mine proves the ore to be continuous, and returns have averaged $40 per ton. Rosebud hill, and that section adjacent to Beacon hill, is to be prospected, and the district should soon be active. The Cresson shaft is down to 1300 ft., and cross-cutting has been started to the orebody. A winze has been sunk in ore from No. 12 level.

IDAHO

SHOSHONE COUNTY

The 60-ton concentrating plant of the Sierra Nevada has started work. The Marsh mine at Burke is opening well, and 65 men are employed in sinking a 3-compartment shaft from 800 to 1000-ft. depth. When this is finished, a raise, which has already been started from the shaft station, will be driven through the 500-ft. level to the main adit, providing a 3-compartment shaft to the 1000-ft. level. An electric trolley line will then be installed from the adit portal to the shaft station. The Hecla Mining Co., of Burke, has declared dividend No. 115, of 2c. per share, amounting to $20,000, making a total of $2,670,000. During 1912, dividends were $300,000.

MICHIGAN

HOUGHTON COUNTY

During its past fiscal year the Ahmeek Mining Co. showed the following results:

Ore milled, tons	651,329
Copper produced, pounds	16,476,000
Yield per ton	$25.3
Cost per ton	$1.39
Cost per pound, excluding construction	5.50c.
Cost per pound, construction	1.22c.
Cost per pound, smelting, freight, office, etc.	1.15c.
Total cost per pound refined copper	7.87c.
Net earnings	$1,520,000
Dividends paid	900,000

The Isle Royale mine produced 8,200,000 lb. of copper in 1912, at a cost of 9c. at the mine and a total of 11.25c.

per pound, the average price received being 16.75c. per pound. Net profits were $520,000, and the surplus is now $768,000.

MONTANA

Silverbow County

(Special Correspondence.)—Some of the machinery for the Butte Central mill has not yet arrived, but by February 15 the plant ought to be in operation. While a number of special features have been included, there has been no radical departure from the practice in other places where concentration and all-sliming methods are used. A large number of preliminary tests have been made on the ore of this mine. The most interesting feature of the mill will be the working of the counter-current method of continuous agitation, in which the highest grade of solution from the first agitator will be drawn off, while the pulp passes continuously through the series, meeting a barren solution at the last agitator, thus getting both a dilution of the pulp going to the filter, at the same time bringing a solu-

MINES AT BUTTE.

tion high in free cyanide, and low in metal content from the last agitator up to the first, this solution building up in metal value as it makes the circuit.

Butte, January 22.

The leaching plant of the Butte-Duluth company is nearing completion. It will have a capacity of 200 tons per day, and the process is similar to that at the Bullwhacker, where results have proved satisfactory. The concentrating plant of the Boston & Corbin company will be ready for work about the middle of the present month. The Anaconda Copper Mining Co. will add to its mining equipment at Black Eagle station, seven 25-ton and two 10-ton electric mining locomotives, supplied by the General Electric Company.

In December the East Butte Mining Co. produced 1,316,962 lb. of copper, and during the past year, a total of 14,747,086 pounds.

NEVADA

Churchill County

During December the Nevada Hills Mining Co. treated 3596 tons of ore yielding $72,730, the loss in tailing being $6370. Costs of mining and treatment were $31,606, leaving a profit of $34,854. Construction expenses were $2646. Assets of the company total $130,500, including cash, $14,600; concentrate and bullion in transit, $32,500; supplies, $55,000; and absorption of metals in mill, $23,000; while liabilities total $100,000.

Esmeralda County

About 40 men are working in the Klondyke district, and James Golden is in San Francisco arranging for a mill of 50-ton capacity. A well is being sunk for water supply for the mill, and town of Klondyke.

Humboldt County

A new mining district has sprung up at Poverty Peak, situated at the western edge of the mountain of that name, and is the turning point of the Little Humboldt river in Paradise valley, and is 30 miles north of Winnemucca, connected by a good wagon-road. Free gold has been found at the foot of the mountain. The orebodies are in an altered porphyry, in limestone. A number of claims have been staked.

Nye County

The Nevada Cinnabar Co. was recently organized, with a capital of $1,000,000, in Utah, for the purpose of developing quicksilver properties in this state. The company has acquired the Davis, and Shoshone Quicksilver Co.'s mine, making a total area of 50 acres. Near these claims there is a 25-ton furnace in operation, and good profits are made.

Storey County

On the 1000-ft. level of the Consolidated Virginia, the northwest drift was advanced 80 ft., including six sets of timber, during the week ended January 25. The face of the drift is in porphyry. In the Ophir, work has been confined to general work on the 1600, 2400, and 2500-ft. levels. Work on the 2500-ft. level of the Sierra Nevada has been temporarily suspended owing to an accident to the motor of the Union-Sierra Nevada joint winze. The Yellow Jacket mill has been working full time on Crown Point, Belcher, and Yellow Jacket ore. The Mexican mill ran 70% of the time and treated 315 tons worth $30.39 per ton, with 93% extraction. No. 1 tube-mill is out of commission owing to the motor burning out. The pumps at the C. & C. pumping shaft were only stopped 15 min. owing to shortage of power.

White Pine County

The Nevada Consolidated Copper Co. will pay bullion tax amounting to $13,284 on net profits for the last quarter of 1912, when the following were the results of operation:

Ore treated, tons	515,115
Gross yield	$2,375,072
Cost of mining	389,662
Cost of freight	135,041
Cost of treatment	1,218,807
Net yield	632,562

The tax rate is $2.10 on each $100 of net profit.

OREGON

Baker County

A peculiar case has been started at Baker by W. Mortison against the Columbia company for $100,000. His son lost both legs through, it is alleged, his wading through the water of Crack creek, which is polluted with 'acids' used in the cyanide process at the mine.

Jackson County

The Sterling mine, eight miles southwest of Jacksonville, one of the richest placer mines in southern Oregon when in operation, is to be reopened by S. S. Bullis and his son, of New York. A ditch for hydraulic work has been surveyed, and will be constructed. The mine has been shut down for four years.

UTAH

The following production of coal was made in 1912 by the coal companies of Utah, as published by W. H. Child & Co. in the Salt Lake *Tribune:*

	Tons.
Utah Fuel Co. (controlled by D. & R. G. railway)	1,951,784
Castle Valley Coal Co.	210,395
Consolidated Fuel Co. (controlled by United States S. R. & M. Co.)	319,777

Blackhawk Coal Co.	99,976
Independent Coal & Coke Co.	401,316
American Fuel Co., mine ready for daily output	1,000
Spring Canyon Coal Co. (controlled by J. Knight), daily	1,000
Castle Gate Coal Co., mine being developed, daily shipment	50

The National Fuel Co., now being financed, has 1040 acres in Carbon county.

Juab County

The annual report of the Lower Mammoth Co. states that development during the six months ended December 31, 1912, covered 1900 ft., and a good deal of low-grade zinc ore has been opened on the 1300, 1400, 1500, 1700,, and 1800-ft. levels. Probably 150,000 tons averaging 12% zinc, or about $17 per ton. Experiments are being made on this ore with a view to its profitable treatment. One car of copper ore and 10 cars of zinc were shipped, 538 tons in all, worth $8716. Including assessments of $20,000, the revenue was $36,052, and expenditure $29,798; while after paying off an overdraft, the cash on hand is $1162.

Salt Lake County

The Utah Apex Mining Co. will soon have in use a new 3-ton electric mining locomotive recently ordered from the General Electric Co. The Utah Copper Co. produced 5,975,246 lb. of copper in December, making the year's total 95,015,391 lb., against 99,456,225 lb. in 1911, the decrease being caused by the strike last September.

A special meeting was to have been held on January 30 of the Consolidated Flagstaff, Superior-Alta, Columbus Consolidated, and Columbus Extension mining companies of Alta, to ratify the action of the directors in agreeing upon a consolidation of these properties. The consolidation will control 700 acres of mineral land under the name of the Wasatch Mines Co., with a capital of 1,000,000 shares of $5 each, of which the Columbus Consolidated will have 160,000; Columbus Extension, 100,000; Flagstaff, 100,000; and Superior-Alta, 40,000 shares. The treasury shares will be used to raise money for driving an adit, and development of the lower levels of the various properties.

Within the next 30 days the crushing department of the Utah Copper Co.'s mill will be completed, giving a capacity of 50,000 tons per day, which is far in excess of the capacity of the mills.

Tooele County

The copper smelter of the International Smelting & Refining Co. is still shut down, although there is about 25,000 tons of copper ore at the plant. The lead smelter is being operated full time.

WASHINGTON

Ferry County

The examination of the San Poil, Old Republic, and Ben Hur mines at Republic, in compliance with the agreement under which the properties were recently optioned under the direction of the Washington Water Power Co., is to begin at once, and J. V. Richards, of Spokane, who represents the option holders, has gone to the district with assistants.

Stevens County

Conrad Wolfle, manager of the United Copper and Aurora mining companies, has announced that the companies have entered into a 10-year contract with the West Kootenai Power & Light Co. for 1000 hp. at $40 per horse-power. By May 1, 250 hp. is to be delivered, being supplied from the plant at Meyers Falls, on the Colville river, recently acquired by the Kootenai company. The remaining 750 hp. is to be delivered within two years from the big plant at Bonnington Falls and covers the remaining 10 years of the contract.

WYOMING

According to the *Centennial Post*, the production of this state in 1912 was: agriculture, $35,820,000; stock-raising, $30,465,000; mining, $24,860,342; and manufacturing, $6,000,000; while the resources of the state are calculated at $47,692,000,000, of which coal, oil, phosphate, iron, gold, and copper lands are set down at $45,300,000,000.

CANADA

British Columbia

During the week ended January 22 the Granby smelter at Grand Forks, treated 22,318 tons of ore and 370,000 lb. of blister copper was shipped. The totals for the first three weeks of 1913 are 65,654 tons of ore and 1,088,000 lb. of copper.

GRANBY SMELTER.

Ontario

(Special Correspondence.)—A deal of unusual importance was negotiated recently when the holdings of the Dominion Nickel Co. in the Sudbury field were acquired by F. S. Pearson. The Dominion Nickel Co. is owned by J. R. Booth and M. J. O'Brien, and it controls large areas of valuable mineral land in the nickel range. Mr. Pearson has for years been intimately associated with Sir William MacKenzie in connection with his electric power-plants in Canada and Mexico, but it is understood that the new company will be financed by the Rothschilds. The Guggenheims had been negotiating for months for the purchase of the Dominion Nickel Co.'s holdings, but satisfactory terms could not be agreed upon, and the way was left open for Mr. Pearson and his associates. No details regarding the terms of purchase are available, although a large payment has already been made, but it is believed that the figures will run into millions. So far the International Nickel Co. has had practically a monopoly in the nickel business, the Copper Cliff mines, near Sudbury, producing nearly 70% annually of the world's supply. This company is now starting to double the capacity of its smelter and expects in two years time to be treating 160,000 tons of ore per month. The market for nickel has been constantly broadening, and it is doubtful if the entry of this new company will have any effect upon the International Nickel Co. In order to successfully compete with them it will necessitate an expenditure of $5,000,000 to $8,000,000 and about five years time.

Sudbury, January 23.

During the week ended January 18, 11 mines at Cobalt shipped 469 tons of ore. Bullion shipments for the year to date total 182,450 oz., worth $115,379. La Rose Consolidated revenue in December was $163,128, making the year's total $1,796,880, and profit $1,026,663. The surplus at the present time is: cash, $1,667,104; ore on hand and in transit, $199,526; a total of $1,866,631.

Yukon

According to G. I. McLean, comptroller of the territory, the gold production of the district in 1912 amounted to $5,250,000, against $4,300,000 in 1911. Almost the entire output is from placer deposits, the first quartz mill in the Yukon, the Lone Star, only yielding a few thousand ounces. The bulk of the gold comes from Bonanza, Hunker, Eldorado, and the Klondike valley, where are the properties of the Yukon Gold Co and the Boyle Concessions, Ltd. About 20 other creeks contributed to the total production. The Yukon Gold Co. operated eight dredges and 15 hydraulic plants. During the coming season the number of dredges will be the same, but hydraulic work will be increased by

1200 in. more of water in the Twelvemile ditch. The Boyle company will increase its dredges from two to four, the new ones having a capacity of 14,500 cu. yd. per day. The former company employs 800 and the latter 200 to 300 men. The total output of gold from the Yukon is approximately $169,000,000.

Skagway has a hydro-electric plant which cost approximately $70,000, including emergency boilers. The maximum output is 500 kw. per hour, and charges are 6c. for power and 10c. for lighting, with a monthly flat rate on lamps burning a certain number of hours. The Home Power Co., which owns and operates the lighting and water systems, furnishes the town with water at $100 per month, the town authorities retailing the water and making $300, charging $2 for the first tap and 25c. each for each subsequent tap. Hotels are charged 10c. per room for water, regardless of the number of taps used. The Alaska General Electric Co. owns and operates the telephone system, which has a radius of one mile and cost $3000 to install. The charge for telephones is $5 per month for business and $3 for residence.

MEXICO

Chihuahua

Owing to a shortage of coke, the Chihuahua smelter was shut down for two days, but resumed operations on receiving a shipment from the United States. This smelter employs 500 men, and deals with 800 tons of ore per day.

Durango

Sixteen Americans, at Inde, were threatened by bandits, who also stated that they would destroy the buildings and machinery of three large American and French mining companies. The Mexican Government sent 150 troops to give assistance. Inde is 70 miles overland from the railroad station of Rosario, Durango. It is the centre for the Inde, Guadalupe, and Matracal mining companies. The Durango Lumber Co. is starting its mills, which will have a capacity of about 5,000,000 ft. of lumber per month. A railroad about 10 miles long has been constructed to Durango. The rolling stock consists of 5 locomotives and 150 cars for transport of logs and finished timber to all parts of Mexico. M. A. Leach is general manager for the new company.

Hidalgo

The estimated production of the Real del Monte Co., of Pachuca, owned by the United States Smelting, Refining & Mining Co., for 1912 was 3,610,032 oz. of silver and 19,867 oz. of gold from the treatment of 40,000 tons of ore per month at the two mills. Profit from these operations was fully $1,500,000.

Mexico

The mill of El Oro Mining & Railway Co. treated 20,560 tons of ore and re-treated 16,670 tons of tailing during December, yielding a total of $177,620. Working expenses were $102,040, development $22,640, leaving a profit of $52,940, which, added to the railway profit of $9720, made a total of $62,660.

Sonora

A vein several feet wide and carrying 300 oz. of silver and gold per ton has been opened about 15 miles east of El Tigre. It is called El Tembior, and a 25-ton mill has been ordered. W. L. Rynerson, who has a lease on the mine, has shipped 20 tons of picked ore, averaging over 500 oz. of silver and 8 oz. of gold per ton, to Douglas.

During December the old mill at El Tigre crushed 3205 tons of ore and the stamp-mill 3416 tons, while the cyanide plant treated 6410 tons of current and 1051 tons of dump tailing, the total yield being worth $143,877. Expenses totaled $84,988, leaving a profit of $58,889. Since January 1, 1912, canceled notes and bonds worth $315,168 were purchased, completing the bond requirements to September 1, 1913. Dividends paid in 1912 were $379,128, making a total to date of $694,296.

Preliminary estimates for 1912 show that the subsidiary properties of the Mines Company of America made a gross production of $2,400,000, and expenses were $1,600,000. The Dolores, El Rayo, Creston-Colorado, and La Dura mines are in full operation.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

Jesse Scobey is in Nicaragua.

C. C. Broadwater has gone East.

A. L. Sweetser has gone to Mexico.

M. R. Campbell was here on Monday.

H. R. Beekman has sailed for London.

F. G. Cottrell has returned from the East.

Thomas Kiddie, of Victoria, is at the Palace.

R. P. Vincent has returned to Australia from England.

R. Y. Williams has returned to Urbana from Alaska.

C. H. Lindley is still in the hospital, but is recovering nicely.

Howland Bancroft was in San Francisco during the week and has gone to Los Angeles.

Clarke Sullivan has been appointed superintendent of the Zapilote mine, in Tepic.

S. J. Kidder, now superintendent of the Buckhorn mine, is visiting in the Middle West.

William B. Fisher has resigned as superintendent for the Davis-Daly Copper Company.

W. M. Bowman is assayer and chemist for the West End Consolidated Mining Co. at Tonopah.

R. B. Rogers was in San Francisco while returning from Honduras and has gone to New York.

H. Kenyon Burch is now engineer for the Inspiration Consolidated Copper Co., at Miami, Arizona.

Louis J. Mayreis is now with the South Urals Mining & Smelting Co., Tanalyk-Baimark, Orenburg, Russia.

J. P. Hart has left Tonopah to take charge of the Manhattan Ore & Milling Co. mill at Manhattan, Nevada.

C. F. Rand has been nominated for the office of president of the American Institute of Mining Engineers.

R. B. Oliver has returned from the Belgian Congo and is now at 2063 San Antonio avenue, Alameda, California.

Charles H. Lee is now at 934 Union Oil building, Los Angeles, where he has opened a hydraulic engineering office.

Bradley Stoughton has been nominated as secretary to the Board of Directors of the American Institute of Mining Engineers.

M. W. Atwater has resigned as superintendent for the Butte & Superior Copper Co. to become superintendent for the Davis-Daly.

Gelasio Caetani has left for Boston after delivering a course of lectures at Harvard University. He will go to Europe for a few weeks.

George E. Collins was re-elected president of the Colorado Scientific Society at the annual meeting recently. The new vice-presidents are E. N. Hawkins and Richard A. Parker. Frank E. Shepard and Thomas B. Stearns were elected to the vacancies on the executive committee.

F. Lynwood Garrison has been retained as chief engineer in charge of exploration of placer lands controlled by the Breitung Mines Corporation in Colombia. Mr. Garrison sails for Colombia on February 1, accompanied by a corps of four assistant engineers.

San Francisco Section of the Mining & Metallurgical Society will meet at Hotel Oakland next Monday, February 3, for election of officers and discussion of workingmen's compensation. A. J. Pillsbury will open the discussion.

Obituary

Edward C. Treadwell, superintendent of the Bonanza mine, in Trinity county, California, was swept away and killed by a snowslide on January 15. He was the son of James Treadwell, of San Francisco, and though but a young man had shown great promise.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	January 30.
Camp Bird Ltd	$ 5¼
El Oro	4¼
Esperanza	8⅝
Oroville Dredging	1⅝
Santa Gertrudis	6⅜
Tomboy	7

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. January 30.		Closing Prices. January 30.
Adventure	$ 4⅛	Mohawk	$ 54
Allouez	39	North Butte	31½
Calumet & Arizona	66	Old Dominion	48
Calumet & Hecla	495	Osceola	96
Centennial	16	Quincy	74
Copper Range	48½	Shannon	12
East Butte	14½	Superior & Boston	2⅜
Franklin	7⅜	Tamarack	31
Granby	69	U. S. Smelting	41
Greene Cananea, etf	8⅜	Utah Con	10½
Isle-Royale	28⅛	Victoria	1¼
La Salle	4⅜	Winona	3⅛
Mass Copper	4⅛	Wolverine	67½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 30.

Atlanta	$ .16	Midway	$ .33
Belmont	8.25	Montana-Tonopah	1.80
Big Four	.80	Nevada Hills	1.37
Buckhorn	.90	North Star	.20
Con. Virginia	.15	Ophir	.21
Crown Point	.20	Pittsburg Silver Peak	.65
Florence	.41	Round Mountain	.30
Goldfield Con	2.02	Sierra Nevada	.17
Halifax	1.02	Tonopah Extension	1.97
Jim Butler	.70	Tonopah Merger	.89
Jumbo Extension	.33	Tonopah of Nevada	6.00
MacNamara	.22	Union	.15
Manhattan Consolidated	.10	West End	1.37
Mexican	.78	Yellow Jacket	.19

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, January 30.

Associated Oil	$42.50	Monte Cristo	$ .81
Brookshire	.50	New Pa Pet	.50
Caribou	.90	Palmer	.17
Claremont	.60	Palmer Union	.18
Coalinga Central	.20	Premier	.30
De Luxe	.60	Republic	.15
Maricopa 36	.32	United Oil	.32
Maricopa National	.20	W K Oil	1.95

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. January 30.		Closing Prices. January 30.
Alaska Mexican	$13⅜	McKinley-Darragh	$ 2
Alaska Treadwell	42⅜	Miami Copper	21¼
Alaska United	21	Mines Co. of America	3½
Amalgamated Copper	74	Nevada Con	18½
A. S. & R. Co	74½	Nipissing	9
Braden Copper	9⅜	Ohio Copper	1
B. C. Copper Co	4⅜	Ray Con	19⅜
Chino	43	Tenn. Copper	34⅛
First National	2⅜	Tonopah Belmont	8¼
Giroux	3⅜	Tonopah Ex	2
Goldfield Con	2⅜	Tonopah Mining	5⅛
Greene-Cananea	8½	Trinity	4⅜
Hollinger	15½	Tuolumne Copper	3
Inspiration	16½	Utah Copper	55½
Kerr Lake	3⅜	West End	1⅜
La Rose	3⅛	Yukon Gold	3
Mason Valley	8½		

ASSESSMENTS ON COMSTOCK MINES.

Company	No.	Del. Board	Sale Day	Amt.
Ophir	91	Jan. 18	Feb. 14	.15
Sierra Nevada	33	Jan. 28	Feb. 20	.10
Andes	78	Jan. 30	Feb. 25	.03
Confidence	60	Feb. 3	Feb. 26	.20
Belcher	99	Feb. 3	Feb. 28	.10
Gould & Curry	24	Feb. 4	Feb. 28	.03
Con. Virginia	23	Feb. 7	Mar. 4	.15
Utah	16	Feb. 21	Mar. 18	.05

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco, January 30.

Antimony	12—12¾c	Quicksilver (flask)	39
Electrolytic Copper	18—18¼c	Tin	53½—54c
Pig Lead	4 60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, January 30.—Copper prices are decidedly unsettled; buyers are holding back for better terms despite the recent drop. Lead is quiet but in better demand. Spelter remains weak. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Jan. 21	16.15	4.33	8.70	62⅛
" 21	16 05	4 33	6 63	62⅛
" 25	15.95	4.33	6 60	62⅛
" 26	Sunday.	No market.		
" 27	15.90	4.33	6 55	62⅛
" 28	15.85	4.33	6.55	61⅛
" 29	15.85	4.33	6.55	61⅛

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
January	1912	89,454,695	178,329,920
February	"	66,280,643	153,820,800
March	"	62,939,988	141,125,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840

UNITED STATES PRODUCTION AND CONSUMPTION

	Production.	Domestic deliveries.	Exports.
January 1912	119,337,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600
August	145,628,521	78,722,418	70,485,150
September	140,089,819	63,460,810	60,264,796
October	145,406,453	84,104,734	47,621,342
November	134,695,440	69,369,795	55,906,550
December	143,353,280	58,490,880	65,712,640

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	....	Aug.	61.32	....
Mch.	58.37	....	Sept.	62.95	....
Apr.	59.20	....	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	....	Aug.	17.49	....
Mch.	14.68	....	Sept.	17.56	....
Apr.	15.74	....	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. Below are the average New York quotations by months:

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	....	Aug.	4.54	....
Mch.	4.07	....	Sept.	5.00	....
Apr.	4.20	....	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	....	Aug.	6.96	....
Mch.	6.57	....	Sept.	7.45	....
Apr.	6.63	....	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	....	Aug.	42.50	....
Mch.	46.00	....	Sept.	42.12	....
Apr.	42.25	....	Oct.	41.50	....
May	41.75	....	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations in cents per pound:

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	....	Aug.	45.80	....
Mch.	42.58	....	Sept.	48.64	....
Apr.	43.92	....	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	3.00	4.35
Borax, powdered, bbl., ℔ 100 lb	3.25	4.25
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.50	13.50
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20¾	0.24¾
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26¾	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	11.50	13.50
Litharge, com'l, ℔ 100 lb	8.00	9.50
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—¾% Fe)	36.00	47.50
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.10¾	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.06
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	12.05	13.50
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	10.25	11.50

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.05	0.05½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	450.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Sulphur, 80%, ℔ ton	16.50	18.50
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	475.00	500.00
Tungsten ore, 65%	425.00	450.00
Vanadium ore, 15% V_2O_5, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50 % up, ℔ ton	*15.00	20.00

James Lewis & Son's Copper Report

The market for standard copper was subject to considerable fluctuation during December, with but little change at the close. In sympathy with a rapid depreciation in the value of the shares of the leading copper-producing companies, prices declined from £76 17s. 6d. for cash on December 2, to £73 5s. 0d. on December 16, and subsequently gradually recovered to £76 12s. 6d., this being the closing value of the year, against £63 at the end of 1911. Sales during December amounted to about 35,000 tons.

Consumers have bought refined copper sparingly, declining to pay the abnormally high price of 17¾c. per pound, or £82 per ton, c.i.f., demanded by the leading American refiners for electrolytic, supplying their requirements from other sources, English and Japanese, while some purchases from the smaller American producers have been effected at 17¼c. per pound.

Exports from the United States during December were 29,274 tons. This will include the excess of 'deliveries for export' by refiners over the custom house exports for November, of 5812 tons. A further considerable increase in American refiners' stocks at the end of December may be expected. Imports into Germany for 11 months amount to 191,993 against 176,525 tons in the same period of 1911; and the exports to 9050 against 8429 tons. The consumption of foreign copper is 193,778 against 169,796 tons, an increase of 23,982 tons. For the 10 months, the increase was 30,246 tons, showing a reduction of 6264 tons for the 11 months, as compared with the 10 months' period. European stocks have increased 785 tons, but the visible supply has decreased 40 tons during December. Imports are 4725 and deliveries 15,165 tons less than during the same period of 1911. Total arrivals in England and France for December were 18,820, and deliveries 18,352 tons fine copper. Arrivals in England from Chile were 2172 and deliveries 1983 tons, and from other countries 12,618 and 11,862 tons, respectively. Arrivals at Liverpool and Swansea from the United States were 2875 tons of bars and 630 tons of ingots, equal to about 3491 tons fine; in London, 311; and in France, 2190 tons fine. Chile charters are advised as 3300 tons, including 1325 tons for the United States.

STOCKS OF COPPER (TONS FINE)

	January 1—			
	1910.	1911.	1912.	1913.
Chilean in—				
Liverpool and Swansea..	11,121	10,123	4,225	5,348
France	815	530	714	832
American in—				
Liverpool and Swansea..	38,166	25,415	12,939	1,146
France	4,888	5,120	4,033	2,992
Sundries in—				
Liverpool and Swansea..	2,629	1,151	786	1,194
London and Newcastle..	24,960	10,907	6,462	3,234
Birmingham	244	607	346	325
France	596	430	507	572
English in—				
Liverpool and S. Wales.	18,553	18,715	17,346	16,516
Total in England and France	101,972	72,997	47,358	32,159
Sundries in—				
Germany and Holland...	2,200	16,300	13,400	2,882
Total European stocks.	104,172	89,297	60,758	35,041
Afloat (as advised by mail and cable to date)—				
From Chile	3,250	3,600	1,575	2,800
From Australia	3,800	7,200	8,350	5,400
Total visible supply...	111,222	100,097	70,683	43,241

ELMORE vacuum plant at the mines of the Sulitjelma company, Norway, produced 650 tons of copper concentrate during December.

Company Reports

TANGANYIKA CONCESSIONS, LIMITED

This company was originally formed in January 1899 to acquire a concession granted by the British South Africa Co. conferring the right to locate an area of 2000 acres in Northern Rhodesia, and other rights. Since that time copper and tin mines have been developed and smelting started, the metallurgical operations of which have been frequently the subject of much discussion; and interests taken in other companies and railroads, until the whole business is of a complex character requiring much study. The company holds 45% of the stock of the Union Miniere du Haut Katanga (Mineral Company of Katanga), whose general meeting was held in Brussels on December 2, 1912. Mr. Jadot, one of the directors, gave the following particulars of recent operations at the mines.

At the Star of the Congo mine, development is being carried out on proper lines, and discoveries made in shafts sunk 91 ft. below water-level are encouraging. At the Kambove mine, where 2800 ft. of adits and cross-cuts had been driven, necessary preparations are being made for extensive work, which, it is hoped, will be completed soon after the railroad from Elisabethville to Kambove is in operation. The other mines will be developed as the railroad is advanced.

	1911. 88 days.	1912. 79 days.	1912. 61 days.
Ore treated, tons	10,341	10,053	7,660
Copper, per cent .....12 to 13		13 to 15	16
Total, tons	996	1,002	1,038
Copper production, tons per day	11.3	12.7	17.0
Copper content, per cent.....	90	95	95
Coke consumption:			
Total, tons	3,434	3,249	2,730
Per ton of copper.....	3.44	3.24	2.65

During the last campaign, ores that had been concentrated by washing were treated, using 1700 tons of Wankie coke, which, produced from unwashed coal, contains much ash and sulphur. A washing plant for the coal is being erected at Wankie. Coke, delivered at the smelter, costs about $29 per ton. Until the quality of Wankie coal and firebricks made in Africa had been tested, construction of coke-ovens at the Lubumbashi works was postponed, but investigation proved them of good quality. A second furnace, of the same capacity as the one in operation, should be finished about February, but other plant will not be ready until June next. The briquetting plant will be ready about that time also. The erection of a new group of furnaces is under consideration. At the Star of the Congo, a plant for sorting and washing is well under way, and tests are to be made to get a better concentration by means of mechanical preparation. Discovery of coal of workable quality, near the Katanga railway, was recently reported.

In connection with the tin properties, the 'specialist engineer' will arrive from the Malay Peninsula with a selected staff about June, and will start work on the Kasonso deposits near Bukama. This engineer has had experience at Katanga, where, several years ago, he did the preliminary development and smelting at the Busanga tin mine.

Progress of the Katanga railway, 180 miles in length, is satisfactory. The traffic depends almost exclusively on the mining industry at Katanga. The whole system, which should be completed in March, will cover 290 miles, having taken four years in construction, which is fair work considering that there were difficulties with transport and labor, being 1600 miles from the port of Beira.

During the nine months ended September 30, 1912, net receipts from the Rhodesia-Katanga Junction Railway & Mineral Co., Ltd., were $130,000. Since June, 370 tons of copper was produced from the Kansanshi mine. On the Benguella railway the line to Huambo, 285 miles from Lobito, was opened in October 1911, and for the ten months ended October 1912 profits were $90,000, while estimates for the year 1913 show a profit of about $185,000.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

CONCENTRATE at the West End mill, at Tonopah, is now reconcentrated, the bulk being reduced and higher grade produced, effecting a saving in freight and smelter treatment charges. The sand from the concentrate so treated is pumped back to the mill circuit for further treatment.

MINE-RESCUE CARS are stationed at seven important points in the larger coal-fields of the United States. During the Bureau of Mines fiscal year ended June 30, 1912, 65,000 persons visited the safety cars and stations; 36,000 attended lectures; 10,000 took training in rescue work; and 1000 certificates were issued to miners.

DREDGE-MINING in New Zealand in 1911 produced gold worth $1,485,000 from 93 dredges, 31 of which paid $225,000 in dividends, and a total of 775 men were employed. Hydraulic mining produced $1,375,000 from 277 claims, which employed 2452 men. Of the dredges, 15 are working on the rivers and flats of the West Coast, and 78 in Otago and Southland in the South Island, while most of the hydraulic work is carried on in the West Coast districts.

PLASTICITY of clay, according to a recent hypothesis, is due to the presence of an organic aluminum compound. This assumption is claimed to explain satisfactorily all the established facts concerning the plasticity of clay. For example, it explains why only impure clays are plastic; why ignition destroys and levigation fails to restore plasticity; the industrial practice of weathering clay before use, and why the plasticity is reduced by bases, since the aluminunf organic compound is soluble in alkali.

BOTTLES containing liquid ammonia of 0.880 strength are apt to burst, or give a violent discharge of gas in hot climates. Before opening a bottle ought to be wrapped in a wet towel, or placed under a stream of cold water for a while. It is advisable to have convenient a weak solution of acetic acid, 10 drops in 100 c.c. of water, to use in case of alkalies getting in the eyes, the usual eye-bath being provided for that purpose. For acid in the eyes, a 1% solution of bicarbonate of soda, in distilled water, should be used.

IRON or steel articles can be made rustproof and at the same time given a good finish, by a process patented by W. Feuerhake, of Westphalia. The iron or steel goods are first electrogalvanized, and then lightly copper-plated from a copper cyanide solution. Then nickel plate is deposited on the copper, producing an excellent rustproof finish. The object of copper-plating is that, though nickel can be plated directly on zinc, it is unsatisfactory commercially, and it is always advisable to copper-plate the zinc first.

BOILER gauge-glass should have strength to resist pressure, insensitiveness to boiler fluctuations, and immunity to chemical action of steam or feed-water. Practically all gauge-glasses will stand 200 to 300 atmospheres pressure in the cold state. Heated up to boiler temperature and sprayed at regular periods, the strengths are considerably decreased and vary greatly; thus French glass will stand 6 atmospheres, English 7, Verbund-Robax 15, Durax 27, and Durobax 31 atmospheres. The makers of Durobax glass seem to have improved on its resistance to attack by steam and feed-water, as their gauge-glasses remain clear for a long time.

NICKEL used in the United States is chiefly imported from Canada. Large deposits are known to exist in Idaho, and an immense deposit of low-grade hydrous nickel-magnesium silicate occurs at Webster, North Carolina; but no economical method for the treatment of such material has yet been devised. A large part of the nickel output is now used in the form of monel metal, a nickel-copper alloy, so the expense of separating and purifying the nickel is obviated. Cobalt is chiefly derived from the silver-cobalt-nickel-arsenic ores of the Cobalt district of Ontario, and the price of the metal has greatly decreased since the discovery of the Cobalt district.

SPECIFICATIONS for the oil for mixing with concrete are given by the Office of Public Roads, U. S. A., for residual oils intended for waterproofing concrete according to L. W. Page's process. (1) The oil should have a specific gravity of 0.930 to 0.940 at 25°C. (2) At least 99.9% shall be soluble in carbon bisulphide at the ordinary temperature. (3) It shall contain 1.5 to 2.5% of bitumen insoluble in paraffin naphtha of 86°B. (4) It shall yield 2.5 to 4% of residual coke. (5) When 240 c.c. of the material is heated to 50°C. in an Engler viscosimeter and maintained at this temperature for at least 6 minutes, the first 100 c.c. which flows out shall show a viscosity of 40 to 45. (6) When 20 gm. of the material is heated to 163°C. for 5 hours in a cylindrical tin vessel, 2½ in. diameter by 1 in. high, the loss in weight shall not exceed 2 per cent.

DIESEL ENGINES of large size have become common in Europe; in Swiss electric stations Diesel-engine units of 2000 hp. are now in use, and it is said that the development of the large-size Diesel engine has been so successful that before long it will not be deemed extraordinary to develop 1000 hp. in one cylinder. One company of world-wide reputation is considering over 2000 hp. in the single cylinder type of Diesel engine. Engines of this type with four cylinders developing 1000 hp. power each can be made as light as the corresponding triple-expansion steam-engine. The weight of such engines compares favorably with that of the corresponding turbines and boilers. A 1000-hp. installation of this type weighed only 187 lb. per horse-power, as compared with 180 lb. for a steam turbine and boiler installation.

PERFECT german-silver castings have been obtained by adding 4 oz. of cupro-nickel-vanadium to the molten bath about 5 minutes before the heat is ready to pour. The cupro-nickel-vanadium, either granulated or broken in small pieces, is wrapped in a piece of paper and dropped in the molten metal, and when it becomes cherry-red is pushed below the surface and held there by an inverted cup-disk with a handle 4 ft. long. It is held near the bottom of the pot until it is completely absorbed by the charge. Then stir the pot with a pumping motion and allow the charge to remain quiet about 5 minutes, during which the vanadium effects the purification. The vanadium is not deleterious to the crucible. When the metal reaches a clear, limpid condition, shown by its greater mobility, the heat is ready to pour. When the metal is in perfect condition, flames of zinc oxide flare up at the sides.

FIREPROOFING of wood by impregnation under pressure is the most efficient method. As a general principle, each species of wood requires a different pressure for the necessary penetration, but the pressure remains constant for the same species, regardless of the dimensions of the piece to be impregnated. The penetration of the wood by a crystalloidal liquid is a function of the time. When displacement and penetration take place in a longitudinal sense, irrespective of pressure, the rapidity or duration of the injection will always be in direct relation to the length; for a given length and constant pressure, for the same species, the rapidity may, in certain cases, vary with the initial capillary speed, depending on the concentration of the injected solution. The species generally used are oak, mahogany, teak, ash, beech, gum, walnut, popular, fir, pitch pine, pine, and birch. The double phosphate of zinc and ammonia obtained by dissolving zinc hydroxide in ammonium hydroxide, and adding phosphoric acid, is superior to any other salt for impregnation, and is the only one that can be applied without inconvenience.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

STARTING of the Gumaus dredge of the Paracale district of the Philippines was appropriately celebrated by visitors from Manila.

JAPANESE copper production for 1912 is estimated at 65,000 tons. The Ashio mine retained first position with an output of 12,000 tons.

NINE million pounds of copper, equivalent to half the annual output of Tennessee, will be used this year by one American automobile factory.

PATENT has been issued to Mr. W. G. Whorf on 63 acres of coal land at Port Graham, Cook inlet, Alaska. This is notable as being the first patent granted for coal land in Alaska.

VENEZUELA has paid the last of the foreign debt resulting from international difficulties during the administration of President Cipriano Castro, and can now devote its revenue to internal improvement.

GUAYAQUIL is being studied by a United States Sanitary Commission headed by Colonel William C. Gorgas, and a safe and sanitary port is promised. With the opening of the Panama canal this will become a matter of first importance, and improvement of the port, following completion of the railway to Quito, will do wonders in opening Ecuador to modern industry.

SALE of controlling shares in the Golden Cycle Gold Mining Company at Cripple Creek to the Burris-Walker syndicate already controlling the El Paso mine, is announced in New York. It is said the consideration was $6,500,000 and that the shares are to be placed on the European market. The property includes the mine, the great mill at Colorado City, and a coal property near Colorado Springs.

MANY members of the American Institute of Mining Engineers, on receiving the invitation sent out by a number of well known engineers to join with them in subscribing $1000 each to wipe out the land debt of the Institute, will have concurred with the sentiments of the old colored man who was asked by a prosperous-looking white man whether he could change a $5 bill. His answer was, "No, sah, I cahn't change no five-dollar bill, but I thankee foh de compliment jest de same."

UNEARNED dividends of one per cent per month were paid by Messrs. A. L. Wisner and John J. Meyers, promoters now on trial in New York for using the mails to defraud, according to testimony given recently. It was shown that it cost $63,000

to mine $20,000 worth of ore at the Empire mine in Sierra county, and that 700,000 shares of stock had been sold for $205,000. The Kansas 'blue sky' law may not be perfect in form, but better protection of investors is certainly needed.

SEVEN years ago prompt wealth was promised investors in the Colorado Yule Marble Company. Now, with a total of $12,869,685 outstanding in stocks, bonds, and floating debts, stockholders are told that it is necessary to issue $2,500,000 worth of additional bonds to meet immediate needs. It takes more than marble to make a successful marble business.

MICHIGAN iron ore is to be subjected to a tonnage tax, remitted when iron is manufactured within the state, if a bill recently proposed be passed. The trouble with this plan is that Pennsylvania and Ohio might decide to tax coke or coal produced within their borders and remit the tax except in cases where the material was used in the manufacture of iron in a state maintaining a discriminatory tax on iron ore exported. The way to delightful complications is opened by the proposal.

EXPORTS to South America from the United States have increased from $38,000,000 in 1902 to $138,000,000 in 1912. So great a growth in the decade is encouraging and would be greater cause for congratulation if the total for the past year represented more than 10 per cent of the total exports to Europe. However, since exports to South America increased 300 per cent in the decade, while exports to Europe only increased 50 per cent, this disproportion is rapidly tending to disappear. So far our trade has been chiefly with Brazil, Argentina, and Uruguay, and the opening of the Panama canal should lead to a speedy growth of trade with the west coast of South America.

DUST in coal mines is a prolific source of explosions and in metal mines is the leading cause of miners' phthisis. In South Africa determined efforts have been made to lessen the danger of the latter by regulation of the use of small air-drills. In Nevada a bill has been introduced in the state legislature prohibiting the use of machine drills save in connection with water sprays or other efficient dust reducing apparatus. Since there are several means that may be employed, this is fair to all manufacturers, and without passing on the wording of the particular bill mentioned, we but express general opinion in saying that the movement to protect the health of miners deserves hearty support.

NOMINATION of Mr. C. F. Rand for president of the American Institute of Mining Engineers assures to the latter the services of an especially capable and active executive. Mr. Rand's success as president of the Spanish American Iron Company, his indefatigable industry, large public spirit, and charming personality, combine to peculiarly fit him for the position. Mr. Bradley Stoughton, who is the official candidate for secretary, is an experienced and capable engineer not so well known in the West as his deserts warrant, since he has worked mainly in the East and on the metallurgy of iron and steel. Mr. Rand and Mr. Stoughton, with a good board of directors, will assure satisfactory conduct of the business of the Institute.

FORMATION of the American Mine Safety Association, having for its purpose the conservation of the lives and health of the mine and a reduction of property loss due to explosions or fires in mines, is announced. This is one of the results of the interest in the subject aroused by the excellent work of the United States Bureau of Mines, and it is appropriate that Mr. H. M. Wilson of the Bureau should be chairman of the executive committee. Membership is open to individuals and firms and those interested are invited to correspond with Mr. Wilson, care United States Bureau of Mines, Pittsburg, Pennsylvania.

EDITORIAL comment performs its best service when it stimulates such thoughtful contributions to our discussion columns as that by Mr. Herbert Lang upon the use of oil as fuel in the blast-furnace. Radical departures from ordinary practice, such as this, develop unexpected difficulties, as our correspondent cites. For the reasons given, it seems probable that oil will never be able to perform the double function as a reducing agent and as a source of heat which coke adequately fulfils. The combustion period of the coke is comparatively protracted because of its slow descent with the smelting column, while the combustion period of the liquid fuel is the brief interval between its ignition at the tuyere and its escape from the zone of combustion. With the coke there is ample opportunity to secure a powerful reducing action in the charge and complete combustion in the zone of fusion, while with liquid fuel the opportunity is so limited as to present marked difficulties. Nevertheless there would appear to be a distinct field for smelting with liquid fuel, and it is to be hoped that other metallurgists will follow the lead of Messrs. Lang, Wallace Dow, Thomas Kiddie, and J. W. Nesmith in its experimental development.

DISCUSSION of the factors governing the choice of an electric motor for hoisting service, as given by Mr. H. A. Russell in this issue, will be both of interest and service to many of our readers. The illustration of a motor-generator set is especially interesting as a sequel to our editorial comment, in the issue of January 25, upon electric hoisting problems, in which it was suggested that an exciter directly connected to the drum-shaft of the hoist would render the electric brake independent of interruptions in the power supply and solve the problem which is troubling South African engineers. It has since been brought to our attention that this result may be better attained by placing the exciter upon the shaft of the fly-wheel of the motor-generator set, as shown in one illustration in Mr. Russell's article. With this arrangement the electric brake will not lose is effectiveness until the fly-wheel has come to a stop; a considerable period in which there is ample opportunity to complete the trip with the cage or skip. A hoist of

this character, built by the Wellman-Seaver-Morgan and General Electric companies is now in successful operation at the Duluth shaft of the Cananea Consolidated Copper Company, and others are in process of construction.

AMONG excellent recommendations made by Mr. Walter E. Clark in his annual report as Governor of Alaska, is one to the effect that holders of mineral claims be allowed to pay in lieu of assessment work $100 per claim per year into a fund for highway and bridge construction. This plan has been followed in Yukon territory with very satisfactory results. It often happens in Alaska that the expense of doing assessment work is much less than that required to send men to the claims to do the work. In such cases it would be to the advantage of the claim owners to pay the cash instead. There is nothing Alaska needs more than roads, and it would certainly seem wise to divert to their building money now largely wasted in assessment work.

Regulating Dredging

Gold dredging is attacked in a bill recently introduced in the California legislature. The bill starts with the declaration that cultivation of the soil is an ordinary use necessary for future subsistence, livelihood, and prosperity of the people, and that use of the soil for dredging purposes is an extraordinary and uncommon use, and provides that any person, firm, or corporation intending to mine soil for gold or other precious metal must make a written application to the State Water Commission for a permit. The application must state the situation of the proposed dredging area, the nature of the soil, whether it has been or is under cultivation, and, if so, the nature of crops and approximate value of the last crop; also whether, in the opinion of the applicant, said soil is more valuable for agricultural than for dredging purposes, and whether it can be restored, after dredging operations, for agricultural purposes equal to its condition at the time of filing. The commission must then examine the soil within thirty and hold a hearing within sixty days. Within thirty days after the hearing it must act on the application, denying a permit if the soil is found more valuable for agriculture. In determining the relative value the commission shall not be limited to a consideration of the value of the annual production of the soil, but may take into consideration the future and natural continued use for agricultural purposes. If it appears to the commission that the soil is more valuable for agriculture, but can be restored after dredging, the commission may grant the application and issue a license, containing as a condition that the soil be restored. It is proposed to make violation of the act a misdemeanor, punishable by $5000 fine or imprisonment not exceeding one year, and individuals acting for corporations are made personally liable. Advocates of the bill declare that dredging companies cannot consistently oppose it, because they have made the claim that dredging is confined to worthless lands, or lands that can be restored. While it is true that little land of agricultural value has been destroyed by dredging, the companies will naturally prefer not to have to justify to an outside and possibly hostile commission, their use of land before beginning work. It will greatly complicate the matter of buying dredging land, since it will be necessary to prospect it before submitting it to the commission and, if by chance the decision after prospecting is a close one, there may be no opportunity to recover the money already invested. It is also worth remembering that interest on the money won from an acre of land by dredging is often many times in excess of the value of any crop that could be annually harvested.

American Institute Election

The world over, the American Institute of Mining Engineers occupies a more conspicuous position than any other of our technical societies. It is exactly because this is true that its affairs must be conducted on the highest possible plane. Our readers are already familiar with the fact that the recent business conduct of the Institute has received unfavorable comment. This is directed at policies and methods, and only at individuals to the extent that they defend and justify the things criticised. We have frankly expressed our opinion that a thoroughgoing change is necessary and that this necessarily involves changes in personnel. In this we but coincide with the opinion of the nominating committee and many of the best friends of the Institute most familiar with its affairs. The matter is before the members and there is abundant room for honest difference of opinion. For our part we do not believe that an officer of the Institute should by force of his position make money out of its members, and we do not consider it proper to reëlect the beneficiary of such a system. To our way of thinking this is not a case where one may properly waive his judgment because of personal friendship or appreciation of excellent work done in the past. The issue is clear, though the method of voting has become confused because of changes already made in the articles of incorporation and impending in the constitution and by-laws of the Institute. Those who wish to vote for the new order should proceed as follows:

1. Make out and forward the proxy drawn in favor of Messrs. A. R. Ledoux and James Douglas, indicating a preference for the new constitution and the new order of business.

2. Vote ballot A, in person or forward it with the proxy drawn in favor of Messrs. W. R. Ingalls and W. H. Nichols, Jr.

3. Vote ballot C, which requires no proxy, but which will be invalid unless only two directors each for the one and the two-year terms be voted for, with five for the three-year term.

4. Make out and forward the proxy asked by Messrs. C. R. Corning and G. C. Stone. Probably, as those gentlemen state, the proxy will never be officially counted, but it will have an important moral effect.

Remember that a new proxy supersedes one already on file and that the date of the election is February 18. Vote, and vote early.

Electric Hoists for Mine Service

By H. A. Russell

*The use of electricity in mining is only limited by the available supply and cost of current, whether produced by the mining operator or bought from a power company. The most potent factor in the growth of a community is transportation. The country dependent upon burros can never progress like one gridironed with steel and macadam roads. And so it is with mining, where the hoist means transportation, and may be anything from a windlass to an up-to-date ore carrier. A hoist may spell success or failure for a mine, and always plays an important part in the operating expenses.

Early Use of the Hoist

The hoist has been the last thing to consider in electricity as applied to mining, because men naturally do those things first which are easiest. The miner first lighted the surface plant and mill with electricity and then applied motors to the stamps, concentrators, and other machinery, so that in many cases everything about the mine was electrical except the hoist, leaving this to be operated by steam, or in some cases water-power. One reason for this was the miner's prejudice against an innovation that might be attended with some risk. He did not wish to risk his life on an unseen power which might fail him. The gradual and almost universal application of electricity, however, has brushed aside this prejudice so that the electric hoist is no longer considered a machine of greater hazard than the long-used steam hoisting engine.

Direct and Alternating Current

It is sometimes asked, in applying electricity, whether it should be direct or alternating current, and a brief comparison of the two may be in order. Direct current is best for all operations that entail much speed control, as the speed can be controlled by a change in voltage or by a change of resistance in either the revolving element (the armature), or the stationary element (the field); whereas a change in voltage in an alternating current motor does not affect the speed. The variable-speed direct-current motor therefore has more possibilities for hoisting than the alternating, but it has its drawbacks for mining work in being a low-voltage machine, and low-voltage direct current is not adaptable to long distance transmission. A current of electricity flowing through a conductor will induce an equal current in an opposite direction in a conductor placed near it, at the moment of starting and stopping. This principle is applied in a transformer which consists of two sets of coils, one carrying the primary current and the other carrying the induced current, and this induction principle is continuous, as the alternating current is a continuation of starts and stops. This enables manipulation of the voltage at will. Current is generated at a low voltage easy to handle, stepped-up by transformers to high voltage, enabling transmission over long distances with small conductors and small losses, and stepped down by transformers again to safe voltages easy to handle for final use. With direct current the ultimate voltage is limited to comparatively small values and transformation can only be done by motor-generators, which are expensive and entail heavy losses. It is therefore necessary to use only alternating current where long distance transmission is general, as in the Western states. For this reason the only case where direct current is practicable is for large hoists, where it is sometimes used, as will be explained later.

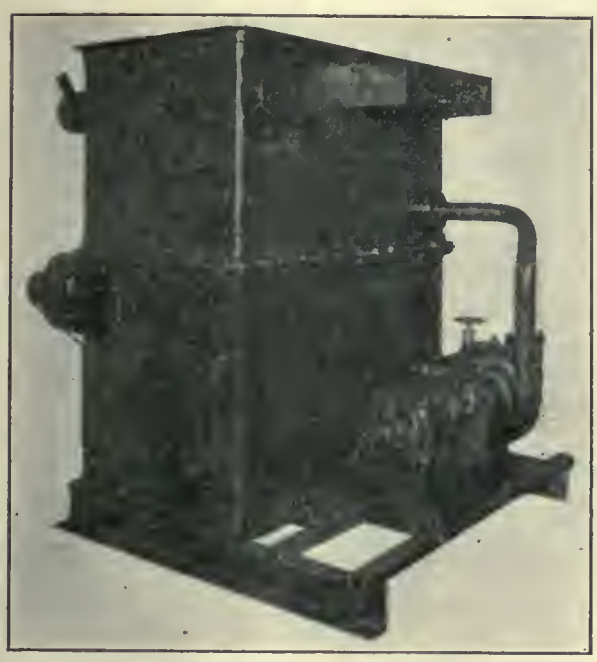
Relations Between Miner, Power Company, and Manufacturer

The hoist motor is the most difficult problem about a mine for the electrical engineer to solve, as it calls for heavy strains for short periods, delicate control of speed over wide ranges, and must be at all times reliable. Aside from the heavy strains which demand mechanical strength, the prime mover back of it must be of sufficient capacity and under such automatic control that the starting of the hoist will not put the rest of the plant 'out of business.' With a generator of 200-hp. capacity furnishing power half of which is used by a hoist, the starting of the hoist would stall the water-wheel and shut down the entire electric plant. The generating plant must be large enough to stand the heavy starting strain, and the water-wheel control must be able to keep up speed and, consequently, voltage when the heavy hoist load comes on. In the early application of electricity to mining the electric plants were scattered about in comparatively small units. The generators were much smaller than at present used, and the plants themselves were comparatively small. This made it undesirable for the power companies to take on a hoisting load which called for high power for short periods and a consequent disturbance of the system. When the hoist load is fed by large transmission systems the power companies still had to face this same difficulty in delivering current to a mine. While the hoisting load may not shut down the power company's plant, it can greatly disturb the other power users in the vicinity by dimming lights and throwing out circuit breakers. It is for this reason that the power company is obliged to keep the so-called peak load within certain bounds.

Another point more important to the power company than to the miner is the comparatively small revenue derived from hoisting. A stamp-mill takes continuous power at a fixed load for 24 hours in the day and the power company has an investment in apparatus every dollar of which is earning revenue. A hoist, on the other hand, is taking 100% more power during the period of acceleration than when it comes up to speed and is then shut off entirely.

*A paper delivered before the California Miners' Association, December 1912.

Generally speaking, a hoist is not earning dividends for the power company's investment more than one-third of the time and during this time the average load will not be over half the maximum demand. For these reasons the electric hoist has not advanced as rapidly as other applications of electricity to mining, but the power companies have had such rapid growth, their plants have grown to such enormous proportions, and their lines have so grid-ironed the mountains, as well as the valley, that they are now in position to offer current at rates profitable to themselves as well as the miner. The problem of the manufacturer is to supply a hoisting motor that will do all that the miner requires and in a way satisfactory to the power company. It is a matter where three parties are concerned and the



LIQUID RHEOSTAT FOR MINE HOISTS.

manufacturer must call upon the miner to give him all the data possible in selecting a motor that will be satisfactory to all.

Selection of a Motor

A hoisting motor must operate over a wide range of load, in fact, from zero to 50 or even 100% over its rated capacity for short periods.

Its efficiency characteristics must be comparatively good over this range. In other words, it must have a flat efficiency curve.

It must be reversible.

It must be of comparatively low speed for connection to the hoist-drum by means of gearing or rope drive in the larger sizes.

It must have high starting torque to enable it to start the load from a state of rest.

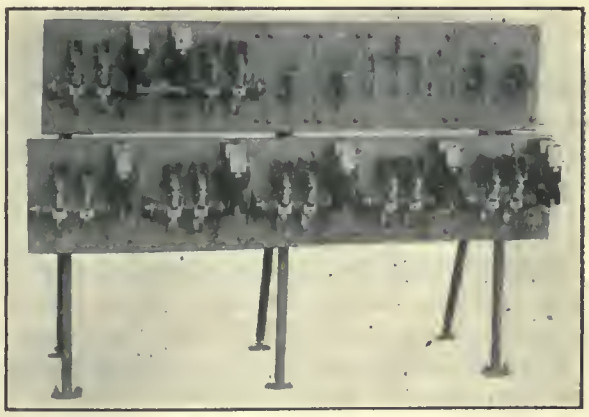
It must have speed control, from zero to full speed in fine gradations.

Being properly designed electrically it must have the mechanical design to withstand the various loads imposed upon it.

For constant-speed operation such as a stamp-mill or a rock breaker, it is a simple matter to calculate the proper horse-power to do the work. It is not so simple with a hoist. In addition to knowing the rope speed and the load the designer must know the period of acceleration, retardation, and rest. A motor may be designed for very heavy torque at starting and a short period of constant speed which would be exactly suited to a certain hoisting operation. Say the rating of such a motor is 100 hp., this same motor running under much smaller load, but running continuously, would not be at all satisfactory and would likely burn out in a short time. It is like a high-spirited road horse that is good for a burst of speed for a short distance, but would wear himself out if hitched to a heavy load.

MOTOR-GENERATOR HOISTING SET.

The manufacturer finds it very hard to establish standards where varying conditions are to be met, but in the case of hoisting motors they have tried to fix two general standards. One is a hoisting motor for intermittent duty where the load comes on and off frequently, requiring very little beyond its starting capacity. Such a motor is found in the



CONTACTOR PANEL.

usual mining hoists. Another is the continuous-duty hoist that must start its load, be under control, and then work for long periods at a fixed speed; such a motor is found in the digger on gold dredges. The miner will thus see why it is necessary for the manufacturer to know the conditions under which he is to operate and why it is necessary for him to furnish the data the manufacturer requires. The bare statement that a 100-hp. motor is wanted for a hoist is vague and misleading. What kind of a horse shall it be—a roadster or a draft-horse? There is as much energy and value in one as the other, but each has its place.

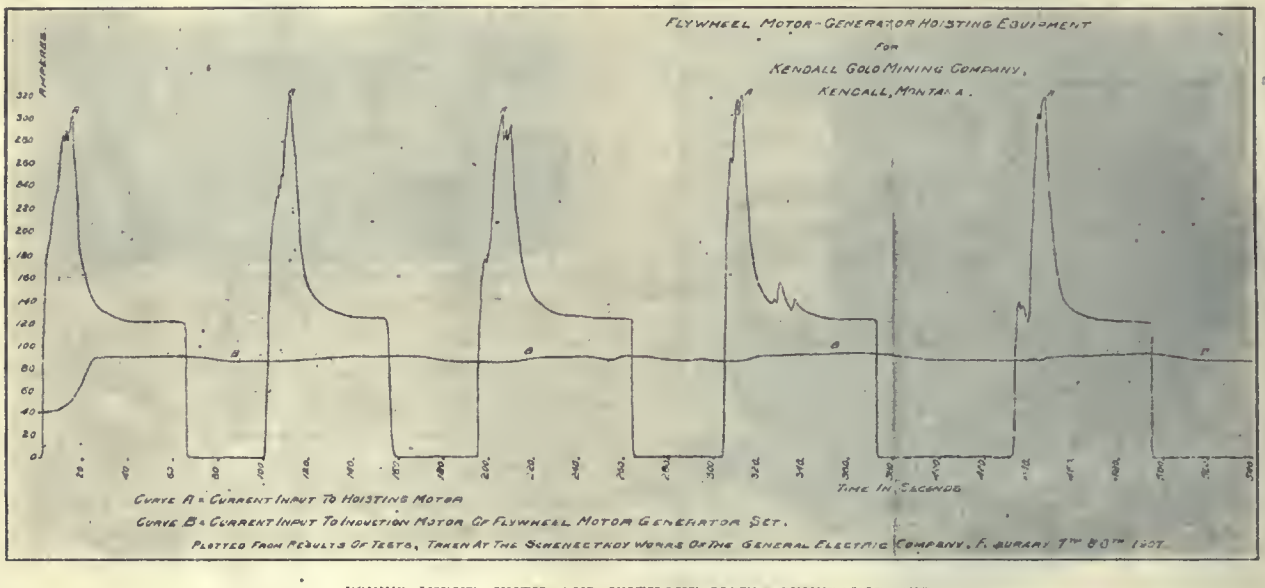
In taking up hoisting question, the following data

are of utmost importanee: Ultimate depth; angle of shaft; condition of track; weight of ore; weight of skip; size of rope (whether or not tail rope is used); speed of hoist with ore; speed of hoist with men; number of trips per hour; whether single or double drum (make of hoist); whether to operate balanced or unbalanced; when working balanced, is it necessary in case of emergency to operate unbalanced; number of seeonds required to accelerate; source of power; eyele of duty (time to load, time to unload); if necessary to operate at reduced speed (sueh as for inspection and timbering), how long will such period last?

With the universal use of electrically-operated street-cars, similar data is furnished by the railway operators, so that manufacturers feel perfectly se-

Controlling Apparatus

After the motor, the control is the important factor in a hoisting outfit. The control is under constant operation, making and breaking contacts, and should be designed with sufficient carrying capacity to withstand this excessive use. With motors up to 150 hp. there is no difficulty in designing a simple drum controller that will satisfactorily take care of the work. Beyond 150 hp., however, the current begins to be unmanageable, and burning of contacts becomes a souree of expense and delay. It then beeomes necessary to use the controller as an auxiliary device, whieh makes and breaks eontact through contactors which are so arranged that the arcing is easily extinguished and the heavy eurrent does not enter into the controller and thereby dam-


FLYWHEEL MOTOR-GENERATOR HOISTING EQUIPMENT
FOR
KENDALL GOLD MINING COMPANY,
KENDALL, MONTANA.
AMPERES.
TIME IN SECONDS.
CURVE A = CURRENT INPUT TO HOISTING MOTOR
CURVE B = CURRENT INPUT TO INDUCTION MOTOR OF FLYWHEEL MOTOR GENERATOR SET.
PLOTTED FROM RESULTS OF TESTS, TAKEN AT THE SCHENECTADY WORKS OF THE GENERAL ELECTRIC COMPANY, F. MURRAY 7TH & 8TH 1907.

POWER INPUT, WITH AND WITHOUT MOTOR-GENERATOR SET.

eure in guaranteeing their operation. The same security should be felt by both the manufacturer and the miner when suffieient data are furnished and the motor is designed for the particular work in hand.

Horse-Power Needed

The horse-power that is to be considered in selecting a hoist can best be illustrated by an example. The maker is furnished with the data necessary as to depth of shaft, speed, etc., and finds that the hoist when working unbalanced will require 335 hp. for the first six seconds during aeceleration, then the load immediately drops to 248 hp. at the end of eight seconds; from this point on the load gradually drops, due to the winding of the rope until it reaches 176 hp. after 160 seconds. Here the cycle is nothing, 325 hp., 248 hp., 176 hp., and nothing again. What should be the size of the motor to take care of this hoist? With this same hoist working balanced, the starting horse-power jumped to 298, immediately dropped to 189, then, due to the winding in of the rope, gradually dropped off to 54 hp. With the necessary data in hand, the manufacturer was able to design a motor, or rather select one, of a line of standards rated at 225 hp. intermittent, that he could guarantee to successfully perform the work.

age it. On the contrary, it is properly taken care of without injury, through the contactors.

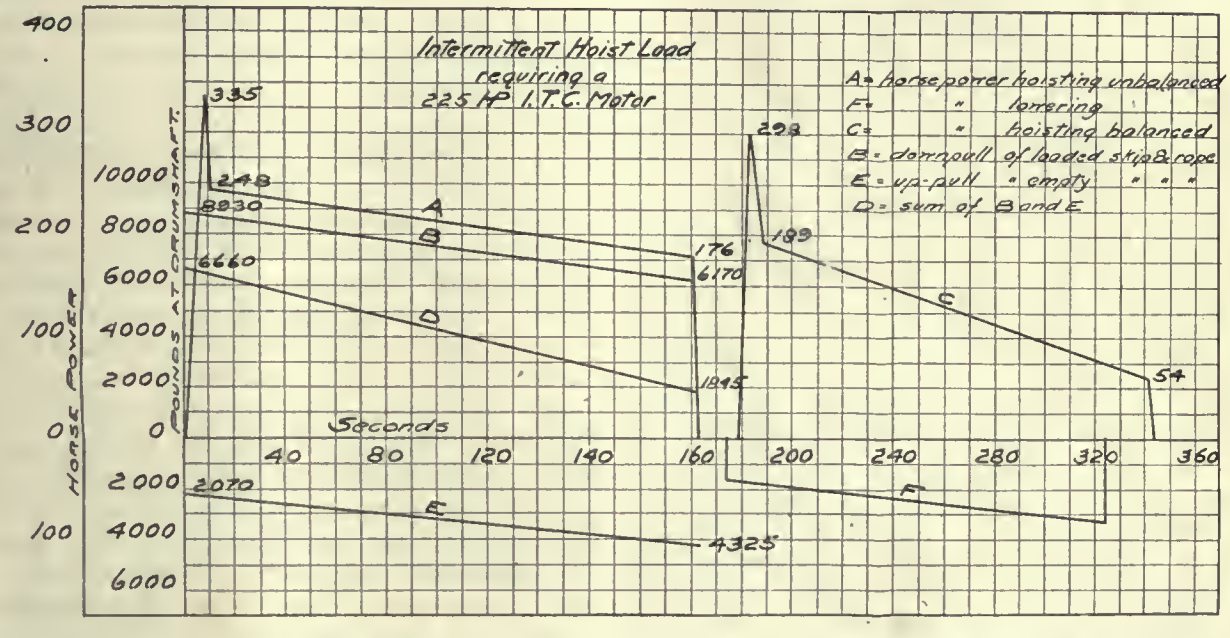
The contactor has another important safety feature. With the straight-drum controller using small currents, it is a relatively small matter whether the current be thrown on slowly or all at once. With heavy current, however, and unwise use of the controller, it would result in serious damage and the contactor system is designed to limit the flow of current that can take place at any one time. The operator might throw his controller around to the full-speed position, but the contactors would automatically come into play, one after another, without allowing excessive inrush of current at any point. Contactor-control panels are designed for motors of 150 hp. up to over 1000 hp. There is another method of control which lends itself to finer graduation than the contactor-panel, and it is therefore sometimes better, but the cost is too high to offset its advantages except in very large hoists. This is the liquid control. The resistance, instead of being cast-iron grids, is a liquid used in a tank which is water-cooled. This makes it easy to dissipate its heat through radiation by the circulation of water. These controls have been used extensively in South Africa on work where long periods of reduced speed are desired and with motors of 400 hp. or over. The system has many advantages.

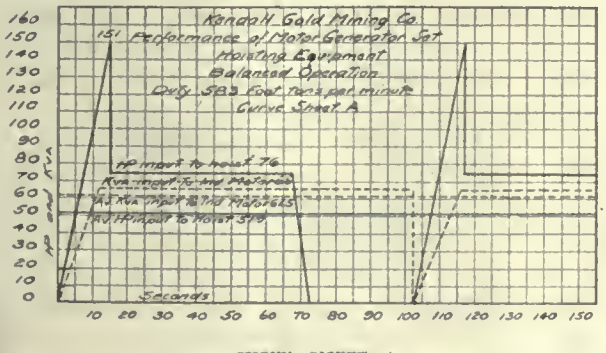
Peak Load

The power company objects to excessive loads, and where the power rate is based upon peak load it becomes necessary for the manufacturer and miner to get together and keep down that peak. This may be done in a degree by balancing the load in a double-compartment shaft. It has been done in some cases with a tail-rope, but this is not practicable in developing a mine, where the lower level is always changing. It may be done through a storage-battery whereby the battery may be stored under a steady load 24 hours per day and drawn upon at will by the hoist. This involves the installation of a motor-generator set and a storage-battery, an expensive outlay.

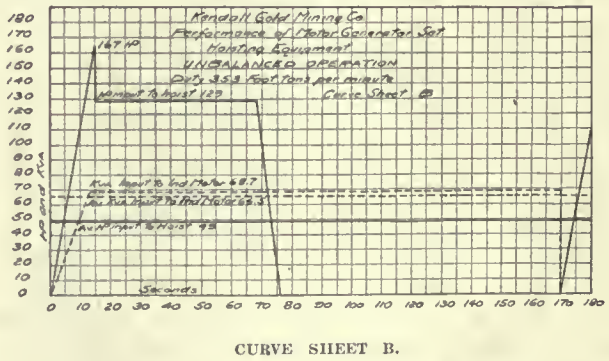
Another plan is the fly-wheel motor-generator set. This system, like the storage-battery system, involves the use of a direct-current motor on the hoist and is one of the cases where ease of regulation makes it desirable to use direct current. The system consists of an induction motor, which receives alternating current, two or three-phase from the power company, direct-connected to a separately-excited generator, and a heavy fly-wheel, all on the same shaft, as shown in the illustration. The hoist itself, as stated, is operated by a direct-current motor. The motor of the motor-generator set is kept running all the time. When the current is thrown on by an automatic control device, as shown in the illustration, the speed of the system is reduced. As soon as the speed drops, the fly-wheel gives up its energy to the generator. When the load goes off, this action is reversed and the fly-wheel then absorbs the power from the system. In this way the excessive peak is taken off and intermittent hoisting is accomplished by a steady drain of power.

The curves given below graphically show the operation of the system. The ragged uneven curve shows the power as it is actually taken by the direct-current motor, and represents the varying load of the hoist. It has sharp peaks and wide valleys. Curve *A* shows the input to the induction motor in comparison to the input to the direct-current motor.





CURVE SHEET A.



CURVE SHEET B.

It shows that the input to the induction motor never runs above 66 kva., or 5 kva. more than the average, which can hardly be called a peak. On the other hand, the input to the hoist is 151 hp., with an average horse-power of 51.9. If the miner had to pay on the basis of the peak load in this case, he would pay nearly three times as much for his current as he would with the motor-generator set. Between the time when the hoist is thrown off and starts up again, the input to the induction motor continues and the fly-wheel is storing energy for the next operation.

Curve *B* is similar to curve *A*, except it is not unbalanced operation, and the curves show that when the hoist load comes on, that of the induction motor goes off, and *vice versa*, thus evening up the drain of curren from the line. In the set from which they were taken, that of the Kendall Gold Mining

Co., Kendall, Montana, the motor is 75 hp., direct-connected to a 120-hp. generator.

Extent of Electric Hoisting

The field for electric hoisting in the West is a large one, and worthy of careful consideration. The power company is prepared to give good service, the manufacturer is ready to furnish reliable apparatus guaranteed to do the work, and the miner can contract with both of them at terms which will show a good return on his investment and a consequent decrease in his operating expenses. It seems like extravagance to throw out a perfectly good steam-engine, that has paid for itself over and over, for the sake of applying electricity. Yet we constantly see engines disconnected or taken away from the hoisting drums, and motors put in their place. It has paid to do it, or it would not have been done. How much better would it have paid had the motor been installed in the first place. In a new venture the power company will run lines to furnish the current, first for a prospecting hoist, and later for the large hoist suitable for heavy work. Where the power-lines are too far removed to economically reach the mine, an independent power-supply can often be developed. The miner, the power company, and the manufacturer are mutually interested in mining development. In the case of new power development touching on Government reserves, perhaps Uncle Sam had better be added to the trinity. This is as it should be, for the harnessing of water-power stands for true conservation. Water-power is unfailing, yet it saves the timber, coal, and oil, which do fail. The Comstock has been reopened by means of electricity for hoisting water, timbers, men, and some ore, and but for electricity this work would never have been resumed. On the Mother Lode a number of hoists have shown good results with electric power. Some of the power companies are supplying current for hoisting work at 1½c. per kilowatt-hour, and less, depending upon the size of the hoist and voltage conditions. This would amount to about $8 per month per continuous horse-power. With current about this figure, mines on the Mother Lode have put in electric motors, replacing steam, with fuel-oil at about $1.75 per barrel, and by so doing have cut the power bill in two.

Coal production from the Honan, China, mines of the Pekin Syndicate, Ltd., for 1912 is estimated at 450,000 to 500,000 tons. The company has had many difficulties to contend with, and no dividends have been paid during the year. Measures are being taken to engage in other forms of profitable business than mining, and the company has already invested $4,000,000 in 5% Honan railway bonds.

Zinc smelters in operation in Belgium in 1911 numbered 13, and produced 198,230 metric tons of spelter, valued at $23,933,659, a large increase over preceding years. There are 6 lead-silver smelting plants, which treated 860 tons of Belgium ore, and 58,580 tons of foreign ore, yielding 96,025 tons of lead and silver valued at $5,150,928.

Placer Gold Dredging and Washing in Bolivia

In addition to the rubber and other jungle products, all the rivers emptying into the Amazon carry gold. Many of the Indians earn their living entirely by washing the gravels from those rivers. The surface gravel is quite rich in gold, where the stones have formed a kind of riffle to catch the grains. By removing those stones and washing up the gravel for a foot in depth, the Indians often make $5 (gold) per day, and some white men make a great deal more. As pointed out, the surface gravels are rich in gold, and this has been the means of inducing an English company to take up many hundred pertenencias of dredging claims on the Kaka river. This company was first formed with a capital of £100,000. After less than two years' work, and before the dredge was working, it went into liquidation and was reorganized with even more capital. It had hardly started work when it again went into liquidation, and was again reorganized with a further capital of £100,000. After being 'bust' for the third time, someone connected with the company thought it would be wise to test the gravel to be found below. Accordingly, an engineer was hired for the first time to test the gravel. He condemned the whole scheme. This was an English company and English capital, with a properly constituted board of directors and a 'real live Lord' for a chairman; must have a Lord for a chairman in order to preserve a frigid atmosphere, in case any shareholders ask impertinent questions, and at the same time give the shareholders the 'glassy eye.' After five years' work (Heaven knows what they were doing all this time) the dredge was started, worked 360 hours and recovered 25 oz. of gold, nearly £100,000 having been spent in the vain effort.

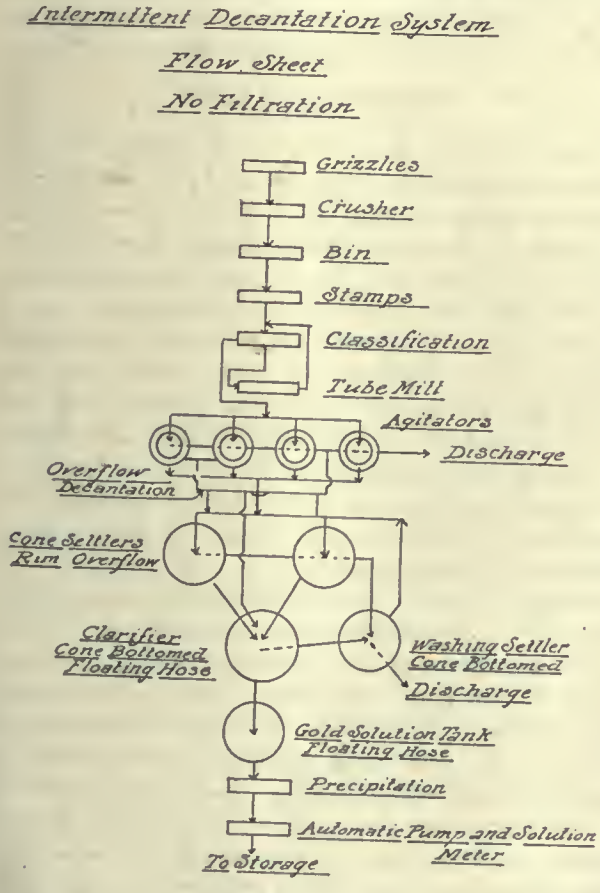
After this company had entirely failed, an old Irish prospector came along, tested the ground along the Kaka river, and decided to work it. He made a rocker out of an old gin-box, and with it and his two hands worked a month and took more gold out of the gravel than the properly organized English company which had spent in a dignified manner, with a large staff, nearly £100,000 of the shareholders' cash. This prospector might have been there yet, but after he had worked a few days he got on a wild 'jamboree' and, while loaded down with 'bugjuice,' danced Irish reels along the Playas and 'whooped it up' in such a manner that he scared the Indians, who used to transport him on the *balsas*, until they thought he was crazy and would not come near him. In vain he tried to get them to come to him in confidence. It is true they came, but always brought some peace offering, like the leg of a pig, some yams, or other food, which is the custom with the Indians thereabouts when approaching somebody of whom they are afraid. There are many prospectors of this hardy type who pass through this region after having followed nearly every gold rush for the past thirty years, and finally they drift down the river, ever onward, until they fill a place marked with a little wooden cross somewhere between here and the Atlantic.—*West Coast Leader.*

The Intermittent System of Cyanidation

By L. P. Hills

*The popularity of the continuous system of direct cyanidation is, I believe, an unfair verdict against the intermittent system. The former undoubtedly sprang from the difficulties encountered in the latter in promptly effecting a condition of suspension in the charge to be agitated, clogging of pipes, etc. All of these difficulties can be wholly obviated at present, one means being by the use of the agitator hereinafter described.

Theoretically, the charge system surpasses the continuous. The latter is, by its very nature, inefficient. Assume a series of 100-ton tanks, with a flow of 10 tons per hour. Consider the efflux from the first tank for any given hour. That 10-ton portion is composed of, approximately:



0.909 tons of the influx of the given hour
0.825 tons of the first preceding hour
0.751 tons of the second preceding hour
0.683 tons of the third preceding hour
0.621 tons of the fourth preceding hour
0.565 tons of the fifth preceding hour
0.513 tons of the sixth preceding hour
0.466 tons of the seventh preceding hour
0.424 tons of the eighth preceding hour
0.386 tons of the ninth preceding hour
0.351 tons of the tenth preceding hour

the remaining 3½ tons in diminishing portions back to the initial inflowing 10 tons. The great bulk of the pulp receives exceedingly long treatment, the time of treatment of different portions varying between wide limits. Also the heavier and coarser particles make the most rapid transit through the series; thus that portion requiring the longer treatment gets the shorter treatment. The ideal system, wherein the pulp receives the exact treatment required to perfect extraction, can be closely approximated in the intermittent system.

The accompanying flow-sheet illustrates an intermittent decantation system for which the following merits can be reasonably claimed: Simplicity, cheapness of installation, economy of power and labor, low maintenance cost, flexibility of operation.

The agitator is the chief feature of this system, and insures reliability of operation. It is a modification of the Pachuca, the central fixed column being surrounded by a vertically adjustable column of a few inches greater diameter. This outer column, by means of a screw at the top of the tank, may be moved from a position where the lower end of the column is in contact with the sides of the cone, to any predetermined point above that, the upper extremity of the column always being below the surface of the solution. During the time agitation is suspended and settling is taking place the outer column is in its lowest position, thus excluding the pulp from settling around the inner column and air-jet. To start agitation, turn the air on, which will institute circulation of solution down between the two columns and up through the central column, whereupon the outer column is raised, allowing the pulp to enter into the circulation. This agitator has been subjected to all kinds of tests and never failed to get the pulp into a condition of suspension and without the aid of additional air.

In the system under consideration, a thickener to precede the agitators is not necessary. The agitator is provided with a baffle which gives a circumferential quiet zone when pulp is being run in and when agitation is taking place, the overflow going to cone settlers. When a charge is sufficiently thickened in the agitator, the pulp is switched to another agitator, and agitation started in the charged tank. During agitation, barren solution may be run in to lessen the gold contents and also to vitalize the solution in the tank.

The extraction being completed, the outer column is screwed down, agitation suspended, pulp settled, solution decanted, and washes repeated as many times as is advisable, depending on the richnes of the ore. The settlings from settlers and clarifier are drawn off intermittently to washing settler, or agitator, and washed.

This system permits operating so that the finer pulp, in which the extraction is rapid, receives the short treatment and the heavier and coarser pulp receives longer treatment.

*From *Colorado School of Mines Magazine.*

Exports of iron ore from Chinnampo, Korea, to Japan are at the rate of 150,000 tons per year. This ore is secured from the Chai-lyong, Anak, and Eunyul mines. Exports of coal from the anthracite mines at Pingyang amounted to 100,000 tons, all going to the naval briquetting plant near Tokugama, near Shimonoseki.

Methods of Teaching Assaying

By D. C. Livingston

The ideal engineering course is one that instils the fundamental scientific principles that underlie every phase of engineering work, and also emphasizes these principles in their practical application and relation to modern engineering projects. In addition to this, the technical school should give to the student who has devoted four years of his life sufficient training in one or more branches of his profession to enable him to creditably fill the positions which he most likely will be called upon to occupy on graduating.

The mining graduate is most likely to be called upon to do either one or all of the following things: surveying, drafting, assaying, and analytical work, or possibly the testing of machines or processes; this last being a somewhat newer line in the direction of efficiency engineering that seems to contain possibilities for the graduate engineer. A number, of course, will obtain work underground until something more to their liking develops, but if statistics were available of the first technical work done by mining graduates, it would be safe to say that the list given would cover ninety out of a hundred. The mining student on graduating should be able to go into a mine assay-office and do the work required without any further instruction, and he should be also capable of making a complete survey of a mine and drawing a set of maps, if called upon to do so.

Defective Teaching

In most of the best engineering schools in this country, field practice in surveying is acquired during a summer school under conditions similar to actual practice, and an intelligent man, on completing such a course, should be quite capable of creditably filling a position as instrument man on a survey party or as mine surveyor, without further preparation. The same cannot be said about courses in fire-assaying, as given in most mining schools, and the unpractical method of teaching fire-assaying which is generally in vogue has often been mentioned in the technical press. The mining graduate is generally incapable of handling the amount of work that is usually required in a mine or smelter assay-office without first learning how to systematize his work. It has occasionally happened that a young assayer has thrown up his first job in despair, and those who have not left have usually been forced to work many unnecessary hours through lack of proper preparation, until they had learned how by experience.

The object of this article is to describe a method of teaching fire-assaying recently adopted at the University of Idaho, which was designed with the object of giving the student a thorough knowledge of the underlying principles and in addition capacity for handling a large amount of work and obtaining accurate results. Though it is fully realized that this course is by no means perfect, yet if its description does no more than bring in one useful suggestion for improvement, it will have fulfilled its object.

The course as given takes two afternoons per week, or its equivalent, throughout the whole of the junior year, and consists of four divisions: (1) the acquisition of a knowledge of the principles and reactions of the processes involved; (2) the acquisition of accuracy in the work; (3) special methods for difficult ores and metallurgical products, assay of bullions, ores containing metallic particles, etc.; (4) acquisition of speed and accuracy combined, and the handling of a large amount of work.

General Plan of Course

Acquisition of the principles is accomplished by laboratory practice, accompanied by explanatory lectures and reading from text-books. Fulton's 'Manual of Assaying' being the one used. In the laboratory work, after he has made sufficient cupels to last the semester, the student first runs a set of experiments to determine the reducing power of the common reducing agents like flour, argol, coal, sulphur, and pyrite ore, with both silicious and non-silicious charges. He then determines the oxidizing power of nitre against several reducing agents in charges similar to the first. This work gives him practice in handling his furnace and in making fusions. He then calculates a series of lead-soda-silicate slags for: (1) a high-grade silicious silver ore; (2) a high-grade silver sulphide ore. In the first case the slag is calculated to range between a tri-silicate and a sub-silicate, and in the second, by varying the amounts of silica as well as the other reagents the slag is made to range between a bi-silicate and an oxide slag. The physical effect of various slags is noted, and the actual effect is determined by cupelling the resulting lead button and weighing the silver. This brings out the reasons for using certain reagents, and both the theoretical and practical limits of the amounts to be used in these two classes of ore.

Necessity for care in sampling is brought out by each student taking a series of samples from a 'spotty' silver ore, which is reduced in size after taking each sample by further grinding and re-sampling. When several students work on the same ore their results will differ widely on the coarse samples, but should agree on the final grinding if this is fine enough and the sampling conducted carefully. The size of lead button which will bring down the maximum of the precious metals is also determined by experiment, using a fairly high-grade ore, by reducing a series of buttons of different weights and plotting the results obtained by a number of the students on the same ore. This work should take from 15 to 20 afternoons to finish properly, or approximately half of an average semester, when two

afternoons per week constitute the course. One of the most important things is accustoming the student from the start to handle as many as five or six duplicate determinations at the same time. This will tend to make him systematic in his work in order to keep his samples from getting mixed. The student is never allowed to mark his crucibles, but is made to run them in rotation as he would have to in practice. Accuracy is demanded in this part of the course, and all duplicate assays are required to check or be repeated.

Training in Accuracy

Acquisition of accuracy, by practice in crucible work, scorification, and fire-assay for lead, is accomplished, as in all other institutions, by handing out to the student carefully checked samples. These are either pulp or samples of 20 lb. in weight or thereabout, ground through 20-mesh. The large samples the student samples and 'bucks down' himself. These are, as a rule, simple ores involving no particular difficulty in the fluxing, as the object of this part of the course is to obtain skill in fusing, cupellation, and parting. Scorification of silver ores and fire-assay of lead ores is also taught at this time. Enough checked samples are kept on hand so that no two students are working on the same ore at the same time. The ores are handed out three or four at a time in order to keep the student systematic in his method of working. This work, on a basis of two afternoons a week, occupies the remainder of the first semester.

The first part of the second semester is spent in assaying difficult ores and metallurgical products by the different standard methods, as the excess litharge and nitre, iron nail, and scorification; and the limitations and advantages of the different methods shown for different types of ores, such as heavy sulphides, arsenides, antimonial and zincy ores, tellurides, hematite and limestone ores, speiss, copper and lead bullion. Checked samples and pulps of these ores are kept on hand for this purpose. The assay of gold and silver bullion, the combined method for copper bullion, and the handling of metallic particles, and any other special methods which may be considered necessary, are also taught.

Training in Speed

Acquiring speed and accuracy combined, and the handling of a comparatively large amount of work with dispatch, are inculcated by spending a whole day in the laboratory instead of two afternoons, as it is impossible for a student to accomplish any large amount of work when limited to a 3-hr. period. It is also absolutely essential that the student have his own muffle and entire set of apparatus, including the pulp-balance, although two students may use the same button-balance without interfering with one another. This part of the course is during the last half of the second semester, and consists of from six to eight whole days in the laboratory, depending upon the quality of the work turned out by the student. Commencing with six samples on the first day, the number is gradually increased to twenty-five on the last. These samples, which are checked pulps, are handed out in the morning and the results expected that night. All kinds of difficult ores and metallurgical products are included in these samples in order to give the student practice. If more than three out of ten of the assays do not check closely with the originals, the whole number have to be re-run until they do. When the student can run twenty-five duplicate assays on unknown ores and have three-quarters of them check within 0.5 oz. on silver and 0.03 oz. gold on a fifty-ounce ore, he is considered as having satisfactorily accomplished the course and should be able to hold his own in an assay-office. During the course over three hundred determinations are made for gold, silver, and lead, many of them being repeated several times. The practical value of the last part of the course appeals to the students, and they have voluntarily given up Saturday as being the only whole day available for the work.

Gold Dredging in the Philippine Islands

In the Philippines four dredges were reported as operating during 1912. The most important project during the year was that of the Philippine Exploration Co. on the Gumaus river. The 5½-cu. ft. dredge, built by the New York Engineering Co. for this company, commenced operations in October. The first clean-up was 275 ounces.

The company expects to handle 85,000 to 90,000 cu. yd. per month and that the average recovery will be in excess of 30c. per cu. yd. The dredge was built at a cost of about $150,000 and the life of the property is estimated at five years. The old Stanley dredge, which has been idle for two years, has been taken over by a new local syndicate known as the Maximall Gold Dredging Co. The hull has been thoroughly overhauled and found to be in fair condition, and the company began operations in October on the upper part of Paracale basin with F. W. Pearson as dredgemaster. The Paracale Proprietary Co. is operating the old Paracale dredge on the Paracale river, and has two dredges under construction. The first should be completed by the end of the present year and the other a few months later. The combined capacity of the two dredges, it is claimed, will be 100,000 cu. yd. per month. The old Paracale dredge has recently been overhauled and repaired. The old Risdon 3½-ft. dredge on the Maliguit river, under the supervision of John A. Bruce, handled from 15,000 to 20,000 cu. yd. per month. Frank B. Ingersoll and A. J. McDonald are planning to place a 5½-cu. ft. dredge of the close-connected type on the Malaguit river. Some ground on the Umiral river below the mouth of the Oyongan is controlled by Australians who are constructing a dredge. The ground has been prospected and the average value has been estimated at 35c. per yd. It is reported that a small dredge was purchased by H. E. Nelson for work on the Mariguina. It is only claimed to have a capacity of 100 yd. per 10 hours. Several areas were examined in 1912 with a view to building dredges if results were favorable and there seems to be a field for small dredges in the Philippines.

Drilling at the Mount Royal Tunnel

By L. B. Schwarz and G. H. Gilman

*A double-track tunnel, 3½ miles long, is being driven through Mount Royal, the high ridge behind the town of Montreal, in order to bring the tracks of the Canadian Northern railroad into the heart of the city, where a new terminal station is to be built. This work is being done by Mackenzie, Mann & Co., Ltd. Work on the tunnel was begun in July of last year. It is being advaneed at four main headings, one from the west portal, two from Maplewood avenue shaft, and one from the Dorchester street shaft. The rock is limestone of medium to hard texture, cut by trap dikes.

The drilling work is carried on by means of Sullivan 'FF-12' light-weight water drills, with 2⅝-in. eylinders, of which 18 are in use, and Sullivan 'UH-2' 3⅝-in. water drills, of which 15 were recently purchased. These drills are operated by eompressed air at 100 lb. pressure, supplied by six 100-cu. ft. belt-driven cross-compound eompressors and two 2000-ft. direct-connected motor-driven cross-eompound air-compressors.

SECTIONAL VIEW OF SULLIVAN WATER DRILL.

Sullivan Water Drill

As this is the first large piece of work in which the Sullivan water drills have been used in numbers, some detailed description of these machines will be interesting. Engineers have devoted much time and study to the problem of clearing drill-holes of cuttings. In a rock that makes sludge rapidly, as for example, shale, slate, and some porphyries, difficulty is experienced in cleaning the holes regardless of the angles at whieh they are drilled.

In a free-drilling rock, which ordinarily may be cleared by throwing water into the hole, depending upon the churning action of the drill-steel to eject the cuttings, this same difficulty is experienced with dry holes. This objectionable feature has been overcome to some extent by the use of a water jet, from a hose nozzle, but an arrangement of this kind practically requires the services of an extra man, since the desired results may be obtained only when the drill steel is reciprocating, and further, the amount of water required will in many cases prohibit the use of such a devicе. Wtih these points in mind, the Sullivan water reciprocating drill has been developed. This is an ordinary rock-drill of the reciprocating type, with a piston and rifle bar bored out to permit the insertion of a small tube, adjustably secured in the back head of the machine. Water under pressure is conducted by a hose line and fittings to the mouth of this tube, through which a constant jet passes into the hollow piston rod and thence into the hollow drill-steel, held in the chuck of the machine. The hole through the drill piston is enlarged for a certain distance from the point at whieh it ends in the counterbore for the rifle bar, and the function of this enlarged opening or secondary counterbore is to conduct an impulse of exhaust air from the rear of the piston chamber down through the hole in the piston, when it withdraws from the lower end of the tube, which happens at the instant of reverse on its forward stroke.

These details are shown in the sectional view. The action causes a charge of mingled air and water to pass through the hollow drill-steel to the cutting face of the bit, which, with the water which passes through when the piston is lifting, has the effect of ejecting the cuttings in the form of sludge from the drill-hole. It also insures a clean rock surface for the bit to strike, and prevents the hole from 'mudding up', regardless of its direction.

When working under normal conditions, air from the cylinder is not admitted to the hollow piston until after the valve is reversed, with the piston on its forward stroke. The air consumption of the machine is therefore exactly the same as if there were no water-tube, because the air which would ordinarily be exhausted by the valve passes through the drill-steel, and no live air can be admitted for this purpose.

If, however, the conditions of the ground warrant it, a charge of live air from behind the piston may be directed into the drill-steel, and this will be followed by the impulse of exhaust air as the piston nears the forward end of its stroke. This may be accomplished by pulling the tube farther back into the head, and then securing it by screwing down the lock plug upon the rubber sleeve. By thus manipulating the water-tube, a varying proportion of air and water may be admitted to the drill-hole to handle to the best advantage the particular kind of rock being drilled.

The water-tube is secured in the back head by the

*From *Mine and Quarry.*

rubber sleeve and gland or lock plug just mentioned. Water is introduced through a water elbow and hose fittings, which include a spud containing a screen to prevent foreign matter from entering the tube, and a screw cap to keep out dirt when the hose is disconnected. A removable plug is provided to limit the amount of water admitted.

Water-Supply

Water under a pressure of from 50 to 100 lb. per square inch is required for clearing the hole of its cuttings. If it is not possible to procure this by other means, a pressure tank may be employed, in which, after being filled with water, the desired pressure is secured by admitting to the tank compressed air at pipe-line pressure. At Montreal the supply is brought in under pressure from pumps and distributed to the drills in the headings by a manifold.

DRILLING SIDE-HOLES FOR WIDENING.

The amount of water entering the drill should only be such as to make a heavy paste of the mud. Using more water than is necessary for this purpose is objectionable, because it requires frequent filling of the water-tank and does not increase the cutting speed. It also is apt to get more water into the drill, in various ways, making it harder to lubricate. The amount of water required will vary with different kinds of ground, and if the $^1/_{16}$-in. opening in the water-spud of the drill is not large enough to suit conditions, the hole can be drilled out larger or another plug with a larger opening substituted. In the event that the cuttings do not come from the hole as readily as desired, the water-tube should be drawn back into the rear head by ⅛-in. stages, in order to allow more air to mingle with the water passing through the drill-steel. This should be tried before increasing the water opening, and if satisfactory results in cleaning the hole cannot be obtained by increasing the air-supply as suggested, more water may be introduced by enlarging the opening in the spud. When the air consumption of the drill is an important item, the water-tube can be pushed forward into the piston and this will cut down the amount of live air used through the drill-steel.

Round hollow steel is ordinarily used with this drill, and requires no shanking. The bit in common use is the regular cross shape, similar to that commonly used with solid steel. Lubrication is provided by the automatic differential-pressure oiler, used first on Sullivan light-weight drills. This consists of a chamber cast in the drill cylinder and holding about half a pint of lubricant. Oil from the chamber is drawn into the chest by the pulsations of the air in it. The speed is controlled by two small ball check valves screwed into the top face of the cylinder and connected by ports with the oil chamber, so that oil is conducted to the inlet opening in the chest. It is then carried through the machine in the form of a spray.

General

The general operation of this drill is the same as that of the ordinary reciprocating or so-called piston machine. It has the advantage of not requiring the use of any external means of extracting the cuttings, which permits it to be kept in continuous operation from set-up to tear down, excepting for time required to change drill-steels. A little practice on the part of the operator will enable him to adjust it to meet to the best advantage the existing conditions of ground and air pressure, and when this is once accomplished, remarkable drilling speed results.

Drilling Speed

The 'FF-12' water drills at the Mount Royal tunnel are mounted on horizontal 11-ft. heading bars, with a leg or support in the centre to secure stiffness. Four drills are used at once on this bar. When the rock is unusually hard, three double-screw mining columns are used instead of the bar. Two drills are mounted on arms on each of the two outside columns, and a fifth drill on the centre column. In one heading the drills have cut as high as 20½ ft. per hour per drill. This does not include setting up, but does include changing steel and lining up holes. The average depth of holes is 5½ ft., and the average speed per drill hour 16½ ft. In sinking a shaft with 7-ft. cut holes and 5-ft. line holes, an average of 8.6 ft. per hour per drill was maintained (total drilling time). In another heading where the rock is harder, the four drills cut in October, 13 ft. per drill hour, or eight 5½-ft. holes in two hours, total drilling time. The steel is 1⅛-in. gauge, and holes are drilled for 1¼-in. powder.

Water-piston drills are being introduced in Missouri, but performance figures are not yet known.

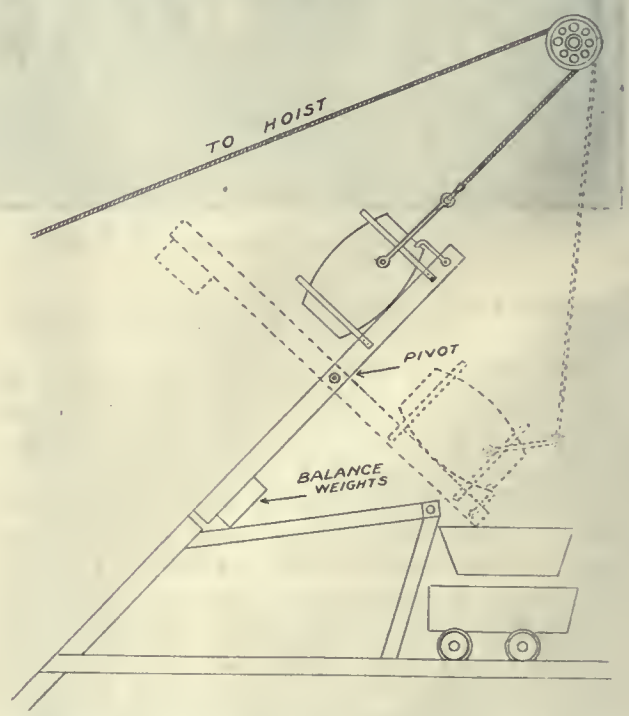
Concentration by Flotation

At the annual meeting of the Minerals Separation, Ltd., it was stated that nearly 2,000,000 tons of zinc, lead, and copper ores are being treated by the company's process yearly, while the following interesting comparisons with other concentrating processes were made by the chairman.

In the up-to-date mines of the United States and elsewhere, where several thousand tons of ore are treated daily, I understand the modern practice is to erect complete self-contained units, each designed and equipped to crush, and concentrate, or treat about 1000 tons per day. Complete plans of such 1000-ton units have been furnished to Mr. Broadbridge, the company's chief engineer, and on that he bases his figures, which have been summarized as follows: First, for an ordinary wet-table and vanner concentration unit to treat 1000 tons per day there are, in the particular mill referred to, 174 tables and vanners, occupying a building or floor space of 41,580 sq. ft. The power required to drive these amounts to 175 hp., and the cost of installation is approximately $120,000. This, of course, refers to the concentration plant alone, no crushing or power plant being included. Second, to replace this mill with a Minerals Separation flotation plant will require only two units of 600 tons each, capable of handling 1200 tons of ore, instead of 1000, and will cost about $20,000. The housing or floor space required will be less than 3000 sq. ft., compared with 41,000, and the horse-power to drive it only 80 to 120 at the most, according to the number of agitators. The additional cost of suitable re-grinding mills recommended will, at the outside, amount to $30,000; adding this to the cost of Minerals Separation flotation plant, the total will then only amount to $48,000, compared with $120,000 for the former unwieldy, and less efficient plant. The extra re-crushing plant forms no part of the purely Minerals Separation process plant, although it is recommended and included, because of the enhanced profit it will ensure. To make this clear, take a 2% copper ore, from which under the best table and vanner methods a possible 70% recovery may be assumed, so that with copper at 12c. per pound the yearly yield will be $1,226,400. Estimating an 85% recovery by Minerals Separation, because all minerals can be freed from the gangue by better crushing, thereby making the higher recovery easily possible, and assuming on a conservative basis that fully 50% of the crushed ore will need re-crushing at a cost of 20c. per ton, and allowing also for the additional cost of smelting, the net results will work out as follows: With copper at 12c. the yield will be $1,459,109, showing a balance of $232,709 to the good, which, again, is equivalent to over 60c. per ton of ore net, or more than sufficient to amortize the whole of the cost of Minerals Separation plant, plus that of the extra fine-crushing plant, in less than three months' operation. In other words, the copper produced from a 2% ore will cost at least 1c. per pound less to produce, the effect of which on the copper production of big mines, and of the world, will be self-evident. In a mill handling 2,000,000 tons per year, of which there are more than one in the United States and elsewhere, the two systems appear to be still more instructive and convincing. With wet, or table and vanner concentration, a plant of this capacity would require 850 concentration tables and vanners, occupying a floor space of over 200,000 sq. ft., consuming not less than 870 hp., with a capital outlay of over $620,000. A Minerals Separation plant, on the other hand, to treat this quantity would only require nine units occupying a floor space of not more than 15,000 sq. ft., would cost less than $100,000, and would require only 400 to 450 hp. If it were found necessary to fine-grind the ore, an additional $144,000 should be added to the above figure, raising the cost to $240,000. In capital outlay alone, the table and vanner plant would, therefore, cost 500% more than a Minerals Separation plant of equal capacity, or over 150% more than a Minerals Separation plant, plus the additional re-crushing plant recommended. The production of copper, assuming 85% recovery (in many cases we have reason to expect to get a recovery of 90%), would be increased from 51,000,000 lb. to over 62,000,000 lb. The net saving would amount to $1,163,547, taking copper at 12c. per pound.

A Self-Dumping Hoist

At small mines and prospects automatic machinery is quite as important as at large ones, and many a dollar may be saved by simple contrivances. One such is illustrated below in a self-dumping hoist as used by the Arcade M. & M. Co. It is especially



adapted to prospecting work on inclined veins. The counter-weight should overbalance the empty but not the loaded bucket. The whole arrangement is easily and cheaply built. We are indebted to C. F. Spaulding for the sketch.

Flotation by the Potter-Delprat process is conducted at a comparatively high temperature. Minerals Separation uses 60 to 70°, and the De Bavay and Elmore normal temperature.

Diamonds in British Columbia

By J. A. Macdonald

A year or more ago it was announced that diamonds had been discovered in British Columbia. Not much has been heard about the matter since, nor have any notable finds of diamonds been reported in the past year. That diamonds really are found in British Columbia is the announcement of R. W. Brock, Director of the Geological Survey of Canada. Stones of commercial value have been found in the glacial drift across the international boundary, in Illinois, Ohio, and other states. These have no doubt come from Canada, but the original locality has not yet been found.

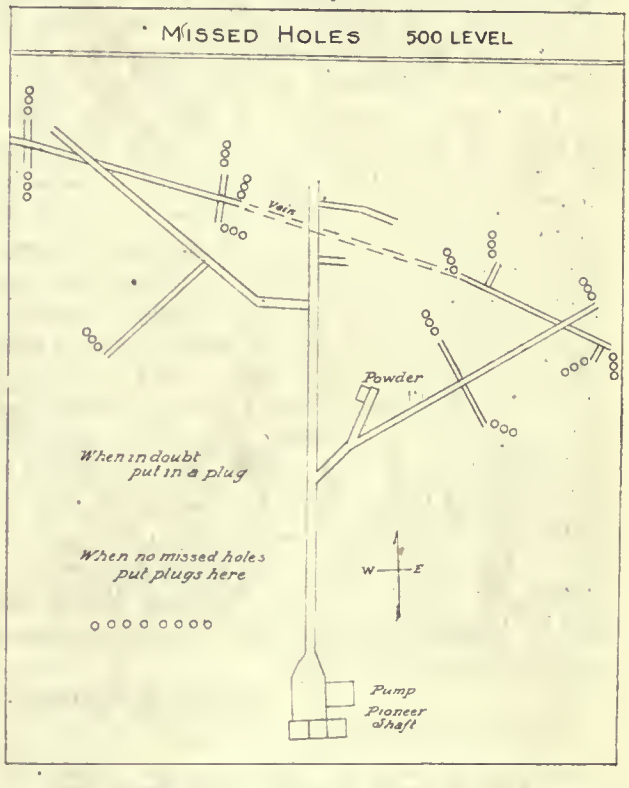
The rock now found to contain diamonds in British Columbia is a peridotite of the variety known as dunite, consisting of olivine and chromite. The rock specimens in which the diamonds were found were collected on Olivine mountain, near the Tulameen river, where C. Camsell, an experienced member of the Canadian Geological Survey, had been making an examination on behalf of that organization. Samples of the rock were submitted to W. A. Johnston, mineralogist of the Survey, to ascertain the nature of the chromium minerals. In the course of his examinations Mr. Johnston secured some insoluble fragments of crystals which appeared to be diamonds. More of this material was separated, and a series of tests established beyond doubt the nature of the material. The individual crystals are small ones, none of them being larger than an ordinary pin-head, but many appear under the microscope to be clear and bright, and of a good quality. Some are yellowish or brownish.

The diamonds occur in the chromite, not in the olivine of the rock. The chromite occurs as short, irregular, vein-like segregations an inch or more in width, in irregular masses, and as small disseminated grains through the rock. Gold and platinum also occur in the chromite. On account of the small size of the diamonds and the limited distribution of the chromite, the discovery is of scientific rather than commercial importance. It is possible that placer deposits in streams draining peridotite rock masses may contain stones of greater size, although the fact that placer-mining for gold and platinum has been carried on for a number of years without any such discovery having been made tends to lessen the probability, since stones of commercial size in the sluice-boxes would be apt to attract the attention of the miners.

The peridotite in which the diamonds occur is often weathered to serpentine. It is interesting to note that it is closely related to the rocks which form the matrix of diamonds in Arkansas and South Africa. This should be encouraging to prospectors. The discovery of diamonds in British Columbia was not altogether unexpected. The Geological Survey officials working there had for some time been on the lookout for them. Some years ago R. W. Brock obtained a few microscopic crystals which were believed to be diamonds, and which gave positive results in all tests to which they could be submitted. As a result of this prospectors were notified to be on the lookout for diamonds. This discovery is a genuine one, and no surprise would now be occasioned by the discovery of diamond-fields. Prospectors should keep a sharp lookout.

Missed Holes

The following method of informing the miners of the existence of missed holes is in use at the Gold Hill mine, Quartzburg, Idaho. A smooth board of convenient size is made for each level and hung on the wall of the change-room. A rough sketch of the level is drawn and, by using a small brush with drawing ink, a suitable map is made to enable each man to identify his own working place. At the end of each drift or cross-cut, on the map, three small holes are drilled. If a miss occurs, a small plug is put into the first hole of the corresponding drift; if two misses, into the second; and if three, into the third. It is noted upon the board that in case of doubt it is best to put in a plug. Should there be a question as to in which drift the miss occurred, as it is hard to distinguish when several shots are fired in drifts that are close together, put in a plug for each drift. Should no missed holes occur, all the plugs will be in a place arranged for them on the side of the board. The accompanying diagram explains this simple and efficient method.



Attention has been called to errors appearing in the article on 'Operating Costs of California Mines' by Charles Janin, in the *Press* of October 26, last. The cost of development at the Fremont Con. should have been $0.383; that of mining at the Gwin, $1.95; and the development cost given, $0.257, should have been added to the total mining cost $2.50 as printed in the company report. Mining cost at the Central Eureka should have been given as $2.82 in place of $2.85.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Progress in Mexico

The Editor:

Sir—In your issue of January 11, under the heading 'Progress in Mexico in 1912,' you state: "The Southern Pacific, which opened its West Coast line to the Tepic capital early in the year, has done no construction work." This is true from the Tepic end, but is not true of the Guadalajara end of the Southern Pacific railroad. The Southern Pacific built 9 kilometres of road for the benefit of the El Favor, Mololoa, and other operating mines, extending its lines from Magdalena to the present terminus, La Quemada, constructing bridges, completing the grading, and laying the rails and has built a splendid depot and sidetracks: and the El Favor Mining Co. has built a warehouse at that point costing $12,000. All ores have been delivered to that point since November 9, 1912, which marked the opening of that extension for traffic. As we have sent out information to several thousand people, interested with us in the Hostotipaquillo field, stating the above fact, we thought some criticisms might be made of the apparent conflict in the statements we have made and those which we have quoted from your report above. It will not be difficult for you to verify these statements, as we are sending fully 20 cars of freight per month from the new station; it is connected by telephone and telegraph with Guadalajara, and the agent from Magdalena was moved to the new station. This construction required an appropriation of $100,000 (gold) from the Southern Pacific railroad in Mexico and trains have been in continuous operation since November 9.

MAKEEVER BROTHERS.

New York, January 17.

Blast-Furnace Smelting with Crude Oil

The Editor:

Sir—Your timely editorial on the use of crude oil in blast-furnace smelting brings to my mind some additional facts pertinent to the inquiry. A great many attempts have been made in this direction, naturally enough, considering the obvious nature of the proceeding and the probable advantages which it should have under the conditions prevailing in this state. Where petroleum is so abundant and cheap it is most evident that its successful application in smelting would be attended with great advantages. In regions like California, where coke, the customary fuel in blast-furnace smelting, commands an excessive price, and where on the contrary the liquid fuel is extremely cheap, there can be no question of the desirability of employing the latter could means be found of rendering its employment perfectly feasible. As has often been remarked, the heat units are there, and only the details of its use remain to be settled.

I have been at much pains to procure information as to the various attempts that have been made to employ oil in smelting in the blast-furnace; attempts which began much farther back than most people are aware. I have seen an illustration of an antique and crude form of cupola devoted to melting pig iron, which was published fully 30 years ago, exhibiting the pipe connections by which petroleum was to be fed into the furnace—evidently in connection with the blast. It entered at the tuyeres, and it may be observed that while provided with means for atomizing the oil, the combustion was intended to take place wholly within the shaft. Of the propriety of thus burning the liquid in the melting zone I will speak hereafter. The next instance of the use of oil in this style of work that I shall instance, was the proposal of W. L. Austin, the celebrated metallurgist, the father, I may say, of pyritic smelting, to employ oil jets in the tuyeres of his furnace, not especially for the heat thus to be gained, but for the special purpose of preventing the formation of deposits of the magnetic oxide of iron, by which he was troubled at that time. I think Mr. Austin took out patents for such application of petroleum, but I am not aware that his invention came into practical use.

Subsequent to Mr. Austin's proposal Mr. Nesmith of the Colorado Iron Works at Denver invented a method of heating the blast of smelting furnaces by burning petroleum within the air main. His apparatus consisted virtually in an enlargement of the main, affording space for the development of the flame of one or more jets, the gaseous product of which, along with the unconsumed air, went on into the furnace. This involved, of course, the provision of refractory linings in the main and its connections. By this means the blast was effectively heated, but the method was criticised on account of the vitiation of the air, which lost a portion of its oxygen, taking up instead a corresponding amount of CO_2 and water vapor as the result of the combustion of the oil. I was under the impression at that time and later that the loss of active oxygen thus brought about was of a serious nature; but reflection convinces me that the proportion of oxygen thus sacrificed is likely to be too small to affect the smelting process noticeably, and I regret that I expressed antagonistic views thereon. It is easily capable of demonstration that the blast may be even highly heated without losing more than a fraction of the total oxygen, and there is also the consideration that if, as is usual, the blast of air proceeds unimpaired into the shaft it still requires to be heated at the expense of fuel, and of its own oxygen. It is now difficult to see why the preliminary heating which it would undergo by either Nesmith's or Austin's method would prove in any way destructive or prejudicial to the smelting process. Another important consideration here supervenes: the preliminary heating can be done with greater economy than the subsequent heating; since the fuel expended in the Nesmith (and probably in the Austin) device would be thoroughly burned, the end products being CO_2 and water; while the coke upon which we otherwise rely for the inter-furnace reactions, is largely converted into carbon monoxide. The reader will appreciate this according to his knowledge of the reactions in furnace metallurgy.

What would be gained by such an application of oil would evidently rest upon the saving in cost of oil versus coke, added to that gained by the more perfect combustion of the former. Some rough calculations may make the possible savings quite perceptible and important. A pound of the ordinary coke sold on this coast sets free approximately 13,000 heat units when completely burned,—that is, to carbon dioxide. A pound of oil produces nearly or quite 20,000, when burned equally thoroughly. Oil is therefore worth fully one-half more than an equal weight of coke under the same conditions as to perfection of combustion. In California crude oil may generally be had for $1 per barrel, more or less, depending on the cost of transportation. Allowing six barrels to the ton, oil costs about one-third as much as coke, which under similar circumstances may cost $12 per short ton, or $18 for a ton and a half, the equivalent in heating power of one ton of oil. Oil, therefore, whenever its use is permissible, costs only one third as much as coke. This computation would doubtless hold good wherever the matter is one merely of heat units, irrespective of the different behavior of the two fuels within the furnace. If the mere melting of a substance be the end sought, as of pig iron in the foundry cupola, or that of the materials within the open-hearth or copper reverberatory, there is no doubt that the monetary consideration holds. In the high iron, as well as in ordinary lead and copper-furnaces, where deoxidation by means of carbon is necessary, there would seem to be little likelihood of oil supplanting coke in spite of its greater heating power and less cost. However, there is much to be learned on this subject.

Concerning the complete combustion of crude oil within the tuyeres or before reaching them, experience has taught something of great significance. I have found by experience, and I dare say others have observed the same, that ample free and unencumbered space is essential for the proper burning of liquid fuel. If the space be restricted, or if the jet, atomized or otherwise, is directed against the materials to be melted, the oil is only partly consumed, and much carbon (soot) is set free, giving a very dense smoke, and in many cases a deposit of heavy difficultly combustible pitch is produced, which falling below the zone of fusion produces some ill effects. Even if the materials within the shaft are wholly incandescent and the combustion lively, as befits the smelting region, there is a waste of oil and the production of no great heat. The lesson learned from this is that the introduction of the liquid fuel directly into the furnace is not a workable method. It is true that in the lower part of the shaft of a pyritic furnace, as commonly run, there is much empty space, through which the currents of gas and air play comparatively freely; but if into a furnace thus working we proceed to inject oil, the immediate result is to lower the zone of fusion, by melting away the partly or wholly solidified matters (the 'noses', etc.) which support the charge above, permitting the whole mass to slide down, obliterating the cavities upon which the perfect admixture of the oil and air depends. When this takes place their blending becomes imperfect and the heavy smoke of unconsumed carbon is again produced, and the rate of smelting diminished. Such was the result of experiments in oil-burning when applied to lead-smelting some years since. The men in charge of that test declared that while the oil effected some apparent saving in the cost of fuel, the advantage was more than compensated by the diminished rate of driving and the attempt was given up. It appears then, in general terms, that oil cannot be worked in a close charge, and I believe that success is only possible when the liquid is applied to the preliminary heating of blast, which brings us back to the question so long argued in connection with pyritic smelting, as to the relative advantages of the heated and the unheated blast. This question, by the tacit decision of the metallurgical world, has been decided in favor of the unheated blast; but the possibility of employing so desirable and cheap a fuel as petroleum adds another chapter to the discussion. The question in its broad aspect is, can we substitute cheap oil for dear coke in some measure, and are there other advantages in the use of oil other than its superior heating power?

There is another advantage, of no mean significance in the use of oil, which I have discovered, and which I desire to call to the attention of practical smelting men. I have observed the strongest tendency on the part of the oil jet to prevent the customary obstructions about the mouth of the tuyeres. The heat bestowed upon the blast is sufficient to immediately liquefy the slag which otherwise would gather there and freeze into a nose, or partly close the exit of the wind stream. Everyone who has handled blast-furnaces recognizes the tendency to choke up the tuyere openings as a serious drawback in ordinary work, and will hail with delight any practicable means of obviating it. The result of the highly heated blast, or perhaps I had better say, the presence of the burning jet at that particular spot, is very favorable to the proper running of the furnace, lessening labor, and by reason of the unimpeded flow of the air-blast relieving the blowing machinery of much unprofitable work. I have used a fan in this connection, and I am convinced that it will deliver fully 50% more air when the oil jets are burning in the tuyeres than when delivering cold air, entirely because the tuyeres are kept free from obstructions. This is an advantage of great moment when large smelting capacity is sought.

Wallace Dow, of the Dow Engine Co., of Alameda, has constructed a melting cupola of his own invention, in which oil is the sole fuel. It has proved an unqualified success, melting with regularity the pig iron for the numerous castings manufactured by that company and doing it with an economy unapproached by coke-burning apparatus. I believe he saves fully three-fourths the cost of fuel by the substitution of petroleum for coke, and there is the greatest probability that through further experience the economy will prove still more decided. Not only is the melting done with dispatch, but the bath of metal may be kept fluid and in proper condition for pouring for many hours; in fact there is no reason why it may not remain molten for weeks, since the jets are so arranged in part as to play on the surface

of the metal. By this means it becomes possible to cast at any desired time. The problem before Mr. Dow differs from that which confronts the copper furnace manager, since in foundry practice it is necessary to supply all the heat of melting by the combustion of the oil alone, while in copper matting we get a great proportion of it from the reactions between the ore and the blast inside the furnace. In the one case the products of combustion must enter the furnace at a very high temperature,—perhaps as great as 3000° F.; while in the other the blast, to carry out all the desired objects, need be no higher as a general thing than 1000° F. Indeed it is generally conceded that with a blast of that temperature no fuel whatever need be used. It is necessary, therefore, to burn but little fuel for the preliminary heating, probably not more than enough to take up one-seventh of the oxygen of the air. In matting stacks there are required on the average about 1¾ tons of blast to each ton of material charged. To raise this weight of air to 1000° F. would require about 875,000 heat units, which is produced by 43.75 lb. oil of 20,000 heat units per pound. This is in the event that combustion is perfect and that there is no loss of heat in the operation. This is in the neighborhood of 7 gallons of fuel. I perceive that Thomas Kiddie has successfully used oil in this kind of smelting, and that he records a consumption of one barrel of oil to three tons of charge, or 14 gallons per ton. Probably Mr. Kiddie's results are more to be relied on than any merely theoretical calculations, although his published experiments related to only a short run. Mr. Dow has not as yet accumulated the facts necessary for precise statements of results, but since he has put his furnace into regular operation, it taking the place of two coke-burning cupolas, he will be able shortly to speak with authority on a number of phases on which there are at present only theoretical considerations for our guide.

Fully realizing the desirability of completely burning the fuel before its entrance into the cupola, Mr. Dow has provided his furnace with two heating chambers, one on each side of the shaft at the bottom, in which the atomized oil is brought into intimate mixture with the incoming blast, and from which the hot gases depart through broad apertures over the sole of the cupola. The heat is necessarily very intense, and its effect upon the firebrick of which the structure is composed is very marked. Better fire-resisting materials than the commercial bricks may be necessary for this purpose. Water-jacketing might be resorted to, but for a furnace which is out of commission the greater part of each 24 hours it seems hardly necessary. In this respect also the practice differs from lead and copper-smelting.

For my part I have taken out patents upon a form of construction which lends itself very well to the new requirements. My stack being supported on hollow columns and an encircling windbox, I have modified these to admit of the combustion of the oil inside of them, directing the highly heated blast to the interior of the stack through tuyeres lined with refractory materials instead of the iron pipes commonly employed. Each supporting column conveys and heats the blast, being lined with firebrick and provided with an efficient burner, by which the oil is injected downward so as to meet and be consumed by the incoming blast, which rises from subterranean pipes connected with the blower. By this means I still retain the feature for which my furnaces have been noted, that of no visible air connections. As I am about to put in operation one of these furnaces I shall take pleasure in later communicating to your readers the economic results of my work.

HERBERT LANG.

Oakland, California, January 15.

Secretarial Ethics

The Editor:

Sir—Referring to the editorial under the above caption published in the *Mining and Scientific Press* of January 25, I do not feel called upon to submit an answer to your criticism of matters pertaining to the policy of Institute excursions, since I did not originate that policy and am not responsible for it. My personal management of the excursion to Japan was investigated by a special committee, appointed at my request at a joint meeting of the directors and the Council, comprising C. F. Rand, chairman, Karl Eilers, and Edward L. Young, the last named being selected as particularly familiar with conditions in Japan. I have Mr. Rand's permission to make public the report of this committee, which follows:

New York, January 8, 1912.

At the first meeting of the Council of the American Institute of Mining Engineers held after the return of the excursion to Japan, Mr. Struthers being present, requested that a committee be appointed to receive and investigate any complaints which might be made concerning his share in the management of the excursion. The undersigned were appointed such a committee. They have seen personally or corresponded with a considerable number of those who took part in the excursion; they have examined the accounts of Mr. Struthers at his request, and have listened to a statement from him. They have discussed the whole situation with other members of the Council and of the Board of Directors, and with other members of the Institute, and are about to make a report to the Council. Some of the facts hereinafter stated are already known to some of those with whom members of the committee have individually been in communication, but the committee thinks it well to repeat them in this statement.

The underlying cause of the few complaints which have been received is the fact that many of the members of the excursion did not fully understand Mr. Struthers' relation to it. They thought that while acting as Secretary of the Institute, he was not only absenting himself from his post, but making a personal profit in addition to his salary. Mr. Struthers did not receive a salary from the Institute while absent from the United States. The excursion was managed by him and by Mr. Vaughn, the latter especially qualified from past experience, but having no official connection with the Institute, entirely as a separate affair. It is unfortunate that the early circulars, which were sent out from the Institute office, did not make this as plain as might have been. The preliminaries of the excursion were undertaken by Mr. Struthers before he became Secretary, and, as we are Councilors, we are aware that upon his election as Secretary he desired to give up the management of the excursion, knowing he was needed at the office. Matters had progressed so far that, after discussion, it seemed wiser to have him carry out what had been undertaken.

It is the opinion of this committee, as well as that of

a considerable number of those members of the excursion with whom the committee has conferred, that the cost of the excursion was as low as could have been obtained by engaging a professional tourists' agent from the outside, and the committee is aware that for many months prior to the departure of the excursion, Mr. Struthers did a great deal of very hard and difficult work in preparation for the trip. Several of those who have communicated with the members of this committee have urged that in future no excursion shall be conducted by any members of its governing bodies.

This committee recommends that a special committee be appointed by the Council to study the entire question of future excursions by the Institute or its members, and to report to the Council their recommendations with respect thereto. After examination of the statement of receipts and disbursements, the committee are unanimous in the opinion that Mr. Struthers' compensation was much smaller than some of the excursionists seem to think and in our opinion no more than was reasonable.

CHARLES F. RAND, KARL EILERS, EDW. L. YOUNG.

A copy of this report was sent to all of the gentlemen in the Japan party, including the responsible editor of the *Mining and Scientific Press*. Several other statements concerning me personally I forbear to notice at this time.

JOSEPH STRUTHERS.

New York, February 1.

[We are glad to give publicity to the above letter from Mr. Struthers, but regret that he did not discuss the policy whereby, as we stated, "the position of Assistant Secretary and later of Secretary of the Institute, has been used to make money out of the members of the Institute in addition to the official salary," since our opposition is to policies and not to any particular individual. In discussing the matter we used only printed documents of the Institute. We did not print the report Mr. Struthers now quotes, as the copy which came to our office was marked 'confidential.' Since Mr. Struthers has referred to the matter, it is but fair to state that the investigation in question was only requested by Mr. Struthers after a formal petition asking it had been sent to the Council of the Institute signed by representative members of the Institute, and following an earlier flat refusal on his part to make any statement of receipts and expenditures to a committee of those participating in the excursion. When this investigation was made Mr. Struthers refunded $854.79 "for salary paid him while absent from the country on the Japanese excursion" and $550 which had been charged to the Institute for transportation from San Francisco to Japan and return and expenses in Japan of A. E. Vaughn as assistant. It is understood that at the same time it was agreed that advance payments made by members of the Institute who found themselves unable to take part in the excursion, and amounting to a considerable sum, should also be refunded. It is proper in this connection to point out that Mr. Struthers did not charge the Institute for his expenses on the Japan trip and that in the past advance payments made by members not taking the trip have been at times refunded and in other cases held. It is also proper to state that circulars regarding excursions have always announced that advance payments might or might not be refunded in such cases. Whether or not they were refunded has been, so far as public record goes, determined by the individual who would have profited by holding them. In the particular case cited, apparently, readjustment was necessary before the committee was able to report that the compensation was "in our opinion no more than was reasonable."—EDITOR.]

A. I. M. E. Secretaryship

The following circular letter has been issued in New York by Messrs. C. R. Corning and G. C. Stone, who, as members of the Committee of Five, are especially conversant with Institute affairs:

There are two candidates for Secretary of the American Institute of Mining Engineers. Bradley Stoughton, who was nominated by the Committee after long and careful deliberation, for the past year has been Secretary of the Iron and Steel Committee, and in that capacity has done excellent work and is largely responsible for the brilliant success of the recent Cleveland meeting. Joseph Struthers, the present Secretary, has been renominated by a number of his friends. Mr. Struthers' record is well known to the members, and the policy he has carried out, although he did not originate it, has caused a great deal of unfavorable comment. In view of the circular of January 27 asking for proxies to Messrs. Charles Kirchhoff and Karl Eilers to support the candidacy of Mr. Struthers, which request will undoubtedly be complied with by Mr. Struthers' friends, we urgently request that all those who are opposed to his candidacy and the policy he represents should promptly sign and return to us the enclosed proxy, which, as it shows on its face, is to be used solely for furthering Mr. Stoughton's election and for preventing the continuance in office of the present Secretary of the Council, Mr. Joseph Struthers. Although the vote for Secretary is not likely to be counted officially, it will be used in an attempt to influence the new Board of Directors in their choice of a Secretary. It is therefore of the greatest importance that all those who wish to see a change in the management and do not wish to have the Directors hampered in carrying out the changes should aid in the election of Mr. Stoughton.

Annual Meeting A. I. M. E.

The annual meeting of the American Institute of Mining Engineers will be held in New York, under the auspices of the local section of the Institute, February 17 to 20. The preliminary program provides for an informal social meeting and smoker at Institute headquarters, 29 West 39th street, Monday evening, at 8 p.m. The business meeting will be held at 10 a.m. Tuesday, February 18. Technical sessions will be held Tuesday afternoon, Wednesday morning and afternoon, and Thursday morning. Tuesday evening F. H. Newell will address the Institute, and Wednesday evening will be devoted to a formal banquet and reception to the president of the Institute. Luncheon will be served in the Institute building Tuesday and Wednesday.

Special Correspondence

NEW YORK

THE FAR EAST AND GOLD.—NEW COPPER PRODUCTION.—WETTLAUFER MEETING.—CRIPPLE CREEK.

As an underlying condition of importance, the financial situation in the Far East continues to attract large attention, especially in London. In answer to a question by one of the members of Parliament, the India Office stated recently that the net imports of gold into India for the year 1912 amounted to £27,637,627, and the sales of council bills and telegraphic transfers to £28,173,143. Moreton Frewen, the famous bimetallist, in commenting upon these figures, states that there must be deducted from the amount derived from the sale of bills and telegraphic transfers what is known as the home charges, amounting to £17,000,000, making a net amount of about £11,000,000 to be added to the net gold import—a total of £39,000,000 in gold absorbed by India last year. Mr. Frewen calls attention to this absorption of yellow metal, saying that it is to be hoped that the publication of these "sinister figures" will put both the India Office and the financial district of London on guard. Further, in this connection, the *Statist* calls attention to the fact that India's absorption of gold does not increase the available supply of money in the Indian money markets. The Bank of Bengal has recently advanced its rate to 8%, and withdrawals of silver from the currency department have been so heavy that the Indian Government has again been forced into the silver market. The movements of cash balances in the Indian banks are held to indicate that the gold now being remitted to India does not get into circulation. How far the production of gold is responsible for some of the apparently anomalous conditions existing is a matter of much discussion among theorists and would-be economists, and however construed, may be said to have little or no effect upon the mining of gold as an industry. Quite a contrary state of facts exists as to the mining of silver, the latter metal being on a commodity basis, and if conditions in the Far East will justify a further slight increase in price on some fairly permanent basis, it will mean much activity in both new and old districts where for some years the net profit to be won from the production of silver has been so slight as not to justify operations. The precious-metal miners are compelled to look to India and China as important factors in the future of the industry. According to the generally accepted theory, any such hoarding of gold as is estimated by Mr. Frewen would both perpetuate and intensify the so-called high cost of living, against which such world-wide protest is now being made.

In the copper market, the trend has been for the most part against any improvement. It is anticipated that there was an increase during January in surplus stock of somewhere between 7,000,000 and 12,000,000 lb. This is based upon an estimated refinery output of something above 135,000,000 lb., while sales, so far as known, indicate a combined domestic and export demand of about 125,000,000 lb. The tensity of the Balkan situation has not been without effect, and the result has been renewed weakness in the London market. The metal touched 16c. in New York, recovered about ½ point, and at the moment the market is a very sluggish one. There is a good deal of figuring being done on the amount of new copper which the mines are preparing to turn out, and this will be one of the chief elements in the fixing of price levels. If present prices are maintained, there will be a great deal of activity in those properties that have been rejuvenating themselves and are now just about ready to begin production once more. The Superior & Boston has resumed shipments to the Old Dominion smelter, and is shipping ore from its eighth level which is taken out in the course of development work. The Shannon Copper Co. is rapidly getting upon a basis where it can show a fair degree of profit on the present copper market. The company produced in September 143,000 lb. of copper at a cost of 13.85c.; in October, 210,000 lb., at a cost of 14.83c.; in November, 436,000 lb., at a cost of 12.71c., and in December, 362,000 lb., at a cost of 12.54c. During the quarter covered by these figures, $40,000 was expended in development and charged to production cost. As a result, ore has been opened on the lower levels showing 9 to 11% copper.

Among the Lake Coppers the important questions for a long time has been the possible life of the Calumet & Hecla. The company has recently adopted a policy of conservation as regards the conglomerate lode, and is maintaining its rock tonnage from the other developed lodes on its property. The result is a decreased net production for the Calumet & Hecla, as the Osceola lode shows an average of about 15 lb. of copper per ton as against 30 lb. for the rock mined from the conglomerate. This policy means that the Calumet & Hecla can maintain its present output for twenty years. The directors of the Chino Copper Co. are to meet on February 28, and it is expected that action will be taken on the company's initial dividend. The rate has not yet been determined, but it is expected that $1 per share quarterly will be paid. On the same date the quarterly meetings of the Utah Copper Co. and the Nevada Consolidated will be held, but no change in the rate of distribution by either of these companies is expected.

The minority interests of the Federal Mining & Smelting Co. are combining to bring suit to declare null and void the present contract existing between the company and the American Smelting & Refining Co. Some effort has been made to adjust the matter without litigation, but no statement has as yet been made by the officials of the smelting company. If the litigation is eventually begun, it is said that a receiver will be demanded.

GOLDEN CYCLE MINE.

The annual meeting of the Wettlaufer-Lorrain Silver Mining Co., Ltd., was a stormy affair, and the present administration was sustained by only a small plurality and, as a matter of fact, this was done only after a deal of hustling for proxies among shareholders. It has been a matter of considerable discussion as to how far the selling of Wettlaufer has been for the account of so-called 'inside' interests. The report of Fred Hellmann, the consulting engineer, in summing up the condition of the property, is as follows: "The known orebodies have been exhausted by the year's operation, development so far has failed to uncover any new orebodies, and a program of development is being carried out with the object of finding further orebodies, or determining, in so far as this may be done, with a reasonable outlay, that none such exist. The future of the property will depend upon the result of this development work." This issue, at one time spoken of a second Kerr Lake, both being in the hands of the Lewisohn interests, has sold down to merely nominal prices.

The merger which is to be made a holding company for the principal Cripple Creek properties is gradually taking shape. A $25,000,000 securities company is proposed, to hold the various transportation lines in the district and to take over the El Paso and Golden Cycle. Later possibly the Vindicator, the Elkton, the Isabella, and others will be included. The shareholders of the Pittsburgh Silver Peak G. M. Co. are to receive a 2% dividend on February 15. The rumor which has been circulating as to a pos-

sible consolidation of the American Zinc, Lead & Smelting Co. with the Butte & Superior is emphatically denied by the inside interests in both companies. The Hayden-Stone people are represented on the directorates of both companies, but it is said there is no ground for talk of consolidation any further than that the present community of interest insures harmonious action. Consolidation of the St. Joseph Lead and the Doe Run Lead companies has reached the appraisal stage, and a joint committee of experts is shortly to make an examination and report on both companies. When this shall have been done, a plan for further action will be submitted to the stockholders. The forthcoming issue of convertible bonds to be made by the Granby has been underwritten by Speyer & Co. This underwriting marks the entry of one of the largest of the international banking houses into what is now for them a new field.

SPOKANE, WASHINGTON

SHORTAGE OF POWER.—NEW POWER-LINES.

The need of more power for the cyanide plants at Republic is a hindrance to the treatment of the ores to full capacity. At the North Washington Power & Reduction Co. mill it is planned to cut out the Chilean mill, install a second tube-mill, running the two tube-mills in tandem on ¼-in. mesh Lone Pine ore. At the San Poil Consolidated Co. mill a remedy for slow grinding is being sought by fastening strips of steel 18 in. apart to the barrel of the tube-mill, along the length of the cylinder. This is claimed to be an improvement, as the strips catch the pebbles, raise them, and cause them to fall with considerable force against the ore. In the San Poil mill ore averaging $10 is being treated at present, and about $4000 per week is reported as the amount of the bullion produced.

Several companies are looking for contracts to bring power into Republic, and among them are the North Washington Power & Reduction Co., through its manager, J. L. Harper; the Washington Water Power Co., of Spokane, and the Stevens County Light & Power Co. of Colville, Washington. The latter two companies would have over 100 miles of transmission-line to build before reaching Republic, so the North Washington P. & R. Co. has a marked advantage, having only about 30 miles to build, by connecting to the Bonnington falls line from Cascade, British Columbia, at the international boundary. Furthermore, this line is already under construction, while the two longer lines have not yet even been surveyed.

The Washington Water Power Co. supposedly has two engineers with four men each at the San Poil and Ben Hur mines, and two at the Republic mine, sampling for the purpose, as already stated in the *Mining and Scientific Press*, of interesting capital as a means of selling power. No information can be had from the engineers. A concern referred to as El Oro Mill Co. is securing land in Republic, beside the track of the Great Northern railway, for a cyanide plant for the treatment of ore from the Black Tail mine, owned by the Hope company.

A valuable body of ore has been opened on the 200-ft. level of the Ben Hur mine and developed for 40 ft. on the strike. It is said to be the richest body of ore ever found in the mine. Work has been resumed on the Laurier mine near Laurier. The Illinois Mining Co. is planning the construction of a barge, to be towed by a steam tug to Peach, a landing at the mouth of the San Poil, on the Columbia, and as soon as the Great Northern railway is completed to Peach, to begin transporting coke to that point and haul it seven miles up the San Poil valley to Keller, and then start up the smelter at the latter place.

At the Twilight group, on Jumbo mountain, in the Orient district, an adit, in 40 ft., is following a well mineralized vein. A contract has been let for development work by the Mogul Mining Co. on a group of claims northwest of Pierre lake for $6000. Fine sulphide and native gold ore is reported from the last shot in the White Elephant mine. The Napoleon mine, near Marcus, is sending about 2500 tons of ore per month to the smelters. A rich discovery is reported at the Swamp King mine.

In the Galena Hill mine, at Rock Cut, a deposit of ore, 7 ft. wide, assaying around $75 per ton, has been developed on the 170-ft. level, the first carload of ore from which will be shipped to the International Smelting & Refining Co. at Salt Lake, Utah. The concentrator on the Galena Hill property has been reconstructed and is operating satisfactorily.

The material for the concentrator for the Lead & Zinc Co. at Metaline is on the ground, and the lumber for its construction is being framed. The First Thought Mines, Ltd., has filed papers in a suit against Stevens county to have the tax levy of $14,036 for the years 1909, 1910, 1911, and 1912 against the First Thought mine declared void, alleging that for 1909-10-11 the property was assessed at $80,000 each year, and for 1912, $40,000; that for no time after 1908 did the property produce any ore of such value as to pay a net profit; that up to the date of cessation of labor on the mine the company had expended upward of $40,000 in diamond-drill and general exploitation, but had found no ore exceeding in value $4 per ton.

GRANTS PASS, OREGON

A NEW MILL.—RAILROAD CONSTRUCTION.

Equipment and machinery have been ordered for the Oriole mine, in the Galice district. The Oriole has been under development for several years, and has made a good showing, particularly in free-milling ore. Many valuable shipments have been made from the property. A mill and concentrating plant, to be operated by water power, will be constructed. The Vanguard mine, on Josephine creek, southwest of Kerby, is being rapidly developed under the management of C. E. Phillips, backed by outside capital. The ore contains free gold, tellurides, and some copper. A crew of 25 men will be employed on the claim through the winter. Mr. Phillips states that a number of other claims on Josephine creek are under development. Many men have lately arrived, being encouraged by the prospect of the Pacific-Interior railroad. This line will run within a few miles of the district.

Negotiations are under way by which the old Granite Hill mine, of Louse creek, will be rescued from oblivion. This well equipped mine has been idle for more than five years, litigation and flooded workings being the prime cause. The vein system is a good one, and it is believed the mine will 'make good,' once it is given a fair chance. Chicago people are the owners. Practically all that is needed to resume work is to unwater the mine, and mining men say that this could be accomplished by a double skip operated in the 2-compartment shaft of the mine. It has in addition to the 30-stamp mill and electric-power plant, one of the finest hoists on any Oregon mine.

The Good Luck or Swastika placer mine, of Jump-Off-Joe, is operating steadily this winter under the management of Cook & Howland. There are few surface mines in southern Oregon that have operated more steadily, and whose returns have been more certain, than the Swastika. Cook & Howland have owned and managed the property for a number of years. Two and three giants are employed, one of them being used much of the time on a grizzly elevator to remove the tailing. The mine has its own electric-light plant for night work. All the hydraulic mines are operating day and night. The rains have been heavy, and there is a good depth of snow on the ranges, so that a long and continued run of the monitors is probable. Gold is already coming to the Grants Pass banks, and a still greater quantity is shipped to the Mint. On Grave creek, Galice creek, Illinois river, Applegate river, Wolf creek, and all other mining streams of Josephine county, placer mining is in progress.

Three camps have already been established on the proposed line of the Pacific-Interior railroad that is to be built from Grants Pass to the copper and gold mines of southern Josephine county, and on across the Siskiyous to Crescent City, California. More than 150 men and half as many teams are employed in clearing trees along the right-of-way and in grading. Grants Pass recently voted

$200,000 bonds to be used in assisting this railroad, and more than three times this amount has been subscribed by mining and timber men. Crescent City people have also subscribed liberally to the railroad fund. Construction work has greatly stimulated mining in the isolated districts of Waldo, Josephine creek, and elsewhere south and west of Grants Pass.

Negotiations are under way by which a Michigan syndicate, headed by H. C. Russell, of Marquette, will take over the Blue Ledge copper-gold mine, of the Blue Ledge district on upper Applegate river. Mr. Russell went out to the camp this week and is making a thorough investigation of the mine. He was accompanied by several of the leading claim-owners and miners of the district, including J. F. Reddy, A. L. Jones, Walter McCallum, and Roger S. Bennett. Robert S. Towne, owner and manager of the Blue Ledge, is at the property, and met the party on its arrival. The Michigan people who are making negotiations to purchase, are heavily interested in the copper mines of that state, and if they take over the Blue Ledge they will develop and operate it on a large scale.

JOHANNESBURG, TRANSVAAL

NOVEMBER RETURNS.—FUTURE YIELD.—NUMBER OF STAMPS.

The November returns of the mineral output of the Union of South Africa show a decrease of £114,297, gold being responsible for £45,316. This was due to the short month and not to any decline in the gold-producing capacities of the Rand, which seem destined to increase for at least some time to come, not to decline as prophesied by H. C. Hoover. It does not, however, seem likely that in the immense stretch of reef-bearing country from Randfontein to Boksburg any marked increase in gold output can take place, and this portion represents the area from which the gold output in the past has been principally obtained. With the approaching exhaustion of several of the richest mines on the Central Rand near Johannesburg, it will be well if the present output is maintained over that stretch from Randfontein to Boksburg, but it is more likely to be slightly increased than otherwise.

Beyond Boksburg there is still a considerable area of goldfield, some of which is expected to turn out well, and but little unprofitable. So that it is to this Far East section of the Rand that all eyes are now turned to supply the increased output of gold on the Rand which for so many years has been such a conspicuous feature. There is also an untouched area southwest of Randfontein, but owing to its being covered by huge thicknesses of dolomite, its gold-bearing possibilities are but little known. Attempts to pierce this dolomite by shafts have not so far been successful, either on the East or West Rand, but providing the reefs are proved to be workable, there does not seem much doubt about the requisite capital being obtainable, as in other parts of the world more than double the water yet found in the Transvaal dolomites has been overcome. Until both the eastern and western extremities of the Rand are developed and producing it seems somewhat premature to talk of the rapidly aproaching decline of the Rand. Few authorities will dispute that in the majority of instances the yield of gold in depth per ton milled on the Rand is not maintained, and profits per ton may decline, but the large-scale workings necessary to reduce the costs will at the same time add to the total gold output, and perhaps the sum total of profits, if not to dividends to the same extent as formerly. This increase of total gold production and fall in the profits earned per ton has been conspicuous for some time on the Rand, and to all appearances is likely to continue. With regard to the present position of affairs in the gold-mining industry of the Transvaal, the figures for the November output are significant.

As a matter of fact, the Heidelberg and Klerksdorp figures ought to be added to those of the Rand, for they are nothing else but extensions of the Witwatersrand into the outside districts, and undoubtedly continuous with those of the Rand. Despite the conspicuous overshadowing of the outside districts by the Witwatersrand, Lydenburg and Barberton are making steady progress, the output of gold slowly but steadily increasing.

NOVEMBER GOLD PRODUCTION

	No. of mines.	Stamps at work.	Tube-mills.	Output, fine oz.
Rand	50	9405	272	728,562
Heidelberg	4	120	2	6,866
Klerksdorp	3	60	2	2,479
Barberton	13	192	3	6,775
Pilgrim's Rest	14	162	6	13,161
Pietersburg	3	30	...	401
Totals	96	9969	285	758,244

SALT LAKE CITY, UTAH

THE LEAD TARIFF.—OHIO COPPER.—STATE AID FOR RESEARCH.

Utah lead producers are beginning to feel easier over the tariff question since the return from Washington of the representatives who went there to present the producers' side to the House Committee on Ways and Means. W. H. King and George W. Riter, representatives of the producers' association, both expressed the belief that the Democratic Congress will keep a sufficient tariff on lead to protect the American mines, which are running on a rather close margin. Private advices from Washington to men interested are to the same effect. Some of the leading mining men in this part of the country are Democrats who favor a tariff on lead and zinc, and they are using their influence to the utmost in favor of the retention of a duty on these metals.

Ohio Copper is still the subject of a wide difference of opinion between the optimists and the pessimists. The latter have all kinds of dire things to say about the property, and their opinion has largely been reflected in the price of the stock. On the other hand, men connected with the operating department cheerfully predict large profits as soon as the remodeling of the mill is completed. December profits fell to $20,000, and the net earnings for 1912 were $305,400. At the mine it is declared that more ore is being uncovered than is broken down, and that in a comparatively short time an output of 3000 tons per day will be maintained.

Independent of the efforts to have the National Bureau of Mines establish testing plants in the West and take more interest in metalliferous mines, it is now proposed to have the state of Utah undertake mining research work. W. Mont Ferry, one of the best known mining men in the state, has introduced a bill in the state legislature appropriating $15,000 for mining and metallurgical research work by the State School of Mines at the University of Utah. "The purposes of the research department," according to the bill, "shall be to conduct experiments and research, either alone or in coöperation with the National Bureau of Mines and other agencies, with a view to finding ways and methods of profitably treating low-grade ores, of securing a higher percentage of extraction of metals from their ores, of obtaining other information which shall have for its object the benefit of the mining industry and the utilization and conservation of the mineral resources of the state."

While metal-mining in Utah as a whole is still waiting for a general awakening and the return of 'boom times,' the coal-mining industry is making astonishing strides. It is only a few months since the United States Smelting, Refining & Mining Co. consolidated several of the principal younger properties in Utah. W. G. Sharp, the president, is authority for the statement that the output has already been doubled, and the campaign of development is scarcely begun. A number of smaller companies have commenced operations recently, and the prospect is that the next few years will see an immense increase in the production of coal in Utah.

The Mines Operating Co., which has a lease on the old Ontario at Park City, has been having trouble on account of water shortage due to cold weather, but is again oper-

ating the new mill. Progress here is being watched with interest by metallurgists. Officials of the company claim that by the present process they will be able to mine and treat the low-grade silver-gold ore at a total cost of $4 per ton. The assays are said to run $8 to $12, with a saving as high as 80 per cent.

TORONTO, CANADA

HOLLINGER OUTPUT.—GOLD LEAF PURCHASE.—NEW RAILROAD.

The payment of the regular 3% dividend due on January 28 was accompanied by a frank and detailed statement by the officials of the Hollinger mine showing the curtailment of operations by the strike and the actual conditions now obtaining. The output is now about 80% of what it was at the outbreak of the strike, and the situation has much improved during the past few weeks. The value of gold produced the week previous to the strike was $51,769, which dropped the following week to $18,043. It fluctuated considerably for some time, falling as low as $10,816 during one week, but the new year witnessed a marked increase, the output for the first week of 1913 being $25,687, and for the week ended January 21, $41,000. The force of miners is still below normal, but there are 427 men now on the payroll and the number is daily increasing. The company has won a test case brought against some of the strikers under the Lemieux act. Three of the men were prosecuted for inciting and engaging in an illegal strike involving a breach of contract, and were found guilty. Two of them were sentenced to fines of $500 each, or 3 months imprisonment, and the third was fined $50, or 60 days in jail. An appeal from the decision has been taken. The main vein of the Dome Lake has been found in the cross-cut at the 180-ft. level, where it shows an improvement both in width and gold content, assaying about $32 per ton. The 10-stamp mill is being constructed and is expected to be in operation about the end of February.

The report of the general manager, presented at the annual meeting of the Crown Reserve at Montreal respecting the McEneany mine, estimates that there are 34,995 tons of ore from 40 ft. below the third level to the surface, which should yield a profit of $650,000. The shaft will be continued to the 500-ft. level. The vein at a depth of 400 ft. is 6 ft. wide, carrying free gold. The financial statement of the North Dome to the end of the year shows receipts of $104,103 and expenditures amounting to $103,366. The Gold Leaf Mining Co. is operating in the Kirkland Lake area in the Swastika district, where it has acquired the Boisseneault-Charlebois claims and is taking in machinery. The price paid for the property is stated as $250,000.

The Elk Lake branch of the Timiskaming & Northern Ontario railway was completed and formally opened for traffic on February 4. The operation of this line will greatly stimulate the silver mining industry of the Elk Lake and Gowganda districts, hitherto heavily handicapped by transportation difficulties, which caused the closing down of many promising prospects. Much freight is being prepared for shipment, including a carload of ore from the Miller Lake-O'Brien, of the value of $75,000. This company has purchased the Millerette, adjoining, and is utilizing its 10-stamp concentrating mill to treat low-grade ore. The Mann mine of Gowganda will also make a shipment. The Mann has developed a vein of 5 to 6 in. of high-grade ore at the bottom of the winze sunk from the 110-ft. level. The Powerful, another Gowganda company, has cut a 6-in. vein of good ore on the 150-ft. level, with wall-rock for a foot on either side impregnated with silver which will make good milling ore.

The new Casey-Cobalt shaft has been connected with the 250-ft. level. The mill is treating an average of 27 tons per day and making good recovery. The annual report of the Wettlaufer indicates that the mine is not likely to continue paying dividends at the present rate of 5% per quarter. Net profits for the year were $320,249, a slight increase over the previous year. The surplus, after paying dividends, was $36,931, a decrease of $63,971. The April dividend calls for $75,000, and it is believed that this will have to be dropped.

LONDON

NISSEN STAMPS IN SOUTH AFRICA.—KYSHTIM.

Mining men in the United States, and especially those in the Western states, are always pleased to hear of the success of their friends in foreign parts, so no apology is necessary for writing something about the Nissen stamp and its progress in countries under the British flag. During the past two years the stamp has been thoroughly tested at Johannesburg. Four stamps were erected at the City Deep mine, and the relative advantages of this type and of the ordinary 5-stamp battery thoroughly investigated. The results were given by P. N. Nissen in a paper read before the Chemical, Metallurgical & Mining Society of South Africa in October 1911, an abstract of which paper was published in *The Mining Magazine* for December 1911. It was conclusively proved in these tests that the Nissen stamp crushed more ore per unit of power, and that as regards the weight of the stamps the Nissen crushed a third as much again. The better regulated feed and the larger area of discharge are responsible for these improvements. The City Deep did not order any more Nissen stamps, because it was already fully equipped with other modern stamps for the capacity of the mine. But the Wernher-Beit-Eckstein group, the controllers of this mine, decided to adopt the stamp at other mines under its control, and has decided to purchase 64 for the extension of the New Modderfontein plant, in the Far East Rand. The group also intends to use the stamp in the enlarged plant at the Modderfontein B, but the number is not yet fixed. At the Fairview mine at Barberton, belonging to the same group, 2 stamps have been crushing to ¼-in. mesh at the rate of 35 tons per stamp per day; 2 stamps are also in use at the Rietfontein in the Lydenburg district.

The Consolidated Gold Fields of South Africa has decided to make the Nissen stamp the standard type for future construction and has ordered a large number for its mines in Rhodesia; namely, 56 for the Shamva, 36 for the Falcon, and 24 for the Golden Kopje. The plant at the Planet-Arcturus will also be equipped with them, but the actual number has not yet been determined. A great many smaller mines in Rhodesia and outlying parts of the Transvaal have adopted the stamp. Most of them are gold mines, but an interesting exception is the Liewpoort tin mine in the Rooiberg district, in the northern Transvaal.

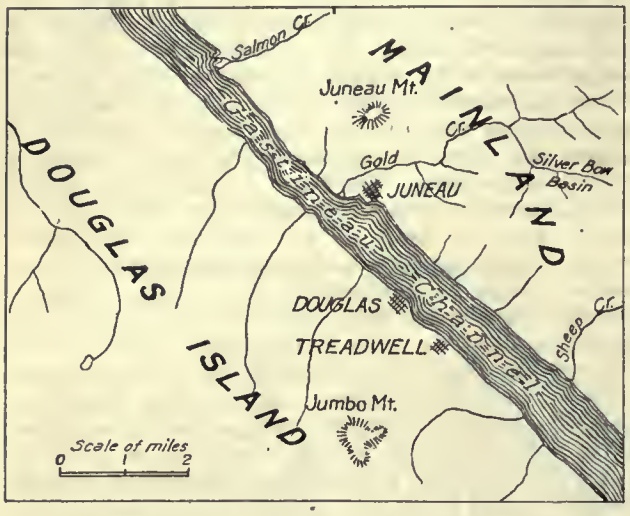
Your readers have been kept well posted on the doings of the Kyshtim Corporation, the company developing the copper resources of the Kyshtim estate in the Ural mountains. The technical management has been largely in the hands of American engineers, R. Gilman Brown being at the head, with Walter G. Perkins as consulting metallurgist, and H. W. Turner as consulting geologist. This venture is well established, so that closer attention is now being turned to the Tanalyk property, 300 miles or so farther to the south, not far from Orsk. The orebodies in the various mines belonging to this estate vary considerably. At first the average ore was supposed to be silicious, with fair copper and a relatively high precious-metal content, with barite occurring occasionally, and in some places zincblende. Exploratory work has shown that the amount of blende is present in larger quantities than was originally supposed. Moreover, the silver is associated chiefly with the zinc. At the Mambet mine, where most work has been done, the nature of the ore is shown by the results on the 105-ft. level. The lode is 15 ft. across, averaging 2.15% copper, 3.9 dwt. gold, and 2.9 oz. silver, with a large percentage of zinc. The copper mineral appears to be brittle and easily slimed. At the Graffsky mine, the copper is less than 1%, with about the same amount of precious metal as in the Mambet, and also a large proportion of zinc. Mr. Brown is, therefore, of the opinion that modifications will have to be made in the scheme of treatment, providing for the removal of the zinc and making a gold-copper and a silver-zinc product. T. J. Hoover has been consulted, and T. W. Draper has been appointed concentration manager. A small reverberatory will handle the less zincy ores.

General Mining News

ALASKA

JUNEAU

During December the Alaska Treadwell 240-stamp mill worked 20.09 days with water power and 6.54 with steam power, crushing 28,201 tons of ore; while the 300-stamp mill worked 14.87 days with water power and 11.79 with electric power, crushing 41,577 tons, the total being 69,778 tons. By amalgamation, $100,464 was saved, and by cyanidation



MAP SHOWING SITUATION OF TREADWELL MINES.

1416 tons of concentrate; the yield was $92,861, the total realizable value being $191,393. Operating expenses were $82,620, construction $25,004, and the net profit $83,769. Development covered 691 ft., and the stock of broken ore increased 3478 tons. The total output in 1912 was 892,192 tons of ore, yielding $2,161,319.

ARIZONA

GILA COUNTY

(Special Correspondence.)—The London Arizona Copper Co., aided by Dan O'Connell, has discovered a large body of silver-lead carbonate ore in its property. It is hoped that the profit from the ore will be sufficient to thoroughly develop the copper orebodies earlier discovered, and even to erect a smelter.

Winkelman, January 30.

(Special Correspondence.)—At the Inspiration property a station is being cut at the main west shaft. Both the main east and west shafts will be concreted. These shafts will have a hoisting capacity of 10,000 tons each per 24 hr., and probably a capacity of 7500 tons each for 16 hr., insuring a full supply for the mill in the event of disablement of one of the shafts. A 20 by 26-ft. station at Live Oak No. 1 shaft has been finished and a drift started from that point to connect with Live Oak No. 2 shaft.

At the Miami mine, one of the eight diamond-drill holes has revealed ore to a depth of 300 ft. below the 720-ft. level. In future the main shaft will be sunk to the 870-ft. level to extract the underlying ore. At the Captain shaft a large head-frame is almost completed, and the raise from the 420-ft. level has connected with the shaft at a depth of 200 ft. From that point another compartment is being stripped downward. When completed the shaft will consist of two compartments, one 4 by 4 ft., the other 3½ by 4 ft. The larger compartment will be used for hoisting rock extracted during development, the smaller will be used for counter-balance cages. Fortunately, all development at the Captain shaft will be in hard rock underlying the secondary enrichment zone. The shaft is being opened to take the place of No. 2 shaft, which, because of its situation in the orebody, will have to be abandoned. The electric hoist now at No. 2 shaft will be moved to the Captain. The 200,000-ton stockpile at No. 2 shaft is nearing exhaustion. J. Parke Channing has assumed direct charge of the Miami Copper Co. during the illness of B. Britton Gottsberger.

Government surveyors are marking the route of a transmission line that will convey electric power from the Roosevelt dam to Superior. It will tap the line now being built to Miami at a point near that town. Bringing in electric power will act as an impetus to development in this district, as the present cost of power is almost prohibitive.

An important discovery of high-grade ore has been made at the Superior & Boston mine, in the raise between the No. 6 and 8 levels. The ore is copper glance, 3 ft. assaying 31% copper with drillings into the hanging wall assaying 16% copper for a distance of 4 ft. The high-grade ore has thus been proved for a width of 7 ft., with the hanging wall not cut. The raise is now up 170 ft. above the No. 8 level, indicating a continuous orebody between the No. 6 and 8 levels, and this new find of glance ore at the present horizon leaves little doubt that this orebody will extend considerably higher. In the west end of the mine ore was mined to within 30 ft. vertically of the surface in this same vein.

Miami, January 30.

Copper production of Miami in January was 2,932,369 lb., as against 3,067,200 lb. in December. Ray Consolidated output in December was 3,830,000 lb., making a total of 35,931,402 lb. during 1912.

The Ray Consolidated Copper Co. has temporarily stopped construction work on the mill at Hayden, the eighth and final unit remaining unfinished. No reason has been given for this move.

GRAHAM COUNTY

(Special Correspondence.)—From September 1 to December 31, 1912, the Shannon Copper Co. treated 95,235 tons of ore which yielded 5,149,805 lb. of copper, 1012 oz. gold, and 54,394 oz. of silver, at an average cost of 13.49c. per pound. The high costs in September and October were due to taxes and liability insurance, while the large furnace 'froze' up in the latter month. The profit was $208,872, and on January 13 a 50c. dividend, amounting to $150,000, was paid. Development cost $40,000. In the west and sublevels of the Shannon mine, high-grade concentrating and smelting ore was opened for a length of 130 ft. over a width of 25 ft., and averaging 9.4% of copper. The Shannon-Arizona railway cost $715,000 to construct, and $414,000 bonds are outstanding. The new store, costing $25,000, is open for business. Liquid assets are $612,717, and current liabilities $174,649.

Metcalf, January 30.

MARICOPA COUNTY

In a west drift of the Cunningham Pass mine, 12 ft. of ore containing copper and gold has been cut. The Bullard, which adjoins the former, is shipping its ninth car of ore. Last week 18 in. of copper glance ore was opened.

MOHAVE COUNTY

C. Grimes, president of the Tom Reed Gold Mines Co., is inspecting the property. The Gold Road company has had trouble with its water-supply recently owing to the cold weather. The Elkhart mine, at Chloride, is being equipped with a plant for separation of lead, zinc, and iron. In the cross-cut of the Arizona Southwestern Copper Co. the vein is 16 ft. wide, carrying $24 per ton in gold and silver. A mill will soon be in commission, to treat 150 tons per day.

Quartzite district is busy, and prospects are good. The Cinnabar Development Co. has a new retort in operation. The Goodman mill is being overhauled. At the other small mines a considerable amount of work is being done.

YAVAPAI COUNTY

(Special Correspondence.)—Grading is being rushed on the new United Verde smelter site at Clarkdale. The T. F. Miller Co. has a store in operation there, and several temporary buildings are up. A modern brick plant of large capacity is ready to begin operations, and several big stacks of lumber are in readiness for use on the townsite. It is reported that the United Verde company will absolutely

control the new town by refusing to sell lots to outsiders. Lots will either be leased or the company will put up the buildings and rent to whom they please. An 8-in. pipe-line is being laid from the Kerwagen spring. The contractor has completed about half of the grading on the tunnel railroad line, from the 700-ft. adit to the smelter site.

The Arkansas & Arizona has been shut down about a week on account of motor trouble. The company has been working right along and has developed promising orebodies. The Haynes is employing about 25 men. This is a wet property, most of the water coming in above the 600-ft. level. The water is being caught there, and a large electric pump is being installed to force it out of the mine. A. J. Pickerell is loading a car of picked ore and concentrate from his properties near Prescott.

Prescott, January 28.

The Bagdad Copper Co. has three drills working, and over 100 holes have been put down. The United Verde Extension mine has been found to be in better condition than was expected, after being flooded for over two years. The Ford Mining Co., whose property is eight miles from Jerome, will prospect with a diamond-drill.

CALIFORNIA

Calaveras County

(Special Correspondence.)—A meeting of the business men of Angels was called last Thursday evening, at which ways and means to fight the Sierra railroad freight rates were discussed. There has been considerable hard feeling in this community regarding this matter, and the Railroad Commission does not seem inclined to interfere, regardless of appeals of Angels business men. Over $1000 was subscribed, and more is promised. The Utica people are getting ready to make their annual trip to the mountains to reconstruct their flumes. This is a yearly occurrence, and one would suppose that the work would be so constructed that it would be permanent. A large number of men will be employed. The Stanislaus Power Co. is making a few improvements at its power-plant on the Stanislaus river. It is planned to put in another pipe-line, which will place them at the head of the list with the largest power producers of the state. The Tanner Mining Co. is contemplating considerable improvements on its property. It has purchased from the Hercules-Horseshoe Mining Co. the 2-stamp mill and other buildings, which will be moved at an early date. A road is now being graded to the site of the new mill. J. A. Campbell is superintendent.

Angels Camp, January 31.

Eldorado County

At the Gopher Boulder mine, near Kelsey, the company has been unwatering the shaft preparatory to reopening the old gold producer. It is stated that an English syndicate intends bonding it and employing a fair number of men.

Inyo County

The Skidoo mill lost 16½ days time in December, and crushed 830 tons of ore. On December 15 the cyanide plant was closed for the winter. Bullion produced was worth $12,287, while total costs of $4790 left a profit of $7497.

Nevada County

During the coming spring it is probable that the old Covotoman and Young America gravel mines will be reopened by J. W. Rea. The old town of You Bet, once having a population of several hundred mining people, has only three families; and the well known flag-pole has been cut down for fuel.

The Queen Radigunde mine, in the Alleghany district, is the basis of a lawsuit between J. J. Guentherodt and E. E. Hoeft. After operating for two weeks on the Deer creek gravel beds, the Keystone drill is being taken to Yuba county. Results have not yet been published. San Francisco people are interested.

Placer County

The power plant of the Jubilee mine, on the Grass Valley road, is shut down for repairs and installation of a large boiler. The incline shaft is down 130 ft. A cave-in at the Red Jacket lead compelled Recknagle Bros. to suspend work. The new dredge for the El Dorado & Placer Gravel Mining Co., at Poverty Bar on the American river, is being rapidly constructed.

Plumas County

By an agreement of January 4, A. Weil will have control of the Rose Quartz group of claims, situated on Poorman's creek, for five years. Under the terms, the mine is to be thoroughly developed and a 5-stamp mill erected.

Shasta County

(Special Correspondence.)—The Oro Water, Light & Power Co. has taken a bond on the Gibson and other ranches just below Redding, and has set a force of prospectors at work. In the event of satisfactory results from drilling, it is planned to build a dredge. The properties are in the Clear Creek district. Porter & Taylor, of Los Angeles, who recently bonded the Russell holdings, have arranged to place 25 men at work early in February. The property comprises the Lost Channel placer claims, near Igo, and about 14 miles west of Redding. Work by the owners has disclosed good gravel.

Redding, January 28.

(Special Correspondence.)—A new copper ore deposit has been discovered near Heroult, by Fred Grotofend, locator of the famous Mammoth mine. The outcroppings were overgrown with brush, but the nature of the formation exposed resulted in investigation and location. It is probable a company of local and Eastern people will be formed to develop the holdings. Development at the Shasta Belmont group continues. Nevada capitalists are largely interested. The claims lie near Heroult.

KENNEDY 100-STAMP MILL.

Redding, February 3.

On January 28, at the Heroult iron smelter, seven miles from Kennett, a furnace was blown in to smelt copper ores by electricity and an oil blast. J. H. Loughrey experimented with a carload of ore from the Iron Mountain mine, and although not an entire success, results were promising.

The outlook at Whiskey Creek is bright. A 20-in. vein of rich ore is being opened at the Gambrinus mine, and a 5-stamp mill and two concentrators are working full time. A. Eggerton and F. Newmeyer have done well in the Mad Mule gulch. At the Mount Shasta mine a new ore-shoot, 2 to 4 ft. wide, has been cut. In New York gulch, M. Gannin's miners have driven a cross-cut to cut, 100 ft. below the outcrop, a vein that shows 2 ft. of good ore.

Tuolumne County

(Special Correspondence.)—What appears to be an important find was made in the Atlas mine, near Tuttletown, this week, when a cross-vein was cut on the 200-ft. level. Both veins are gold-bearing and at the junction are very rich. The housing of the mill is almost finished, and the work of placing the machinery has begun. About 30 men are employed in the mine and on the surface. The Longfellow Gold Mining Co., organized under the laws of Arizona, filed articles of incorporation in this county this

week. The principal place of business is Phoenix, Arizona, and the capital stock is $500,000, represented by 500,000 shares of the par value of $1 each. By its articles, the company's liabilities are limited to $50,000 at any one time. It is understood it will operate the Longfellow mine, at Big Oak Flat. The M. McCormick company has become sole owner of the Draper mine, near Soulsbyville, having purchased the interest which Cotton Bros. & Co. owned. The price paid, according to papers recorded here this week, was $40,500. The mine, which is 600 ft. deep, has been a good producer, but has been idle for some time. Approximately 100 mine locations have been recorded during the present month.

Sonora, January 25.

COLORADO

Clear Creek County

The new mill at the Pioneer mine, at Empire, is producing a clean product. The Capital mill is also operating steadily on company ore. Lessees at the Seven-Thirty mine are opening good ore. The old dump from the Burleigh mill has been cleared away from the site where the Edison mill is to be erected. The Marshall-Russell property is not being worked, pending a consolidation of a number of claims in the Empire district. The adit here is in 7000 ft., and should cut a number of veins. A new compressor plant is being erected at the Bellevue-Hudson mine, near Lawson. A large number of mines in the Daily and Atlantic districts have been closed for the winter.

Dolores County

The annual meeting of the Rico-Wellington Mining Co. was held at Provo, Utah, on January 30. During 1912 the production was 4700 tons of ore. The new mill for treating zinc ore is ready, but nothing definite has been done toward starting concentration of ore. Its daily capacity is 75 tons. An orebody containing copper, lead, and silver is being opened.

Gilpin County

At the Castle Rock mine, a shipment of 8 tons of smelting ore, containing copper and lead, assays $63.90 per ton. On the 400-ft. level the vein is 18 in. wide, showing improvement in driving. A carload of ore from the Two-Forty mine returned 4.75 oz. of gold and 8.5 oz of silver per ton. This came from the 200-ft. level. The property is developed by two adits, each 1000 ft. long, besides a shaft 340 ft. deep. At the Pittsburg regular shipments are made. With the Waugh No. 12 stoping machine one man has drilled 122 ft. in 6 hours.

Lake County (Leadville)

On January 27, 1905, the *Herald Democrat* stated that, in time, ore as low as 15% zinc would be profitably mined; and at the present time 17% ore is being shipped, and by March, the smelters will receive 15% zinc ore. This will be a boon to many in the Leadville district. There is little new from this centre, everybody being busy.

Ouray County

(Special Correspondence.)—The Wanakah mill worked 89 days during the quarter ended October 31, 1912, and treated 4469 tons of ore yielding a total of $48,232, the profit being $24,230. Development covered 707 feet.

Ouray, January 30.

Teller County (Cripple Creek)

A contract for the sale of control of the stock of the Golden Cycle Mining Co., which is held by Messrs. Milliken, Logan, and Carter, who, it is said, have 1,400,000 shares out of 1,500,000, has been signed. The sale involves about $5,500,000 for the mine and $1,500,000 for the mill, the latter treating 70% of the ore from Cripple Creek mines. Joseph Walker & Sons, of New York, who financed the El Paso Consolidated Co., has the option on the Golden Cycle stock. During the past week Joseph Walker, Jr., and others inspected the El Paso property. During January local mines paid $167,843 in dividends. The Vindicator produced 96,934 tons of ore worth $29.50 per ton, and lessees 10,775 tons, worth $18.50 per ton, in 1912. Royalties paid were $27,868. The annual meeting of the Mary McKinney Mining Co. will be held on February 10. During the past year the company produced 10,459, and lessees 3086 tons of ore, yielding $272,454 and $53,858 respectively. Total revenue was $328,028 and expenses $211,071, leaving a balance of $116,957. At December 31 the surplus was $77,670. A 2c. dividend, amounting to $26,185, was paid on January 28, 1913. Development to 920-ft. depth covered 4314 ft. A station is being cut on the 900-ft. level of the Nichols shaft of El Paso, and the ore-house is ready. Ore is being mined at three places in the Abe Lincoln property on Gold hill, the average grade in December being over $25 per ton. The flow of water from the Roosevelt drainage tunnel was recently 8485 gal. per minute.

IDAHO

Bonner County

At the Idaho-Continental mine, near Porthill, machinery is being assembled, coming from that place by sleighs a distance of 21 miles. The Union Iron Works, of San Francisco, is supplying three sets of rolls and other machinery. A hydro-electric plant has been erected about 10 miles from the mine, the 4000-ft. flume remaining to be constructed.

Lemhi County

The first consignment of precipitate from the Musgrove mill has been received at Salt Lake City, Utah people being interested in the property. The mill has a capacity of 25 tons per day, and at present is operated by steam, but when water-power is available a profit should be made from ore over $3.20 per ton. By the manager, R. L. Edwards, the following details are given of the mill, which type is coming into favor in several countries:

The Lane mill, running at a little over 5 r.p.m. (the proper speed is 8) will crush one ton per hour so that 95% passes 200 mesh. The tailing on the first charge (the charge was agitated) assayed only a trace. At the present time we are not able to keep up sufficient speed on the mill and run the agitator too, with the small boiler, so are crushing the ore a little coarser and not agitating. It leaches better than one would expect from the amount of slime in the ore. The highest tailing sample so far has assayed only 80c., but the ore we have run has been very low, averaging $4.80. The precipitation is perfect, and cyanide consumption is low, so it is settled that the mill is going to do fine work.

We figured on getting some help from the water-power in the winter, but we did not get connected up with the flume.

Shoshone County

The Federal Mining Co. has purchased the Frisco mine, at Gem, its 500-ton mill, and water right on Canyon creek for $250,000. This mine has paid $1,250,000 in dividends since 1889. The Frisco Consolidated company has 15 separate properties. The Frisco mine is 600 ft. west of the Morning mine, which belongs to the Federal company, and has been developed to a depth of 200 ft. by 20,000 ft. of workings. Originally it produced lead and silver ore, but the percentage of zinc has increased, so that the mine was practically abandoned. The process at the Morning mill will successfully deal with this ore.

The Stewart Mining Co. made a profit of $536,900 during 1912. About 500 tons of ore is shipped daily. In February the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 185 of $65,400. This makes the total amount of dividends paid $14,042,550.

KANSAS

Cherokee County

On January 14 a slab of rock, 5 by 18 by 45 ft., estimated to weigh over 200 tons, and a large piece of limestone, fell from a drift in the Hartford mine, near Galena, and killed four men, while another was badly injured. Twenty-one men worked hard at rescue operations.

MONTANA

Silverbow County

(Special Correspondence.)—The Boston people who

brought suit to annul the decision of the Parrot company to sell its property to the Anaconda Copper Mining Co. for 90,000 shares, are still fighting the case. A short while ago, evidence was taken at Butte bearing on the sale, the witnesses being Anaconda officials. The minority holders, who are trying to have the sale annulled, contend that the property is worth far more than was paid for it; while the Anaconda company claims that, as it had been an unprofitable property, the payment was ample. Owing to a scarcity of water, the Barnes-King mill is treating only 100 tons of ore per day, but in the spring there will be plenty. B. B. Thayer, president of the Anaconda Copper Mining Co., is now at Butte on his semi-annual inspection of the properties. A good deal of activity prevails in the Georgetown district, the extension of the Butte, Anaconda & Pacific railway into that part having made the improvement. The vein on the 2000-ft. level of the Tuolumne mine is 30 ft. wide, with 9% copper and good silver content. Shaft-sinking is being continued.

Butte, January 30.

NEVADA

Esmeralda County

(Special Correspondence.)—The estimated production of the Goldfield Consolidated Mines Co. for January was 27,265 tons of ore, yielding $505,000. Operating expenses were $175,000, leaving a profit of $330,000.

Goldfield, February 3.

During the last quarter of 1912 the Goldfield Consolidated Mines Co. produced $1,255,782 from 86,294 tons of ore, at a cost of $510,248, leaving a profit of $745,533.

On the hanging wall of the 100-C raise, in the Vernal mine, there is an 8-in. vein which carries high-grade ore showing free gold, and with it there is 30 in. of lower grade ore which can be mined at a good profit. On the 50-ft. level a cross-cut is being driven. Regular shipments are being made. Salt Lake men have acquired control of the Round Mountain Mining Co. The mill is treating 180 tons per day, and 90% is extracted by grinding and amalgamation. During 1912 some good developments were recorded to a depth of 900 ft., and on the lowest level 12 ft. of ore is being driven on. Placer-mining has been done to some extent by lessees on the Sunnyside claims of the Round Mountain. The Goldfield Oro shaft is being enlarged from 350 ft. to the surface

Humboldt County

Rochester Canyon has a population of about 800 people, there being three towns close together. The Rochester Hills Mining Co. has an adit in 52 ft., in hard ground, and at 115 ft. it is expected to cut a vein at 100-ft. depth. With the Big Four people, a tramway 1750 ft. long will be erected. There are 4000 sacks of ore on the Big Four lease which is to be sent to the Thompson smelter. To supply the new centre with water, a supply can be brought by gravity from Lee's springs, while for electric light and power it is proposed to erect a power-plant at Oreana, on the Southern Pacific railroad.

Lyon County

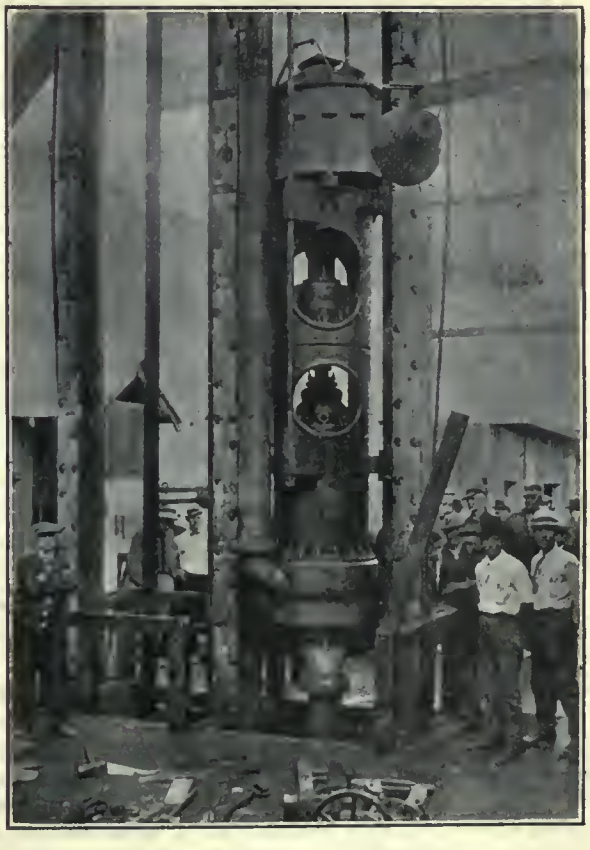
During the past year the Thompson smelter received ore from 125 different copper properties in western Nevada. There has been a decline in Mason Valley stock, due, it is stated, to the company borrowing money on unsold stocks of copper. At the Nevada-Douglas mines, 250 men are employed, and ore shipments for the week ended January 9 were 3063 tons. A new orebody has been cut in the Berryhill adit, almost directly under the 'big stope' of the Douglas Hill mine. At the Ludwig, the incline shaft is down 68 ft. below No. 7 level, in ore averaging 2.5 to 10% copper. Leaching experiments have reached the stage where a 10-ton experimental plant is to be erected. It is believed that 1.5% ore will yield a profit by this process.

Nye County

The following development was reported by Tonopah mining companies during the week ended February 1: Ten mines shipped to the mills 11,090 tons of ore worth $231,635, including Jim Butler, 450 tons; Merger, 165 tons; North Star, 45 tons; and Midway, 45 tons. The year to date shows a total of 52,870 tons, worth $1,104,832 from all mines. Between the 565 and 615-ft. levels, the Montana Tonopah cut 16 ft. of good ore. On No. 6 level of the Jim Butler the shoot has been driven on 100 ft., showing 6 ft. of ore at present. Improvements at the MacNamara mill have been finished. The Extension opened good ore on the 600-ft. level. Sinking of the Belmont main shaft has been resumed, it being in trachyte in the footwall of the vein. During the quarter ended November 30, 1912, the Tonopah Mining Co. produced $702,368 of bullion, from which mining, milling, and general expenses left a surplus of $374,654. Sundry receipts and T. & G. railroad dividends brought the revenue to $448,335. Dividends absorbed $400,000. Cash on hand amounts to $416,831.

Storey County

The annual meetings of the Crown Point, Belcher, and Yellow Jacket mining companies were held in San Francisco last week. The combined report states that the Yellow Jacket mill treated 7787 tons of dump ore and 21,660 tons of mine ore, during 197 days, valued at $144,549. The Crown Point mined from the 1400-ft. level, and winze to 1450 ft., 17,826 tons. The three companies shared expense in repairs to the Yellow Jacket shaft, tramway, and bin, and are preparing to unwater the mines by pumps at Gold Hill. Generally the condition of the mines and finances is satisfactory. During the week ended February 1 the Mexican mine produced 1315 tons of ore worth $37,099; and the mill treated 442 tons yielding $13,658, with 92% extraction. An up-to-date mill is to be erected in the Six-mile canyon, using the Fischer plant for a start. This has 5 stamps, and the capacity will be increased to 50 tons per day. It will treat ore from the Comstock-Phoenix mine and other claims.



CENTRIFUGAL PUMP AT COMSTOCK.

White Pine County

Nevada Consolidated Copper Co. produced 70,800,244 lb. of copper in 1912, as against 63,048,997 lb. in 1911.

TEXAS

Brewster County

(Special Correspondence.)—Closing of the Del Carmen mines in Coahuila, Mexico, is announced. These mines are

in the foothills on the western side of the Sierra del Carmen and belong to the Madero family. They were worked for lead for several years by the Kansas City Con. S. & R. Co., but recently have been operated for zinc. The mines are 15 miles from Boquillas, Texas, and the ore has been delivered by aerial tram to the north side of the Rio Grande. From Boquillas to Marathon, on the Southern Pacific, 82 miles, the ore has been hauled by mule-team. A new type of auto truck was tried, but proved unsatisfactory. The cost of delivery of ore, coupled with disagreement between Texas and New York men interested in the operation of the property, has led to closing the mine. As the

TERMINAL OF DEL CARMEN TRAMWAY.

custom house at Boquillas has been closed, it is now impossible to bring in the ore economically.

Marathon, January 20.

SALT LAKE COUNTY

At the meeting of shareholders of the four Alta mining companies, mentioned in these columns last week, to agree to consolidation, the Columbus Extension holders disapproved of the proposal, holding that it would not benefit the mine. The meeting was adjourned. During 1912 the Ohio Copper Co. produced from 757,000 lb. of copper in February to 187,000 lb. in October, when the strike was in progress, and profits ranged from $37,000 to $20,000 in December. The year's output was 6,952,700 lb., and profits $305,400. Assets total $500,000. The Utah Copper Co. produced a total of 95,105,391 lb. of copper in 1912, as against 99,456,225 lb. in 1911.

SUMMIT COUNTY

Five mines at Park City shipped 1843 tons of ore during the week ended January 25. Snow has interfered with mining in the Snake creek district. At the Ontario mill, water pipes and solution-tanks have been thawed out, and the roasting-furnaces fired up.

TOOELE COUNTY

At the International smelter, No. 3 lead furnace has been started, and No. 4 will be ready by February 15, giving a total capacity of 1000 tons of ore per day.

WASHINGTON

STEVENS COUNTY

The Standard Chewelah company has opened a rich vein of copper ore in its shaft two miles from Chewelah, and is installing a boiler and pump to unwater a deeper shaft on the property. An east cross-cut is in 175 ft., and with 75 ft. more the vein will be cut. A compressor will also be installed, and ore shipments will begin in 60 days. The United Copper Co. held its annual meeting last week. The gross revenue during 1912 was $226,000, and the estimate for the current year is $662,500.

WISCONSIN

GRANT COUNTY

(Special Correspondence.)—There is much interest now among zinc miners in various new types of drills. The Leyner one-man drill has been introduced in many of the mines and is rapidly replacing two-man drills. The Vinegar Hill company uses it entirely and pays on a footage basis. Homer Snow has put the Leyner in at the Empire mine. At the Frontenac the Temple air-electric drill is in use, while the Mineral Point Zinc Co. is getting excellent results with the Ft. Wayne electric. In average ground 145 ft. was driven recently in 45 shifts. The wide distribution of electric power through the district favors introduction of power drills. The Mineral Point Co. has not found much in the Merry Christmas, a tract of ground worked years ago but long idle, but is expecting good results from the work being started at the Black Jack, south of Galena. This property was worked heavily in the nineties, shipping to the Illinois Zinc Co. At Highland, matters are rather quiet. The Highland Mining Co. has sold out to the Mineral Point company, leaving the Franklin the only independent mine of importance.

Platteville, February 1.

CANADA

BRITISH COLUMBIA

So far $1,324,554 has been spent by the Granby company on its Hidden Creek mines, and a further $1,620,000 will be necessary for full equipment on a 2000-ton daily capacity. During the past six months the smelter at Grand Forks has yielded a profit of $790,054, and the surplus is $1,095,575.

ONTARIO

The Crown Reserve Mining Co. produced bullion worth $1,692,060 in 1912. Total expenses, including $147,910 royalty to the Ontario government, were $556,050, leaving a profit of $1,130,010. Dividends paid totaled $1,061,288, and the surplus stands at $821,392.

During the week ended January 25, 20 tons of gold-bearing ore was sent out from the Tough claims at Kirkland lake, near Swastika. Ten Cobalt mines shipped 327 tons of ore, and two 65,164 oz. of bullion, the total of the latter for the year being 247,615 oz. The Hollinger mill treated 43,227 tons of ore in 1912, yielding $933,974. The average assay was $22.45 per ton, and extraction 96.3%. It is estimated that the Dome mine produced $750,000 in 1912, which, with other small mines, makes the Porcupine output for the year $1,800,000. The main vein has been cut on the 180-ft. level of the Dome Lake mine, where it is 30 in. wide, worth $32 per ton.

NICARAGUA

Recent reports are to the effect that the La Luz & Los Angeles M. Co. will make improvements at its property to the value of $500,000. George Fletcher, the managing director, visited the property recently. The Bank of Nicaragua, in which Eastern capital is involved, was recently started.

PHILIPPINE ISLANDS

The new dredge of the Philippine Exploration Co. on the claim at Gumaus, is at work. F. B. Ingersoll, president and general manager for the company, states that an Australian company is operating two dredges in the river at the town of Paracale. The company had an old New Zealand dredge. This concern was incorporated as the Philippine Dredging Proprietary, Ltd. The Philippine Dredging Syndicate was operating a Risdon dredge in the Malaguit river, and was recovering about 300 oz. of gold per month. Up in the country at the junction of the provinces of Rizal, Tayabas, and Nueva Ecija, on the upper waters of the Umerai river, the Luzon Gold Co. is getting gold, using hydraulic power.

New York Metal Market Review

January was an eventful month with the metals, especially copper, because of the tumble in prices of that metal. The first month of the year ended with a net decline of about 1½c. per pound for electrolytic, while at one time the market was 1¾c. below the recent 'peg' price of 17.75c. which the producers demanded. While the statistical report for December had great influence in bringing about the decline, foreign conditions were quite as potent, and it may be repeated, as stated in the November review, that European demand must revive before great improvement can be expected. The situation demonstrates the importance of Europe as an outlet for American copper. Tin prices, with intermittent trading, have been more than maintained. Lead has been dull, but prices have remained stationary. Spelter is much lower, and antimony is down also. Lead, spelter, and antimony have all been affected by uncertainty as to tariff changes.

Copper

At the beginning of January, electrolytic copper was quoted at or near 17.62½c. cash, 30 days, delivered, New York. At the end of the month quotations were 16.30c. cash, 30 days, delivered. Until the appearance of the Copper Producers' statement on January 8, the market was strong and optimism was general, as for several weeks there had been a hardening of prices and improvements in domestic sales. Late in December between 7,000,000 and 10,000,000 lb. had been taken by one large consumer at the market price. The disclosure by the Producers' report that nearly 20,000,000 lb. had been added to stocks in December, on the heels of which came disturbing reports of renewed hostilities in the Balkans, caused a break in London, and an immediate softening of prices here, especially of those quoted by second hands. Futures were affected first, but quick delivery metal soon followed in the decline. One break followed another abroad. They were reflected here, and the word 'demoralized' began to be heard with reference to the market. About the middle of the month, outside lots of copper sold down to 16c., and there were rumors of still lower prices. The large agencies indicated that they were willing to take concessions, and for the first time in many months it was evident that the producers were not standing together. The low prices were followed by an incomplete recovery and in a steadier market; sales were reported at 16.40c. cash, c.i.f. New York. Then came another break abroad, and between January 10 and 15 standard or speculative copper dropped £6, and in the week between January 18 and 25 electrolytic for February and March delivery was offered down to 16c. f.o.b. New York, and even lower prices were rumored. It also became known that two of the largest agencies, the United Metals Selling Co. and the American Smelting & Refining Co., were sharply competing for business abroad, and once more talk of demoralization was heard. Then came a sudden turn for the better, and several million pounds was taken by London dealers at 16.25c. f.o.b. New York. The market hardened toward the end of the month, prices rising to 16.35c. cash f.o.b., with March and April offered at a concession of 25 points. Throughout the month domestic consumers appeared distrustful of the market and did not come forward to buy except as necessity compelled them. Lake near the end of the month was quoted at 16.50c. cash, New York. Brass sheets, wire, and rods were reduced ⅛c. on January 27, and copper wire also was off a fraction of a cent. The feeling on the part of some speculative dealers that lower prices are to be expected in copper is shown by their willingness to sell short in futures. This is a form of gambling which is vigorously condemned by those who do a legitimate business in the metal. Exports were fair in January, considering the situation, amounting to 23,048 tons.

Lead

The price of lead has been maintained throughout January. Early in the month an active demand resulted in good sales which strengthened the market. The activity soon subsided, however, and quiet then ruled throughout the month, the price standing at 4.35c. New York. While some bullish talk was heard early in the month, it is not believed by careful students of the market that there will be any undue or rapid rise while the tariff question is pending.

Spelter

The month opened with 7.30 to 7.35c. New York quoted for spelter, and with shipments good, but not much new business. The trend of prices throughout January has been downward, and at the close 6.80c. New York was quoted. Large quantities of German spelter, which was sold on the Atlantic seaboard at 5 points below the market price of prime Western, made its appearance, and this influence, together with tariff uncertainties, has had a detrimental influence on both prices and trading. The weakness which developed late in the month was regarded as surprising in view of the small stocks and good consumption. Despite the low price, buyers held aloof.

Antimony

Declines marked the antimony market in January. Probabilities of tariff changes are a disturbing influence with this metal also, although buyers have stayed out of the market to a considerable extent for the reason that they were sufficiently supplied. Throughout the month the metal was dull and irregular, with pressure to sell, but few takers. Near the end of the month quotations were 9.50 to 9.75c. for Cookson's, 9.25 to 950c. for Hallett's, and 8.50c. for Chinese and Hungarian grades, having declined from 9.87½ to 10.25c. for Cookson's, 9.50 to 9.75c. for Hallett's, and 9c. for Chinese and Hungarian. The appearance in the market of speculative lots has not helped trade, and at times it required a good deal of shopping to get the 'rock-bottom' price.

Aluminum

Prices of this metal have dropped a little in the month, and both prompt delivery domestic and foreign are now quoted at 26.25 to 26.50c., a decline of about 25 points. Consumption has continued good, though perhaps not quite as brisk as in the last quarter of 1912. In the early part of the month it was confirmed that the Aluminum Company of America has obtained riparian rights in North Carolina and Tennessee, and has plans in prospect for a new aluminum plant, to be operated by water power. Good freight rates and the labor supply will determine the location of the plant. Until the water power is available it is planned to secure electricity from the Tennessee Power Co. It is expected that the new plant will be ready for operation by the middle or latter part of the present year. Extensions are planned by the same company, it is understood, at its plant at Messina, New York, part of which will be available this year.

Tin

Tin prices held up throughout the month, opening at 50.60c. and closing a trifle lower, but over the 50c. mark. There were periods of dullness followed by others of considerable activity. In the first half of January there was a shortage of spot and prompt delivery metal, and prices went from import cost to nearly 60 points above it, and declines in London were not followed by the New York market. The arrival of the *Minnetonka* from London, January 15, with 1025 tons, was all that averted a serious situation. As it was, some dealers who did not have metal to cover their contracts were pinched. Later in the month further generous arrivals eased the shortage, and the premium gradually vanished. In the next few weeks quiet is looked for, inasmuch as February and March tin was freely dealt in during November and December. The arrivals in January were 4169 tons, and there is afloat 3075 tons.

The sale of 2500 tons of Banca tin in Holland, January 29, brought the high price of 137¼ florins (equivalent to 50c. c.i.f. New York), and it is declared that it had all been contracted for before the auction. Reports are that a Vienna, Austria, firm has Banca tin practically cornered.

Market Reports

LOCAL METAL PRICES

San Francisco, February 6.

Antimony	12—12½c	Quicksilver (flask)	39
Electrolytic Copper	18—18½c	Tin	53½—54c
Pig Lead	4 60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, February 5.—Copper prices are decidedly unsettled. Lead is quiet and firm. Spelter remains weak. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Jan. 30	15.90	4.33	6.50	62
" 31	15.90	4.33	6.50	61⅞
Feb. 1	15.80	4.33	6.40	61⅞
" 2	Sunday.	No market.		
" 3	15.80	4.33	6.28	62⅛
" 4	15.80	4.33	6.23	62⅛
" 5	15.80	4.33	6.23	62⅛

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	February 6.
Camp Bird Ltd	$ 4⅞
El Oro	4⅛
Esperanza	8⅛
Oroville Dredging	1⅛
Santa Gertrudis	6½
Tomboy	6¾

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. February 6		Closing Prices. February 6.
Adventure	$ 4	Mohawk	$ 52½
Allouez	37	North Butte	29
Calumet & Arizona	64⅛	Old Dominion	48¼
Calumet & Hecla	489	Osceola	93
Centennial	16	Quincy	70
Copper Range	45½	Shannon	11½
East Butte	13	Superior & Boston	3⅛
Franklin	7	Tamarack	30
Granby	66	U. S. Smelting	39¾
Greene Cananea, ctf	.8⅛	Utah Con	10¾
Isle-Royale	26⅛	Victoria	1⅛
La Salle	4⅜	Winona	3
Mass Copper	4⅛	Wolverine	65

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 6.

Atlanta	$ .15	Midway	$ .33
Belmont	7.90	Montana-Tonopah	1.72
Big Four	.83	Nevada Hills	1.37
Buckhorn	.90	North Star	.20
Con. Virginia	.13	Ophir	.31
Crown Point	.20	Pittsburg Silver Peak	.63
Florence	.41	Round Mountain	.35
Goldfield Con	2.30	Sierra Nevada	.17
Halifax	1 02	Tonopah Extension	1.97
Jim Butler	.70	Tonopah Merger	.85
Jumbo Extension	.31	Tonopah of Nevada	6.00
MacNamara	.22	Union	.15
Manhattan Consolidated	.10	West End	1.37
Mexican	.79	Yellow Jacket	.20

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. February 6.		Closing Prices. February 6
Alaska Mexican	$13⅜	McKinley-Darragh	$ 2
Alaska Treadwell	42⅜	Miami Copper	23
Alaska United	23¾	Mines Co. of America	3
Amalgamated Copper	71⅜	Nevada Con	18
A. S. & R. Co	72½	Nipissing	8¼
Braden Copper	9½	Ohio Copper	¾
B. C. Copper Co	4½	Ray Con	18⅜
Chino	42½	Tenn. Copper	33⅞
First National	2½	Tonopah Belmont	8
Giroux	3⅜	Tonopah Ex	2
Goldfield Con	2½	Tonopah Mining	6
Greene-Cananea	8¾	Trinity	4¾
Hollinger	15	Tuolumne Copper	3⅜
Inspiration	16¾	Utah Copper	52½
Kerr Lake	3¼	West End	1⅜
La Rose	3⅜	Yukon Gold	3
Mason Valley	8		

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

B. B. THAYER is at Butte.

JAMES DOUGLAS is in Arizona.

J. PARKE CHANNING is at Miami.

R. G. HALL is at Salt Lake City.

E. G. THOMAS has gone to Mexico.

R. G. WALKER is in San Francisco.

PAUL RINK is here from Ketchikan.

A. J. MCDONALD is here from Manila.

THOMAS KEARNS is at the St. Francis.

E. G. SPILSBURY is at Houston, Texas.

C. A. RODEGERDTS has returned from Peru.

J. V. N. DORR is visiting the Panama Canal.

WILLIAM WRAITH has gone East for a brief visit.

W. H. BLACKBURN was in San Francisco last week.

EDMUND JUESSEN was in Calaveras county last week.

W. L. CREDEN is now consulting engineer for the Davis-Daly.

J. C. NILON, of Nevada City, was in San Francisco recently.

F. H. BOSTWICK has been in Arizona and California recently.

L. H. DUSCHAK is now chemist for the Bureau of Mines at San Francisco.

GEORGE E. VIGOUROUX is now with Trippe & Co., 25 Broad street, New York.

A. F. DIXON is now with the Caribbean Petroleum Co., Caracas, Venezuela.

D. D. MUIR, JR., was in San Francisco and has gone to Rochester, Nevada.

H. C. BELLINGER was in San Francisco and has gone to Spokane on his way East.

R. G. THOMAS is making an examination of mining properties near Hillside, New Mexico.

CALVERT WILSON was in San Francisco during the week and has returned to Los Angeles.

E. C. ENGELHARDT is now superintendent of the Idaho Smelting & Mining Co., Clayton, Idaho.

UTLEY WEDGE was in San Francisco and has gone to Seattle, expecting to return in about ten days.

Obituary

C. H. THOMAS died at Tuolumne, California, on January 8, aged 74. He was born in England and his first mining experience was in South and Central America. Coming to California, he engaged in mining in Amador and Placer counties, and was for many years superintendent of the Dead Horse mine.

ARTHUR CROZIER CLAUDET has joined the miners who have 'crossed the divide.' He was educated privately, and after three years experience in the alkali industry and the hydrometallurgy of copper and silver, in 1881 he associated himself with his father in London, where he continued in consulting practice for over thirty years. Besides notable achievements in the art of metallurgy he was prominent in public work, being a founder and trustee of the Institution of Mining and Metallurgy and serving as editor of its *Transactions* since 1895. He also took a prominent part in the reorganization of the Royal School of Mines, serving on the sub-committee of the Board of Education and on the building committee of the School of Mines. Perhaps his greatest service was in the way of establishing scholarships for worthy students and securing positions for them after graduation. He was always generous in his help to poorer men and will be sincerely mourned.

Company Reports

KALGURLI GOLD MINES, LTD.

This company has a capital of only $576,000, and is one of the important and most profitable of companies operating at Kalgoorlie, Western Australia. To date the mine has produced 1,092,605 tons of ore, yielding $14,848,570, and has paid $6,012,000 in dividends, of which 123,800 tons yielding $1,207,820 was produced in the year ended July 31, 1912, and $460,800 was paid in dividends. The year 1906-7 was the best from all points of view. Since then the lower levels of the mine have not opened satisfactorily, and the past year's output is $500,000 lower than the year mentioned.

During the past year ore was extracted from 18 levels, the greatest tonnages coming from No. 4, 12, 14, and 1, in the order given, the average value being $10.40 per ton, at a cost of $2.12 per ton. On No. 1 level the south orebody has been mined to its payable limits, which cover a length of 150 ft., and average width of 30 ft. Over 95 ft. the average grade is $7, falling to $6 per ton in end-sections. Diamond-drilling has given good results. On No. 2 level a westerly cross-cut was ppt out 163 ft., and at 147 ft., 5 ft. of ore worth $30 per ton was cut. North and south drifts were driven 37 and 113 ft. respectively, opening ore of good average value. Development on the 1250-ft. level proved ore over a length of 55 ft., and width of 30 ft., averaging $22 per ton. The main north drift off the main west cross-cut on the 1450-ft. level was extended from 163 to 246 ft., opening 8 ft. of $6, 5 ft. of $10, 6 ft. of $25, 4 ft. of $9, 6 ft. of $35, 7 ft. of $7, 7 ft. of $28, 8 ft. of $10, 7 ft. of $13, and 25 ft. of $3 to $5 ore, the average stoping width being 6 ft. The ore-shoot opened during the previous year on the 1750-ft. level has been further proved to cover an area of 33 ft. north and south, and 62 ft. east and west, the value on the eastern side being $11 per ton. At other points on this level there are large quantities of rock just unpayable. On the deepest level, 1850 ft., the main south drift was continued to a distance of 784 ft. from the west cross-cut, and 70 ft. from the Associated boundary. The shoot opened from 169 ft. south, proved to be 25 ft. long, 20 ft. wide, and worth $15 per ton. Raising and winzing did not open any good ore. A shrinkage stope has been carried to a height of 50 ft. above the level, the area at that height being 27 by 37 ft. To 25 ft. the value was $11, but from there to 50 ft., only $5 per ton. From observation, it is stated that possibly the ore on the 1850 and 1750-ft. levels is not of the one orebody. Thirteen holes, totaling 1638 ft., were drilled east and west, in barren calc schist and diabase rock respectively. Development covered 4083 ft.; diamond-drilling, 2108 ft.; and sample holes bored, 3294 ft. The Kalgurli mine has always been noted for the width of its orebodies, and while no close estimates of ore reserves are given, they at present approximate 250,000 tons. The report is accompanied by 13 mine plans. Extraction in the mill averaged 93.67%, against 94.75 for the previous year, the residue from $10.40 ore being 66c. per ton.

CHAMPION REEF GOLD MINING COMPANY OF INDIA, LTD.

The capital of this important company, which owns 1093 acres in the Kolar goldfields of India, is $1,248,000 in 2,080,000 shares of 60c. each, all being issued and fully paid; and during the year ended September 30, 1912, $624,000 was paid in dividends, equal to 50 per cent.

At the mine, the circular shaft had reached a depth of 3510 ft. on September 30, a depth equivalent to No. 39 level. Connection had already been made with the main workings on No. 33 level. Work on the erection of the head-frame and hoisting engines is well ahead. This shaft was sunk 476 ft. during the year, and it is estimated that at 4500 ft. the lode will be cut. Whether it will be economical to provide hoists to work to that depth remains to be proved. Only 7000 tons of ore has been stoped below No. 30 level. In Garband's section of the mine, an ore-shoot 800 ft. in length has been opened on No. 36 level, the western part of the lode being 45 in. wide, worth $15 per ton, 280 ft. of which is 9 ft. wide. This ore has been further proved south from Glen shaft on No. 37, 38, and 39 levels. On No. 41 and 42 levels, the north drifts have opened ore for 200 and 300 ft. respectively. North drift on No. 37 level from Garband shaft shows 18 in. of ore, worth $31 per ton, the total length of the shoot being 480 ft., averaging 16 inches in width, worth $36 per ton. At Glen shaft a cross-cut is being driven to the lode on No. 41 level, while on No. 39 level the last 195 ft. driven has proved 24 in. of quartz, worth $22 per ton. No. 38 level south was advanced 516 ft. in ore 18 in. wide, averaging $11 per ton, lately improving to 48 in., and $36 per ton. In Carmichael's section the shaft was sunk 255 ft., making a total of 4457 ft. on the incline. The lode still tends to dip steeper in depth, and sinking is being done at 76°, or twice as steep as some of the shafts first sunk on the field. Driving has been started on No. 44 level, where the lode is improving, it being 21 in. wide, worth $25 per ton. Northward, No. 41, 42, and 43 levels show much improvement, north drifts on the two latter levels having opened 280 and 146 ft. of ore, 24 and 27 in. wide, worth $24 an $27 per ton respectively. Ore reserves total 400,747 tons. Details of the past year's results are as follows:

Ore mined, tons	277,438
Sorted out, tons	56,828
Ore milled, tons	220,610
Stamps working	140
Gold recovered, ounces	101,173
Cyanide plant operation:	
Tailing treated, tons	167,213
Dried slime, tons	33,953
Old tailing and slime, tons	88,567
Gold recovered, ounces	29,210
Total value of gold recovered	$2,447,059
Expenditure, including London	1,385,217
Profit	912,964
Depreciation, written off shafts, etc.	176,539
Added to reserve	72,000
Total reserve fund	144,000
Cost of operation:	Per ton.
Mining	$2.80
Development	1.50
Milling	0.54
Treatment	0.56
Repairs	0.12
	$5.52
Total cost, including London expenses, etc.	$6.28

During September the new slime plant was started. The total production of the mine to date is approximately $48,000,000.

GAIKA GOLD MINING CO., LTD.

This company owns 229 claims in the Sebakwe district of Matabeleland, Rhodesia, and has an authorized capital of $1,440,000. Treatment commenced in Augnst 1905 with a 5-stamp mill, Chilean, and Huntington mill, and cyanide plant. During the year ended June 30, 1912, there was treated 34,243 tons of ore yielding $325,000. The profit was $120,000, out of which $66,000 was paid in a dividend of 5%, the remainder being carried forward. The mine is being developed with satisfactory results, and the reserves stand at 57,755 tons of ore averaging $15 per ton. The water-supply has been adequate for all requirements during the year, and improvements in equipment will effect considerable economy.

The following figures of German consumption of foreign copper for the months January to November 1912, are given by L. Vogelstein & Co.: Imports of copper were 191,993 tons; exports, 9050; and consumption, 182,943, as compared with consumption during the same period in 1911 of 168,096 tons. Of this quantity 166,307 tons was imported from the United States.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

CAMBRIAN BRACHIOPODA. By Charles D. Walcott. Part I, text, 872 pp., ill. Part II, plates, 373 pp., 104 plates. Monograph LI, U. S. Geol. Surv. Government Printing Office, Washington, D. C.

The two volumes of this scholarly monograph represent the work of a decade by the former Director of the United States Geological Survey, who is now secretary of the Smithsonian Institution. The description covers 477 species and 59 varieties of Cambrian brachiopods and 42 species and 1 variety of Ordovician brachiopods. The monograph consists of two volumes, one containing principally the text, the other containing figures of fossils. The text (part I) covers 872 pages and contains 76 text figures; the plates (part II) comprise half-tone views of more than 450 fossils, the entire work including illustrations showing 538 forms. The work includes tables of synonymy and statement showing the places and horizons at which the fossils were found. The author writes: "My main purpose has been to make the results of the investigation of value to the student of Cambrian faunas and to the stratigraphic geologist."

ESSENTIALS OF ELECTRICITY. By W. H. Timbie. 271 pp., ill. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price $1.25 net.

This little book is primarily intended for the use of students in electrical trades, and therefore contains only the more essential facts and principles, which are clearly and logically presented. The steps by which the transition is made from one concept to another have been so shortened and connected that the book will not only admirably serve the purpose for which it is intended, but may well serve as a text for the general reader. The universal use of electrical equipment, for domestic as well as industrial purposes, makes it desirable for everyone to have some understanding at least of the subject. Those who have attempted to 'read up' on the subject of applied electricity, only to become discouraged by its complexities will regard this little handbook as a treasure. The simple exposition given of gas-engine ignition will especially appeal to automobile users, while such topics as electric switches, signs, and annunciators are of general interest. Each chapter concludes with a brief summary of its important features.

MINERALOGY. AN INTRODUCTION TO THE THEORETICAL AND PRACTICAL STUDY OF MINERALS. By A. H. Phillips. 699 pp., ill. The MacMillan Co., New York, 1912. For sale by the *Mining and Scientific Press*. Price $3.75 net.

This is an excellent addition to the number of good mineralogies for students which are available. Methods of study have developed rapidly in the past two decades, and the good photographic illustrations, many of them of thin sections or polished specimens, indicate at once the excellence of this volume and the reasons which made the preparation desirable. If any criticism may be made, it is that a 700-page 'introduction' is apt to appal the beginner, who has no means of distinguishing between what is important and what is not, and too frequently obtains but little aid from his instructors. Mineralogy, on the other hand, is not circumscribed by political boundaries, and it would have been better to discuss the occurrence of minerals more from a cosmopolitan standpoint. Crystallography and determinative mineralogy are well covered. Part II, descriptive mineralogy, includes 225 species of the more important and common minerals and is introduced by three chapters covering the chemistry of minerals, their origin, and physical characteristics that will be especially useful in conveying a general grasp of the subject such as the student is commonly unable to obtain from the study of individual species.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

PHOSPHATE LEASE—CONSTRUCTION

A ten-year phosphate lease with $1 consideration, $5 per year rental, and 25c. per ton royalty on all phosphate mined, was held to imply that the lessees should commence work within a reasonable time and continue operations with reasonable diligence, or failing so to do, the lessor might declare the lease forfeit.

Killebrew *v.* Murray, (Kentucky) 151 Southwestern, 662.

COAL MINE—UNINTENTIONAL TRESPASS

The measure of damages for coal taken from another's land through an honest mistake is the value of the coal taken as it lay in the mine, or the usual reasonable royalty paid for the right of mining; the 'royalty' being the price paid for coal as it lies in the earth.

Burke Hollow Coal Co. *v.* Lawson, (Kentucky) 151 Southwestern, 657. (Dec. 20, 1912.)

PLACER LOCATIONS—DISCOVERY LACKING

Where placer locations have been made within a forest reserve with the apparent sole purpose of protecting a water right as a speculative venture, and the locators were ousted by other parties who, ignoring the pretended claims, obtained permission from the Government, and went ahead with surveys, improvements, and development in good faith, it appearing that no discovery had been made or assessment work done to support the placer location, the locators thereof were denied relief.

Spokane Portland Cement Co. *v.* Larson (Washington), 128 Pacific, 641. December 14, 1912.

MINING TRESPASS—HELD NOT COMMITTED

In an action for damages and an injunction, it was held that the findings of the trial court that plaintiff's quartz claim overlapped defendant's placer location, that plaintiff had made no discovery sufficient to support his location, and that most of the assessment work had been done on the placer claim, were supported by the evidence, and that on the basis of such findings, judgment was properly given for defendant.

Olaine *v.* McGraw, 45 California Decisions, 23. January 2, 1913.

DEPARTMENTAL GAS LEASE—ASSIGNMENT

A departmental oil and gas lease was executed by a citizen of the Cherokee nation to a lessee who thereafter assigned the same with the approval of the Secretary of the Interior, but without the consent of the lessor, to defendants, who immediately entered into possession, expended considerable money, and developed a gas well. The lessor was notified of the assignment and accepted rentals and royalties under the lease for several years. Held that her conduct estopped her from asserting any rights under a clause in the lease prohibiting assignment without lessor's consent.

Scott *v.* Signal Oil Co. (Oklahoma), 128 Pacific, 694. December 3, 1912.

MINING CONTRACT—FORFEITURE UPHELD

Where under a mining contract the purchaser was to have possession of the mine and pay 10% of the proceeds of clean-ups as royalty to apply on the purchase price, and defaulted in the payment of such royalties at the time they were due, the seller was entitled to rely on the terms of the contract and claim a forfeiture. The tender by the purchaser after he was in default of the amount of the royalties at the time the vendors demanded possession of the mine would not excuse the non-performance prior to that date, and the vendors need not accept the tender.

Champion Gold Mining Co. *v.* The Champion Mines (California), November 20, 1912. (Not yet reported.)

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

OIL should not be used on rawhide pinions, but the application of a little flake graphite is harmless to the teeth.

GOLD exported from North Island of New Zealand is subject to a duty of 54c. per oz., and that from the South Island, 6c. per oz. This is on gold produced.

CONCENTRATION of dissolved metals in slime-ponds has been noted at El Tigre, Sonora, Mexico, when sampling the face of a residue dam, the upper layers assaying 6.5 oz. of silver per ton, the usual tailing being only about 2 oz. per ton.

CONCENTRATE produced from the seven mills treating Tonopah ore amounts to about 300 tons per month, which will average over 500 oz. of silver per ton. Experiments have shown that fine grinding, fresh strong cyanide solution, and long agitation will extract a high percentage of bullion; but the consumption of cyanide is nearly ounce for ounce with the weight of silver, and solutions become very foul.

COAL now bought by the United States Government is purchased under the general technical supervision of the Bureau of Mines. The cost of purchases under specifications prepared by the bureau for the use of the government now aggregates over $5,000,000 per annum, and the additional fuel bought under the general advice of the bureau now totals in purchase cost some $3,000,000 per annum more, making the total value not less than $8,000,000.

MILL TAILING may be disposed of by impounding behind suitable dams, storing it in mine stopes, or sluicing it into a river, provided this method does not interfere with navigation or agricultural land. Many mills in California are situated in canyons or at places where suitable areas for the permanent storage of tailing are not obtainable, and the question of disposal is now one of importance, as farmers are demanding compensation from certain mines in Amador county.

LITHIUM belongs in the alkali group with sodium, potassium, rubidium, and caesium. It is a soft silver-colored metal, has a specific gravity equal to 0.5936, and atomic weight equal to 7. Its valence is one. It melts at 180°C. and vaporizes at about 1000°C. It very closely resembles sodium, potassium, rubidium, and caesium in its reactions. In the wet way it may be distinguished from K and ammonium salts in that it forms no precipitate with chloroplatinic acid (H_2PtCl_6), while, on the other hand, it forms an insoluble (Li_2CO_3) upon the addition of a carbonate, while potassium and ammonium salts do not.

MINERAL locations are to be made on mineral lands only, and the question arises, what is mineral land? Mineral land is land more valuable for its mineral contents than for any other purpose. The mere appearance of mineral is not sufficient to give the land a mineral classification, if there are not substantial and lucid reasons for believing that valuable mineral deposits may be eventually opened. Again, the absence of mineral indications will not give the land a non-mineral classification, if it is within an ore-bearing zone or in a continuation of known and proved ore-bearing formations. The extent of the mineralization required to sustain a mineral location varies with the conditions. In the case of a contest between two mineral claimants, very little evidence of mineralization may be required, whereas in a contest between an agricultural and a mineral claimant, the evidence must be more conclusive. In the latter case, while the comparative value of the land for agricultural or mining purposes determines the result, the principal and usually most weighty question is, would a prudent and experienced miner or prospector feel justified or willing to spend his labor or money in trying to develop a valuable mineral deposit on the land?

TUNGSTEN is used chiefly in making steels that will hold their temper when heated, but it is most generally known as supplying the filament of tungsten incandescent lamps. The great improvements in drawing tungsten wire, and further notable improvements in the size of the globe of the tungsten lamp, and in other mechanical details that add greatly to its efficiency, are making it encroach upon the carbon-filament lamp and the arc lamp, and it is rapidly driving from the market the tantalum lamp, which was the first good incandescent lamp having a metallic filament. Diamonds are used for dies in drawing tungsten wire. At first it did not seem possible to drill small enough holes through the diamonds to make wire sufficiently fine for lamps of small candle-power, but wire 0.0006 in. diam. can now be drawn in quantity. The total quantity of tungsten ore used for electric lights, however, amounts to only a few tons per year. New uses of tungsten, in making electric furnaces, electric contacts, and targets for Roentgen rays, have been developed, and the last two products are being actively manufactured.

SULPHURIC ACID plants at Ducktown, Tennessee, were constructed for the purpose of disposing of the objectionable fumes from the large smelters of the copper companies at that place. They use what was, until their establishment, not only wholly a waste product of the smelters, but also a menace to all the adjacent country. These acid plants have therefore produced at least three desirable results by furnishing a large supply of acid where it is most needed, by rendering valuable large supplies of sulphur hitherto worthless, and by relieving the region of the nuisance of the smelter fumes, thus making it possible to continue operating the mines and at the same time to cultivate the surrounding lands. The successful manufacture of fertilizer from rock phosphate depends in great measure on a cheap source of sulphuric acid. A plentiful and cheap supply of sulphuric acid means a cheaper and a more readily available supply of fertilizers. The greatest demand for sulphuric acid is in the fertilizer industry, the greatest supply of raw materials for this industry is found in the Southern states, and the greatest demand for fertilizers also exists in this same section. Few industries, therefore, are of more importance to the South than the manufacture of sulphuric acid.

ELECTRIC LIGHT and power plant of the Kalgoorlie municipality, population about 85,000, during the financial year ended October 31, 1912, generated 1,122,863 units, of which 827,328 units were sold, or 64%. For street lighting and other city purposes, 14% was used, while 22% was lost in accumulators, mains, and unaccounted for, the latter item being 2.6%. The use of metallic filament lamps has accounted for 69% in the decrease of current used for lighting, when compared with the previous year. There are 1906 consumers, of whom 1472 use light, 347, heat, and 87, power, the total horsepower of motors connected being 598 hp. Costs per unit are as follows:

	Cents.
Fuel, @ $3.24 per ton of wood	2.19
Water, @ $1.68 per 1000 gal	0.22
Oil	0.03
Repairs and upkeep	1.93
Sundries	0.15
Wages, generation	0.88
Wages, distribution	0.23
Management	0.65
Total cost per unit	6.28

The total revenue for the year was $88,000, and profit after paying interest on capital, new accumulator, and all expenses was $14,000. The station is equipped with two Parsons turbo-generators, aand several vertical high-speed engines, and a large accumulator plant.

Use of Explosives in Ore Mining

*In most mines it is desirable not to break the ore too fine on account of the loss in valuable material that would ensue. On the other hand, in most iron mines, and in some of the Michigan native copper mines, the only desire is to get the ore out as cheaply as possible, regardless of the expense. In the Cripple Creek district the gold is in the soft tellurides and soft sulphides. The veins and stringers are narrow and this makes it necessary to mine large quantities of waste rock. By breaking the material large most of the waste can be picked out by hand, leaving a small amount of rich fine material to be treated at a minimum cost. Therefore, in the Cripple Creek district, the comparatively slow-acting Repauno gelatin and Monobel No. 1 are used to advantage.

In the Lake Superior copper country, on the other hand, as it is impossible to shatter the native copper, most of the mines use the stronger grades of Giant and and Red Cross extra dynamites. The nitroglycerin dynamites were discarded because the fumes, combined with the heat of the lower levels, had a bad effect on the men. Some of the mines of that district have wide veins varying from 30 to 40 ft. in which the copper occurs in irregular shoots. In these the vein material is broken in large pieces by drilling flat holes, having medium burdens, in the stopes, and blasting them with Giant extra or Red Cross 30% extra dynamite, which have a slow heavy action. The miners can distinguish the rock containing copper by feeling with the hand. The coarse and fine are sent to the mill, while the waste remains in the stope for filling. Here also the value of a slow-acting explosive is apparent.

The mining of sulphide ores that require concentration before the valuable material is extracted constitutes another class of work where slow explosives with a strong heaving action is necessary. This applies in particular to sulphide copper ores and arsenical sulphides containing gold or other metals in paying quantities. With the sulphide lead ores this point is not of great importance, because fine lead ores are sintered in roasting. With the sulphide copper ores the greatest care should be taken not to have the mineral finer than is best for treatment.

In the soft hematite mines of the Lake Superior district a slow-acting explosive must be used in order to reduce the explosive costs to the lowest possible point. If an explosive, having a quick smashing action, is used in soft material, a large part of its strength is consumed in pulverizing and compressing the ore or rock immediately around the bore-hole. The underground temperatures in most of the Lake Superior iron mines are low enough to freeze ordinary nitroglycerin explosives at any time of the year. Therefore, Red Cross low freezing extra dynamite, from 20 to 40% strength, is the most used explosive.

Where the ore or rock to be blasted occurs in alternate layers of hard and soft material, a quick-acting explosive must be used. If dynamite having a slow heaving action is used under these circumstances, its strength will be largely wasted by blowing out through the soft streaks. In the selection of an explosive for underground work, the class of labor employed must not be overlooked.

For general all-round use in underground work the 'extra' grades of dynamite will be found to be the most desirable. Their fumes after blasting are not obnoxious. The cases contain the largest number of cartridges consistent with good packing, and they are the safest high explosive as regards handling. It is practically impossible to ignite the extra grades of dynamite by the side spit of cheap, damaged, or defective fuse.

Careful experiments and observations over a period of years have shown that better results can be obtained by the use of strong than weak blasting caps and electric fuses. The stronger and sharper the initial shock that explodes the dynamite, the more complete will be the detonation. This means both more work and better fumes. While the leading manufacturers of explosives recommend the use of nothing weaker than a No. 6 detonator, a large number of mining companies and tunnel contractors, after careful experiments, now use nothing weaker than No. 8 blasting caps and electric fuses which are twice as strong as the No. 6 detonators.

It is also of the very greatest importance to tamp all charges solid to the collar of the hole. Tests made at the United States Bureau of Mines testing station at Pittsburg showed that with the quickest dynamite there was 30% more force available in a tamped hole than in one where no stemming was used. Also, the analyses of gases after explosion show a material reduction in bad fumes when holes are tamped.

*Published by courtesy of the E. I. du Pont de Nemours Powder Company.

How Long Will a Motor Truck Last?

By R. W. Hutchinson, Jr.

One of the most interesting examples which shows more conclusively than mere claims the long life of a motor truck may be found in Washington, D. C. There is in that city in daily service of the Metropolitan Coach Co. a Mack motor bus that in a three-year period (from July 4, 1909, to December 20, 1912) had attained a mileage of 142,728. In other words, the machine has made an average of more than 47,000 miles per year, better than 128 miles per day. When it is remembered that a three-ton motor truck in constant service averages about 40 miles per day, or 12,000 miles per year, it will be obvious that in attaining a mileage of 142,728 that this Mack bus has seen the equivalent of about 12 years of actual service in less than 3½ years of operation. That the 140,000 odd mileage of this Mack bus has not in any way affected its serviceability is proved by the statement of the manager of the Metropolitan Coach Co., S. D. Lincoln, that "our old reliable Mack is running just as if it might be good for 140,000 miles more." The only visible damage to the mechine is a rather battered appearance of the front wheel fenders. The bus is operating on an average of 19 hours per day, seven days in the week, which is certainly a rigorous test of the engine and the vital parts of the chassis.

Another interesting record comes from Wilkesbarre, Pennsylvania. In that city are three motor buses which have run from 98,000 to 175,000 miles. On June 27, 1908, a Mack enclosed bus was put in operation in Wilkesbarre. This bus ran continually until February 16, 1911. The body was destroyed by fire in the garage on that day and to all appearances the bus was useless for further service. The owner, C. M. Loveland, sold the bus to R. B. MacCallum, who decided to rebuild it. He placed it on the same route where it is in operation today. This bus, up to November 15, 1912, had made more than 175,000 miles, making 18 round trips over a 5¼-mile route, a total of over 110 miles per day. Motor-bus service is certainly one of the severest uses to which a motor truck can be put, as the machine must run on schedule time in order that patronage may be gained for its owner, and it is usually a service in which the truck is operating from 16 to 20 hours per day, allowing but little time for a machine to be overhauled and for the engine to cool. The Mack bus with a record of 175,000 miles is stated by the owner to have been out of commission but two weeks during 1912, and only then for overhauling.

Another example of the lasting qualities and reliability of a motor truck is that of a Saurer truck built in 1900 by Adolph Arbon, Switzerland. The International Motor Co., American builders of the Saurer truck, claim that this 12-year-old Saurer is in hard service today delivering embroidery machinery between Arbon, the centre of Mr. Saurer's large embroidery industry, and St. Gall and St. Bernice, large embroidery manufacturing centres. The photograph of this Swiss Saurer truck shows that the Saurer machines built in this earlier day differed but little from the lines of the machines constructed today. This particular truck has been operating in the neighborhood of 225,000 miles, and with the exception of annual overhauling it is as it was originally built nearly thirteen years ago.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

WORLD-WIDE regret is awakened by the loss of the explorers who sought the South Pole.

AUTOMOBILE passenger service has been started between Blagovesehenk and Tsitsihar in northern Manchuria. Apparently the East is learning to hustle itself.

ANOTHER of our contemporaries has adopted the two-column page and ten-point type. We congratulate the *Mining and Engineering World* on the greatly improved appearance of its pages.

POSSIBLE impending tariff changes give interest to the observation that although this is a high-tariff country, enormous quantities of merehandise are brought in duty free, the total last year being valued at practically a billion dollars. Chief among these commodities are coffee, hides and skins, rubber, raw silk, tin, copper, tea, and a great variety of food products and raw materials of industry which cannot be produced at home. It is interesting to note that works of art, on which the import duty was recently removed, valued at $60,000,000, were imported last year.

SALE of a Stock Exchange seat in New York for $48,000, just one-half the price reached in 1909, fills Wall Street with gloom, and there are many guesses as to whether the lean years are to continue indefinitely. No one can fail to have noticed the large increase in business on the part of stock and bond houses dealing directly with the people, which has marked recent history. It seems to have been found more expensive "to make a market" than to peddle stock direct. There are advantages, as there are also dangers to the public, in either method of marketing securities. It is impossible to say which lends itself more easily to abuse, and it is the abuse, rather than the system itself, that destroys public confidence.

MOSQUITOES have come to occupy a place in the calculations of engineers out of all proportion to their size, and around the mosquito as a medium for the transmission of disease has grown up a whole new body of sanitary science. As engineering is but the application of science to the accomplishment of useful work, the engineer must always keep in close touch with advances made in scientific research, and none have valued more highly the work of physicians in combating contagious diseases than have the engineers. It is a long road from the crude empiricism of the South American Indians who considered mosquitoes to be evil spirits which have climbed up from

the swamps along the rainbow that they might annoy and injure mankind, to such a knowledge of the insect as is reflected in Dr. H. G. F. Spurrell's scholarly article, of which we print the first part this week. It is rare that a physician has the gift of making technical matters clear to laymen, and Dr. Spurrell's ability in that direction is evident. Mining engineers, who must travel to the far places of the earth and accomplish results against many difficulties, will, we are sure, be especially grateful for this article.

RAILWAY transportation is of first importance if Alaska is to be developed. If the latter is worth doing, the problem of railway building must be squarely faced. The Alaska Railway Commission reports that under private ownership it will be necessary to charge 7 cents per mile for passengers and 8 cents per ton-mile for freight. It also reports that these rates are at least 2 cents higher than the maximum under which traffic can be expected to move freely. Government aid in some form is inevitable unless the interior of the country is to be abandoned. It becomes distinctly a question of what is most worth while. The commission is unanimous in recommending construction of 733 miles of road, to cost $35,000,000, one line serving to connect Fairbanks, Cordova, and the Bering River coalfields, and the other Seward, the Kuskokwim, and the Matanuska fields. The amount asked is a small sum to pay for even the potential development of so large a territory. It is to be remembered that every Western state was developed by railroads built by government aid. If, as the public seems to have decided, the old basis of government aid was bad, a new one should be found. No reason exists for discriminating against Alaska, and we believe that the people of the United States, when they understand the situation, will not hesitate in choosing between building a government road or abandoning the territory.

ALIEN ownership of land is limited in a number of states. This is especially true in the Middle West where there was once great fear of the establishment of a big estate system with absentee English landlords. According to United States mining laws an alien may not patent a mineral claim, though there are no restrictions on purchase of claims located or patented by others. In British Guiana it has recently been proposed to prohibit ownership of mining claims even by companies having foreign shareholders, unless the latter be in minority, and in California it has been proposed to exclude foreign corporations from any land ownership. At one time the Japanese, to bring pressure upon the foreign governments for revision of the treaties granting extra-territorial rights to the latter, refused to allow any alien to own land. When the treaties were revised this obnoxious rule was rescinded. Now foreigners are allowed to purchase lands, but foreign mining companies must operate through local companies organized under Japanese laws and having a majority of local directors. This provision is similar to the Texas law regarding railroads which, in order to assure supremacy of the state in rate regulation, requires operation of all railways by local companies. It is a sound principle that each political entity should retain the right to control industry within its territory, but any state that in order to do this shuts out foreign capital must prepare itself at once for reprisals and for slow development. It is a matter of policy, not of right.

Progress in Chemical Research

Research in the profounder depths of chemical science is constantly bringing forth results which render the world of industry its debtor. The field of work is so wide, however, that the beneficiary does not always know of what is being done in his interest, and it is desirable, therefore, to summarize at frequent intervals the results which have been attained. Such a summary of recent work in inorganic chemistry has been so admirably made by Mr. James L. Howe, professor of chemistry in Washington and Lee University, that we reproduce below, largely in his own words, those matters of greatest interest to the geologist and chemist. Data of geochemistry are difficult to obtain, and the study of the metamorphosis of minerals has been largely theoretical, more especially as to the effect of high pressures. An experimental study of their possible effects has been made by Spezia, in Turin, who found that by using pressures of 6000 to 9500 atmospheres, corresponding to depths of 12 to 20 miles, and in some cases continuing the pressure for several months, no instance of chemical action could be found. No action took place between silica and calcite, indicating no silicification. Alabaster, alum, and limonite, embedded in pulverized quartz for eight months at a uniform pressure of 8000 atmospheres, showed no loss of water. The great difference between the action of heat and of pressure was shown by the fact that goethite, heated in water to 330 degrees for seven days, became anhydrous, while it remained unchanged under 9500 atmospheres pressure continued for twenty-six days. To test reduction, copper oxide was kept in contact with magnesium and then with potassium for months at 9500 atmospheres pressure without change, although the sum of molecular volumes would have been decreased by a reaction; nor was calcite changed to aragonite. Bismuth was not liquefied by a pressure of 9000 atmospheres. Spezia also calls attention to the great difference in the effects of one-sided pressure and those of pressure uniform on all sides; the latter alone cannot liquefy metals or plastic substances.

Bergius, in working on reactions under pressure, found that when peat is heated in water to 250 or 350° it is charred, and from the velocity of the reactions he considers it possible to calculate the time necessary for the formation of bituminous coal in nature. His calculations place the time at seven to eight million years, which he considers agrees with geological estimates. In connection with theories as to the genesis of the diamond, it is interesting to note that Bolton has found that hydrocarbons are reduced by alkali amalgams to carbon, a part of which appears to be in the form of diamonds. Utilizing the fact that crystallizing substances have

a strong tendency to be deposited on crystals of the same substance if present, von Bolton led moist illuminating gas for four weeks through 14 per cent sodium amalgam in a tube coated with a very fine suspension of diamond powder in waterglass. The whole was kept at 100°. Under the microscope the powder was apparently amorphous, but after the experiment minute crystals were clearly visible. These showed the properties of diamonds, and while the amount did not suffice for quantitative analysis, it seems extremely probable that diamonds are thus formed by the reduction of hydrocarbons. If this be true, their occurrence in certain basic igneous rocks may be capable of a more simple explanation than has commonly been supposed.

The question as to what is the first reaction that takes place when carbon burns in oxygen has long been a subject of controversy and is of importance to metallurgists. The commonly accepted view that the initial combustion is to CO_2, which in the presence of incandescent carbon is reduced to CO, rests experimentally chiefly on the work of Lang, who found that in a slow oxygen stream carbon was oxidized at 500° almost exclusively to CO_2, while no CO_2 was reduced to CO at this temperature. The formation of some CO in a more rapid gas current Lang attributed to local heating, which did not occur in the slow current. The conclusions drawn from these and other experiments by Lang were called in question by Dixon, and his experiments and those of Baker on explosion rates seemed to show that at least in the case of gaseous carbon the formation of CO precedes that of CO_2. C. J. Baker also showed that while moist oxygen absorbed by carbon at −12° was given up as CO_2 when the carbon was heated to 100°, dry oxygen (by P_2O_5) absorbed by dry carbon at +12° was not given up till 450° and then mainly as CO, it appearing thus that CO is the first product of oxidation. Rhead and Wheeler have more recently approached the subject experimentally from the standpoint of determining the velocity of the reactions (*a*) $C + O_2 = CO_2$; (*b*) $CO_2 + C = 2CO$; (*c*) $2C + O_2 = 2CO$; and (*d*) $2CO + O_2 = 2CO_2$, at different temperatures. If it could be shown that either reaction (*a*) or reaction (*c*) proceeded at a temperature at which, under the same experimental conditions, the rates of reactions (*b*) and (*d*) were inappreciable, the problem would be solved. It was, however, not found possible to obtain a temperature at which the velocity of carbon oxidation was appreciable, where there was conclusive evidence of the primary formation of either oxide to the exclusion of the other. Some CO is produced by the oxidation of carbon at low temperatures under conditions which do not admit of its being formed by the reduction of CO_2, but on the other hand CO_2 is undoubtedly produced at low temperatures in quantity which cannot be altogether accounted for by the supposition that CO is first formed and then oxidized to CO_2. The conclusion is therefore drawn that when carbon is burned at low temperatures CO_2 and CO are produced simultaneously; one quite in accord with practically all previous experimental evidence.

Studies of the rare metals have been especially fruitful, and the production of ductile tungsten, for example, has been of immediate practical utility. Ruff and Martin have similarly endeavored to obtain purer vanadium than is now available, but without complete success, as the metal dissolves VO as well as the aluminum and carbon by which the V_2O_3 is reduced. Brunck has suggested the substitution of tantalum for platinum for a variety of purposes, since it is lighter, firmer, and cheaper, and almost equally resistant. Ductile tungsten has been suggested for similar purposes and seems to offer a good deal of promise. The volatility of the metals of the platinum group, when subjected to high temperatures, is not generally realized. Crookes has found that platinum loses ¼ per cent of its weight by heating to 1300° for 30 hours, while iridium loses 7.3 per cent when subjected to the same temperature for 22 hours. Ruthenium loses 25 per cent of its weight in 8 hours, while rhodium, the least volatile of all the group, only loses 0.13 per cent when heated to 1300° for 30 hours. An enormous amount of work has been done, of which the significance is not immediately evident, but the data of today are the basis of the practice of tomorrow, and the industrial operator is under a heavy burden of obligation to the scientist who with patient exactitude determines the principles and data which serve as guides to practice.

War in Mexico and Elsewhere

Mexican conditions continue too disturbed for safe prediction as to results. Ultimately the country will settle down to peaceful industry, but how soon was never less certain. The smelter at Chihuahua has closed because of the impossibility of obtaining a regular fuel supply, and mines that have maintained themselves in operation or which resumed within a year, are giving up the struggle. The dramatic outbreak of the past week in the City of Mexico would seem likely to force matters to a conclusion, but may fail to do so. It is to be remembered that there is a large Indian population, and except in the possession of better fire-arms the Zapatistas seem to differ little from the Apaches and Comanches who long disturbed our own Southwest. Raiding villages for cattle and women is primitive savagery, not civilized warfare, and a much smaller number of Indians kept our own army busy for years. Major military operations in Mexico are hardly likely to drag on even as long as did our own civil war, but pacification of the backward states will probably take years. It is to be remembered that despite the manly attitude of the ex-Confederates who went home to plant and rebuild, political conditions throughout our own South were anything but peaceful through a long reconstruction period. In the museum at New Orleans the visitor sees relics of the war in the streets waged between the police and those who captured and overturned the regular government years after the war had ended. Looking back on our own period of trouble, we smile. Dangerous and disastrous to our interests as is the present war in Mexico, patience and hopeful sympathy is distinctly our part.

Gold Placers in Central China

By E. C. Thurston

Gold is produced in many parts of China. Pumpelly listed 64 *hsien* in 14 provinces in which, according to Chinese books, gold is found, and doubtless this number could be increased materially. Perhaps the best known placer area in China proper is on the Yangtse above Su-choufu in Ssu-chuan. In this part of its course the Yangtse is called the Kin-sha-kiang or gold sand river. The earnings of the gold-diggers there are probably larger than elsewhere, but in general, the occupation is not lucrative. These notes relate to a few placers in the provinces of Hupeh and Hunan visited in November and December 1903.

PUMPING OUT A PROSPECT HOLE.

RAISING WATER FOR WASHING GRAVEL.

Hupeh

Hupeh province is in central China, lying mostly north of the Yangtse river. The Han river enters Hupeh from the northwest and flows east, then south, then east to Hankow, where it empties into the Yangtse. At various places along the Han from Yung-yang-fu to below I-cheng-hsien the natives wash the river gravel and sand for gold, notably, at low water, above and below I-cheng-hsien.

Just below Ming-chin-tien, and not far above I-cheng-hsien, over a hundred men were working a bar in the bed of the Han where that river is about two miles wide. They said they worked the whole year, moving to higher and probably poorer ground during high water, and working the lower sand-bars as these emerged far enough for digging. There are no hills for many miles up stream in which it is likely the gold originated, the nearest on the Han being the conglomerate hills between Lao-ho-kou and Hsiang-yang-fu. In such a wide shallow river, turning its sand over and over again and each time moving it farther down stream, it is probable that the gold came from long distances up the Han or its tributaries.

There was nothing apparent at this particular placer to distinguish it from many other sand-bars. The pebbles were principally quartz, slate, and schist. The largest pebbles seen had a maximum dimension of about 5 in. The men worked in gangs, each under a foreman, who was generally the temporary owner of the ground. The number of men in these gangs varied, but averaged about seven. The ground was divided between the gangs to their seeming satisfaction, but by what method I did not discover. They said they paid no royalty or taxes. A certain area was marked off by the foreman, and this area was worked to a depth varying with the conditions, but averaging about 6 in. and seldom exceeding a foot. There was said to be no gold at greater depth, and this was probably true as regards profitable operation. No wages were paid, but all shared in the profit, the foreman getting a larger proportion than his men.

The washing is done over a riffled contrivance consisting of two round wooden rods converging at the bottom and held together by cross-pieces at top and bottom. A flat wooden board is held in grooves in the side rods: this board is about a half-inch thick, with smooth surface near the top, 4 ft. wide at the top of the riffles and 3 ft. wide at the bottom of the riffles. The upper end of the contrivance rests on a wooden horse. The riffles are horizontal, and extend for about 4 ft. down the length of the board, about 3 riffles per inch. These dimensions vary. The illustration gives a rough idea of the contrivance.

At this place the gravel is washed as it came, not

RIFFLE-BOARD AT MING-CHIN-TIEN.

WASHING BLACK SAND, WU-TSA-TSO.

a selected layer only, as noted below. It is excavated with native iron hoes, and shoveled into a shallow circular wicker-basket with a slightly raised conical centre. The basket is placed at the head of the inclined riffle-board and supported beneath by a stick or shovel-handle. The central cone serves to distribute the gravel evenly. The riffle-worker pours water on the gravel, two or three circular twists are imparted to the basket by means of a short wooden handle fastened to it, during which the sand washes through the meshes, and one skillful turn finally tosses the coarse barren pebbles upon a pile at one side, and the basket is ready for a new load.

, The sand from the basket is washed over the riffles to the ground, leaving in the riffles the black sand containing the gold. This operation is repeated until the riffles are full, when the riffle-board is turned on edge and the black sand washed down sideways into a shallow wooden scoop 14 by 18 in. The black sand is then either panned out on the spot in a hemispherical wooden dipper about 6 in. diam., with a short handle, or taken home, washed, and rubbed by hand with mercury. The amalgam thus obtained is heated on charcoal or in an oven to drive off the mercury.

Most of the gold is fine and flaky, rarely some little nuggets the size of small peas are found. The operation of washing, though crude, is fairly efficient, and the men are very skillful at their work. Some of the tailing below a riffle-board was panned out, and, though considerable black sand was found, no gold was detected.

The daily earning per man was said to vary from 60 to 200 cash (4 to 12c.), rising exceptionally to $2. Allowing two extra shares to the foreman, the daily earnings per gang varied from 540 to 1800 cash or 34c. to $1.12. The area worked per gang per day was variously given as 175 to 275 sq. yd., which, at 6 in. average depth, gives a mean of 37 cu. yd. per gang.

The gold won is sold to buyers in Fan-ching (opposite Hsiang-yang-fu) at the rate, I was told, of 4000 cash per mace. At 16 cash per cent and 2.43 dwt. per mace this price equals $1.03 per dwt., which is obviously too high. More likely the price received was 3000 cash per mace, as at Wu-tsa-tso below I-cheng-hsien, or 79.2c. per dwt., which, if the gold was over 950 fine, gave the buyer a handsome profit. Assuming the value of the gold was 20% more than the miners received, the daily earnings per gang varied from 40c. to $1.36, and the yield of the gravel was from 1 to 4c. per cubic yard, with occasional richer patches.

While traveling up the Han river in March 1870, Baron F. F. von Richthofen visited and made notes upon a gold placer not far above I-cheng-hsien and opposite Li-kin-tien (which means 'gold digger's inn'). It was the season of low water, and the physical conditions he reported were almost identical,

WASHING CLAY FROM GRAVEL.

PANNING OUT GOLD.

except as to quantity of gravel worked daily per gang, which must vary materially, with those I noted at Ming-chin-tien; a few isolated gravel flats amid banks of sand were scraped to a depth of about six inches and washed over riffle-boards. The gold diggers at that time were said to earn 50 to 150 cash per day, 7 men averaging 15 cu. yd. per day, containing about 2½c. per cubic yard.

Von Richthofen was a keen observer, and his deductions were proved correct as often as I had opportunity to check them. Of this placer he writes:[1] "Every year the gold is exhausted by man and its supply renewed by the river; and, if it were at all possible to introduce here contrivances for working a large quantity of gravel in a short time (which is not the case),[2] cupidity would at once destroy the conditions for the yearly yield of gold. The gravel banks act on the same principle as the riffle of the Chinese, concentrating on their uneven surfaces the gold from its immensely fine and scanty distribution in the river sand, of which probably millions of tons are yearly carried over these places in the season of high water. When this subsides, the Chinese comes to reap his regular and unfailing crop." I did not visit Li-kin-tien, as it was uncertain whether work had commenced when I passed.

At Wu-tsa-tso, below I-cheng-hsien, on the Han, an inspection of the work was made by one of our party. Instead of washing the sand as it came (there were very few pebbles) it was carefully removed from a layer of black sand lying from 1 to 18 in. below the surface. This layer of black sand averaged about ¼ in. thick, though slightly more sand was washed to avoid loss. The gold was finer here than at Ming-chin-tien. One particular gang was watched and the record of their operations for one day was as follows: 1820 sq. ft. was worked, 84 cu. yd. of sand was handled, and 2.2 cu. yd. of black sand was collected and washed; 1.154 dwt. gold was obtained, which, at 92c. per dwt. (a little over 900 fine) amounted to $1.06 worth. The yield was therefore 48c. per cubic yard of black sand washed, or $1.26c. per cubic yard of sand handled (neglecting any gold in the material not washed). The method of washing was similar to that practised at Ming-chin-tien.

Hunan

In Hunan province a series of bench-gravels have been desultorily worked for centuries. Most of these gravels have been covered by later deposits of soil, those on the lower valley of the Hsiang river and Tung-ting lake being submerged at the season of high water in the Yangtse, while others bordering the smaller streams above the flood-level can be worked all the year.

Near the custom house on the river at Chung-ling-kee, about 7 miles north of Yo-chow, there is a horizontal quartz-gravel bed from a few inches to 2 ft. thick overlain by about 15 ft. of sandy red soil. This bed is only exposed at low water. A few short adits were driven into the bank, but more attention is usually paid to the beach-gravel, just below the outcrop and washed out from it during high water, which was naturally a little richer as the result of a later concentration. This deposit is probably poor, even for China, for though the water was low enough to permit work at the time of my visit in December, none was being done.

About 30 miles south of Yo-chow and 2 or 3 miles north of Kwei-yi and of the Mi-shui river there is a bench-gravel deposit under a low rolling plateau bordering a wide valley. The pebbles in the gravel are white quartz, and the overburden consists of 10 to 20 ft. of sandy soil. The workings extend for, perhaps, 3 miles along and east of the high road. Thousands of old shafts were seen, often not over 20 ft. apart, through which the gravel was brought to the surface and washed for gold. These workings were abandoned, I was told, during the Ming dynasty, several centuries ago, and were probably exhausted, for they are neglected by the present-day placer-miners who constantly pass over the ground. Probably the deposit never was rich, for the valley is wide here, and the Chinese miner has always been satisfied with scant returns.

Another small patch of ground close to the Mi-shui river and just east of the Kwei-yi had been worked and abandoned. The gravel bed here is 6 in. to 2 ft. thick, covered by about 12 ft. of soil. From this place up-stream to the town of Ping-kiang-hsien the river flows in a narrow channel between high hills, and above Ping-kiang to Chang-sur-kai very little placer mining was done.

Between Chang-sur-kai and Kin-tong the valley is from ½ to 2½ miles wide and the benches above the river are under cultivation, mostly as rice-fields. Under these fields at a depth of 12 to 18 ft. there is a gravel bed from 6 to 18 in. thick and extending about a quarter of a mile longitudinally, as indicated by the workings. The overburden is probably barren. Prospecting by trial pits is conducted until a piece of ground rich enough to warrant operation is found. Vertical pits are then sunk to the gravel bed, and drift mining on a small scale is practised. The pits are usually oblong, about 2½ by 1½ ft. in section. The gravel, from small drifts, is carried to the surface and washed in the Chinese wooden batea. Water is lifted from the river by foot-pumps to a tank where the washing is done. As the pits occupy but little space on the surface and are filled when exhausted, the land is not harmed for farming. Sometimes up to a thousand men are said to work the placers near Chang-sur, but I saw only a few hundred. The miners occupy themselves in farming and other pursuits during part of the year, and seem only to resort to mining when more lucrative work fails, though a few said they worked here the whole year.

Most of this ground is topographically suited to dredging, but the gravel bed is too thin and the grade too poor to permit profitable operation, aside from the difficulties that would probably be encountered in acquiring the necessary land.

Conclusion

From the examples of placer mining described, it will be seen that the Chinese are keen prospectors.

[1] F. F. von Richthofen, 'Letters to the Shanghai Chamber of Commerce, 1870-1872,' p. 24.

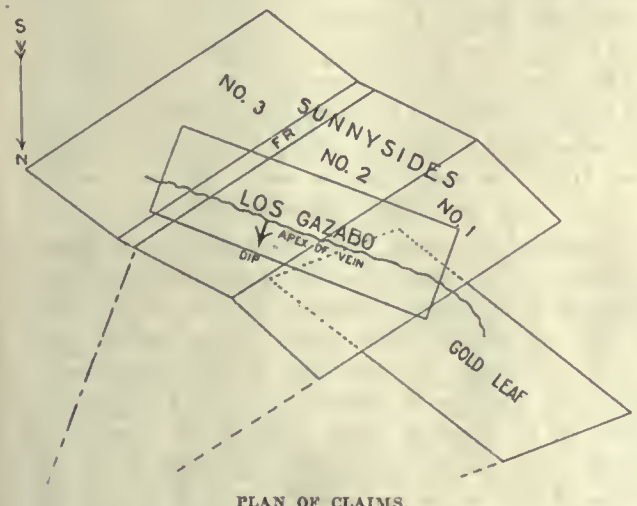
[2] Dredges were not then in use.

industrious workers, and are satisfied to earn a pittanee. Gold is widely distributed throughout China, but probably in no readily accessible district in sufficient quantity and sufficiently concentrated to warrant foreign exploitation. The evidence seen during the trip in 1903 led to a eonclusion preeisely similar to that of von Richthofen, who traveled extensively through China and whose opinion reported to the Shanghai Chamber of Commerce in 1872 may be quoted in eonclusion:

"From my own experience on the subject I have arrived at the conviction that the great number of places in which gold is washed from river-sand in China at the present day, far from furnishing a proof of the wealth of the country, is, on the contrary, clear evidence of the superabundance of human labor, the general prevalenee of relatively low wages, and the poverty, individually, of those engaged in the search for gold. The gold washers of today, with probably very few local exceptions, earn less than the lowest wages which they can get for ordinary labor, and take to that occupation in those seasons only when there is the least demand for field-work. We ean, therefore, safely conclude (with those few exceptions) that the greater the yield in gold, the greater will be the poverty of any one provinee. The sum total is, in some over-populated districts, not inconsiderable, and has quite misled the judgment of those who have even witnessed the miserable conditions of the gold diggers. The number of places in which gold occurs in the various hilly countries of Europe is probably greater, on an average, than an equal area of China: But no notiee is taken of them, because nobody could be induced there to wash gold for so little return as is generally obtained in China."

The Round Mountain Case

The Supreme Court of Nevada, on January 4, filed its decision in the case of Round Mountain Mining Co. *v.* Round Mountain Sphinx Mining Co. *et al.* The case is rather a novel one, presenting the peculiar situation resulting from a single location on the one hand and a group of locations on the other, covering the same segment of vein apex, and illustrating the attempt of the owner of these conflicting locations to change the direction of the extralateral sweep flowing from this segment of vein apex by attempting to shift the previously asserted priority as between the two sets of conflicting claims.



PLAN OF CLAIMS.

The plaintiff had obtained a patent to the Los Gazabo and Sunnyside groups of claims. The Sunnyside locations conflicted in surface area with the Los Gazabo, the conflict appearing on the face of the group patent.

Defendants owned the Gold Leaf and Black Hawk claims, adjoining the Sunnyside group. The conflict arose over extralateral rights claimed by the Los Gazabo owners extending beneath the Gold Leaf and Black Hawk. If the end-lines of the Los Gazabo were to be taken as the boundaries of the extralateral plane, then the orebodies beneath the Gold Leaf and Black Hawk would be included therein. If, however, the Sunnyside claims, which lay across the Los Gazabo, were taken as the basis for the extralateral right, it would be bounded by the side-end lines of the Sunnyside group and no conflict with the Gold Leaf or Black Hawk would exist.

The Sunnyside and Los Gazabo owners, in other words, had proceeded to patent their claims so that the extralateral sweep of these claims flowing from the same segment of vein apex might be taken in either of two directions, and, as development proceeded, elected to use the Los Gazabo lines as giving the most valuable extralateral sweep on the dip of the vein. No adverse claims were filed prior to patent, and the group patent issued, showing the Sunnyside and Los Gazabo lying across each other, and the patent itself gave no light as to which claims took the conflict area. Plaintiff's contention was this was an attack on the patent which was not possible in a collateral proceeding.

The defendants, however, claimed, and their contention was sustained by the court, that inasmuch as a conflict in area was shown on the face of the patent, it was open to construction as to which one of the claims was entitled to the conflict area, because the Government cannot convey the same piece of land twice, even though it is twice described in the same patent. That it was therefore competent for the defendants to go back of the patent and determine which of the locations on which the patent was based was prior in date. That having found as a matter of fact that the Sunnyside locations were prior in date to the Los Gazabo, the Los Gazabo location was invalid as to the conflict, and hence the Sunnyside claims took this conflict area under the patent. That defendants were not estopped by their failure to adverse as to surface area because extralateral rights are not the subject of adverse claims.

The court held in substance:

"It cannot, of course, question the validity of the surface conveyed, but as the patent contains grants of distinct mining claims described by metes and bounds in conflict with each other, and controlling extralateral rights in different directions, it can insist on a determination of which particular claims the apex of the ledge belongs to, as controlling the extralateral rights."

The Habits of Mosquitoes

By H. G. F. Spurrell

*The mosquito, which was formerly regarded as a nuisance, is now considered a danger, and science devotes to its mode of life a close attention very like that with which Scotland Yard honors certain notorious and slippery criminals. The public usually receives the benefit of this careful study in the form of dogmatic assertions, that this or that must be done, or not done, for fear of something terrible happening. These injunctions, based on ascertained knowledge of the part played by insects in the transmission of disease, would probably be received with more respect, and therefore more often obeyed, if intelligible reasons for them were given at the same time. It is the hope of making these reasons plainer which has influenced me to attempt a brief review of the habits of mosquitoes.

Kinds of Mosquitoes

Upward of a thousand different species of mosquitoes are already known, and there are undoubtedly many as yet undescribed, so it will at once be seen that a composite picture of the mosquito with an account of its habits is an impossible task, and moreover, one that would not be worth achieving. It would be of no more value than a composite picture of the snake, combining all that is known of tree-snakes, burrowing snakes, water-snakes, viperine, elapine, and constricting snakes, to mention only a few of the types. Such a generalized portrait might be hailed as an inspiration by amateurs of heraldry, but it would be out of place in a natural history. The differences among mosquito types are just as great, and an attempt to generalize would be just as useless as in the case of snakes. Mosquitoes have, moreover, this also in common with snakes, that the harmless species are vastly more numerous than those which are capable of inflicting injury upon man, yet only an expert can distinguish dangerous and innocuous snakes and mosquitoes. Often even the expert can only make sure by elaborate methods: dissection in the one case and use of the compound microscope in the other. When, however, we remember that only well defined kinds of mosquitoes carry disease, and that of these, again, different kinds carry widely different diseases, we may reasonably infer that in localities where these diseases are prevalent the peculiar mosquito will be abundant. I think the habits of these few better known species, which frequent situations where they have easy access to human beings, may have enough in common to be generalized with profit. Not all these species are harmful, but it is safest to assume, according to the principles of French criminal procedure, that every mosquito is dangerous until its innocence has been established, a rule that may well be applied to snakes also.

One cannot go far wrong in saying of the mosquito that it is a feeble creature, and its habits are largely explained by its feebleness. The adult insect being weak on the wing, is an easy prey to its enemies and helpless in winds, hence it has a way of lurking in sheltered corners, and the range of its wanderings is narrow. During its larval existence, it cannot face competition in the water, hence its breeding places are often temporary puddles, too small to harbor fish or to serve as nurseries for larvae of the larger predaceous insects, like the dragon-fly.

Where Eggs are Laid

When the female mosquito is ready to deposit her eggs, she chooses a pool where the water is sheltered from the wind, and its unruffled surface is more preferred if screened from the light also. Mosquito larvae are sometimes found in streams, but when this happens the eggs have usually been laid in a stagnant backwater and among the stalks of grass on the margin. Many species of mosquitoes are to an astonishing extent independent of the quantity of water available. A collection of water not much more than a tablespoonful perhaps, caught in the hollow of a large leaf, or a hole of a tree, will sometimes be found to be swarming with mosquito larvae, and I have known a house infested with mosquitoes which I eventually traced to a lively inch of water in an old cocoa tin under the veranda.

The eggs are always deposited on the surface of the water, sometimes in 'rafts,' sometimes in clumps, and sometimes singly, according to species. At first they float. In some species each egg has air-cells to buoy it up and some eggs will not hatch if they are splashed or sunk, even if carefully dried and refloated. The eggs of other mosquitoes, notably the stegomyia, which transmits yellow fever, often, though not always, sink some hours before they hatch. Not only are the eggs of this genus uninjured by prolonged immersion and consequently liable to be washed down gutters or carried by pumps into places where the appearance of the larvae at first seems inexplicable, but they will also survive the drying up of the puddle in which they were laid, and, after long dessication, hatch when the next rains come. No generalization is possible either about the quality of the water. Some mosquitoes will flourish in a cesspool; others more fastidious prefer drinking-water cisterns and filters. At New Orleans, I have known mosquitoes to breed in distilled water when it had been left uncovered for a few days. In fact, one can only say that, wherever there is water with a calm and sheltered surface, a mosquito may be expected to deposit her eggs.

The egg usually hatches in about two days, though this depends mainly on temperature, for if kept cool enough, hatching may be delayed also indefinitely. The appearance of the larva which issues from it is only too familiar, for though at first it is very small, it unfortunately is allowed, in the majority

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of cases, to grow till its structure can easily be made out with the naked eye. It feeds voraciously upon both vegetable and animal matter, its diet ranging from microscopic water plants to weaker individuals of its own kind; and the amount which it gets to eat, provided the conditions of temperature are favorable, determines the time which it takes to reach its full size. Having attained its full development, in possibly eight days, shedding its skin several times to permit of growth, it changes from the larval or caterpillar stage, to the pupa or chrysalis phase. In the former it resembles a short bristly worm with a distinct head and conspicuous eyes; in the latter there can be distinguished a large body made up of the head and parts which are to form and support the wings and legs, and a long tail, which is usually tucked under this body, the whole having a distant resemblance to a shrimp. Two points, however, both phases have in common. In both, the young mosquito breathes air and must not only visit, but spend a considerable part of its time, at the surface of the water; and in both stages it swims actively with a peculiar flickering wriggle. It is worth while for many reasons to remember that the young mosquito is continually returning to the surface to breathe, and that if the surface is not still enough for it to do this, it will drown; no less important is it to remember that when alarmed it immediately dives and lies on the bottom until the danger is past.

The pupa stage only lasts about two days, during which the creature ceases to feed and is waiting for the internal readjustment of its organs to take place. When this has been accomplished it swims to the surface, the adult emerges from the skin of the pupa, stands for a time upon it while its limbs expand and harden, and then flies off, a mature insect.

Methods of Destruction

This finishes the first half of the mosquito's life-cycle, and at this stage it may be convenient to consider how far a knowledge of its history suggests methods for its destruction. It is at once obvious that the breeding habits of the mosquito lay it open to attack in many ways. Often it is easy to dry up its breeding places altogether, and where this is impossible much may be done to prevent the mosquitoes developing in them.

Taking these two lines of attack in order, the first thing to do is to clear vegetation. The exuberant vegetation of tropical countries holds water, hides water, and shelters water. Not only do the large leaves and axillae of tropical plants often catch and hold collections of water, small but quite enough for mosquitoes to breed in, but the rapid growth and decay of tropical plants means vegetable rubbish which acts, during the heavy and continuous rains of the wet season, like an array of saucers. The paupau tree will serve as an example as well as any. It grows rapidly and soon dies, and its soft stem breaks or is cut down, leaving a stump with a top like a deep basin. Often in the course of its growth it throws out branches which get broken off, leaving cup-like hollows, in which mosquitoes breed, while the main stem is still alive and bearing useful fruit. Not long ago in West Africa I found innumerable mosquito larvae in the cup of a broken branch springing from a tree whose leaves brushed the walls of a bungalow.

When vegetation is cleared anywhere in the immediate neighborhood of human habitation, the ground is found littered with old tins and broken bottles. No power on earth will keep native servants from throwing such things where they cannot be seen, and the only way of ensuring that old tins and their inevitable complement, mosquito larvae, shall not be found within a certain distance of a house is to clear the ground round it of any vegetation which can conceal them.

Experiments have been made in the way of placing scented plants in the ground which has been cleared of its native weeds, but the hope that mosquitoes could be discouraged in this way has usually been disappointed.

Draining Pools

The next step is to drain the surface water from the neighborhood, and in doing this mistakes can easily be made by those whose intentions are excellent. Wide sheets of water, running streams, and deep ditches that are always full, do not, as a rule, lend themselves well to the requirements of the mosquito, provided that the margins are not allowed to form weedy shallows. A common error is to drain large open ponds where hungry myriads of small fish and aquatic insects keep the feeble mosquito brood from developing, and to leave in their place innumerable small puddles in which mosquito larvae alone can thrive. Draining is desirable wherever it can be done effectively; but where this is impossible, flooding is almost as good and much better than incomplete drainage. A large body of water, whether in a water-butt or a lake, can be made useless to mosquitoes by means of kerosene. A little kerosene poured on the surface will spread out until it has covered the whole with an exceedingly thin film through which the mosquito larvae are unable to reach the air when they come up to breathe, and upon which the female mosquito will not deposit her eggs. Kerosene is very valuable where it can be satisfactorily applied; but one cannot spend one's life in apportioning one drop of kerosene to every few drops of water which has been caught in the hollow of a leaf or is left as a puddle on the ground after rain.

It was, I think, in the West Indies that the stocking of all streams and ponds with a tiny fish popularly known as 'millions' was first systematically carried out. Up to a certain point the 'millions' have been a success. They feed voraciously upon mosquito larvae, but obviously they cannot find their way into the temporary puddles where eggs are deposited by the winged insect, and they have, besides, certain idiosynerasies which restrict their usefulness. In many laboratories today, experiments are being made with a view to discovering or breeding a strain of small fish which will not object to living in iron cisterns as well as natural pools and streams, nor be too fastidious regarding the depth and quality of the water into which they are intro-

duced. If these attempts at cultivation are successful, the fish will doubtless be distributed to all countries where mosquito-borne diseases are endemic. It is to be hoped that they will not then merely serve as food for the indigenous fishes.

Excluding Mosquitoes

Precautions to be taken about the house seem at first sight obvious enough. Anyone can pour kerosene on large bodies of water; no man in his senses will tolerate a litter of old tins and broken bottles near the place where he lives; and the practice of planting bottles in cement on the top of walls and breaking them with a hammer when the cement has set, which was once popular in the West Indies, has been superseded by more rational methods of fortification. The management of gutters, and the covering of rain-water tanks and cisterns, are mere matters of care and common sense; but unfortunately care and common sense, as a rule, stop short where negro servants take up the management of water or anything else.

It was in the West Indies that a medical practitioner gave me my first demonstration, and a few weks later I was applying his lessons in Louisiana. Certain rooms in a house remained infested with mosquitoes, in spite of every precaution which had been taken to exclude them. The householder scorned the possibility that mosquitoes bred in the bath-can and toilet jug: they were emptied and filled afresh every day; yet the larvae were found in both. The explanation was simple. It is the habit of mosquito larvae and pupae to dive and lie on the bottom when they are alarmed, as they naturally would be when the servant picked up the jug or can; and it was the habit of the servants to empty the vessels carelessly, leaving a few dregs, and in them all the mosquito larvae, behind in each; so that after they had been refilled their population remained precisely as before.

Feeding Habits

The mosquito, whose life history has so far been traced from the egg to maturity, is a feeble insect, and, like most feeble creatures, unless endowed with special facilities for concealment, is a rapid breeder. If it were not, it would have become extinct long ago. A female mosquito is ready to deposit her first batch of eggs by the time she is ten days out from her water existence, and she lays eggs by hundreds at a time. As she repeats this exploit at intervals during a life which may last for months, a pair of mosquitoes in the spring represents, potentially, millions of mosquitoes in the following autumn. But in order to accomplish a task involving such a drain upon the system, the female mosquito must live well. Her ordinary food, and the sole diet of the males of all except a very few species, is vegetable, consisting of the juices which can be sucked out of soft plants and fruit.[1] To support her in her duty to her species, however, she requires feeds of blood, which not only man, but other animals, birds, reptiles, and even insects are called on to supply.

The males of most species are exclusively vegetarian, and in many species both sexes subsist entirely on plant juices; but though there are exceptions in which the male takes blood as well as the female, I do not think any kind of mosquito is known in which he takes blood and she does not.

When a mosquito intends to bite she settles on the part she means to attack. This in man is most often the wrist or ankle. She then drives the piercing and sucking organs of her complicated proboscis into the skin, while the sheath-like lower 'lip' doubles back in a loop to let them project beyond it. Through one small tube the mosquito sucks the blood of her prey, and through another and still smaller tube she injects her own saliva into the wound. This saliva is held to aid the mosquito in two ways: by acting as an irritant and so determining a larger flow of blood to the part, and by altering the nature of the blood in such a way as to prevent it from clotting. It causes in the victim the local inflammation which persists for some days as an irritating papule, and is so familiar to all new arrivals in a mosquito country. The bite is hardly ever felt at the time it is inflicted, and repeated inoculations of the saliva soon induce an immunity to its after-effects which is perhaps a doubtful benefit to mankind. The mosquito takes about a minute to draw in all the blood she requires, and the amount ingested is sometimes more than would be guessed by looking at her distended body; for while still sucking she will often excrete minute droplets of clear fluid, retaining the solids of the blood in a concentrated form. After finishing her meal the mosquito is too heavy to fly actively, and retires to some dark corner where she must spend three or four days in digesting before she is ready to feed again.

Choice of Victims

Many observers say that a mosquito prefers to hang about one particular place, to feed always from the same person, and to draw her subsequent meals from the near neighborhood of her first bite. These may be her preferences, but unfortunately, in practice, she often bites more than one person or we should not have to dread her as a carrier of disease. She is more regular in the time when she bites. She may feed for the first time, in her adult life, by day; but after she has once had a feed of blood, certainly after she has deposited her first batch of eggs, she feeds again only by night. In nature all processes tend toward economy. The microscopic filaria worms, which may give rise to elephantiasis, lurk in the deeper organs of the body by day, and are only found in such blood as may be drawn from the skin by the prick of a needle or the proboscis of a mosquito, during the night hours when mosquitoes are feeding.

The habits of the various species of mosquitoes differ considerably. Some affect houses, some never come near them, some live in the bush by day and come into rooms in search of food at night, and there are even exceptional species which feed by day instead of by night; but as a general rule it may be said that mosquitoes do not like light or even light colors. Early during my residence in the United States I had pointed out to me the advantage of

wearing light clothes, particularly light socks; and, when at restaurants or on a veranda at night, of choosing a chair near, but not too near, some one who was wearing black!

One may make another safe generalization by saying that mosquitoes do not like wind. It is on warm, still, cloudy nights, when there is rain in the air, that they are abroad most. At such times one may hear, preferably from within one's mosquito net, the thin piping of the blood-thirsty females. Regarding this song of the mosquitoes, I heard a well known lecturer in the United States telling his pupils that they could distinguish the voice of the anopheles, which carries malaria, from that of the culex, which does not, by its being in a lower key; and bidding them fix the fact in their memories by thinking of grand opera in which the hero is always a tenor while the villain invariably sings bass. We need not, however, feel any particular regard for the hero in this case, as, though he does not carry malaria, he may be laden with filaria or dengue.

Range of Flight

Being feeble on the wing, the mosquito does not stray far; the distance is usually given at half a mile at most, from the place where she was bred. I heard this disputed in South America on the grounds that a certain ship always swarmed with mosquitoes when she came into port, although she usually lay some distance from the shore. I noticed, however, that the mosquitoes usually arrived after the lighters had lain alongside for the two or three days which it takes to coal in that leisurely part of the world. It is even said that the mosquito prefers to deposit her eggs on the very pool in which she passed her own youth. This may be so, but her readiness to take advantage of small puddles within a few hours after rain has fallen, shows that she is not over particular upon this point. The distribution of mosquitoes on a large scale is little understood. There seems little doubt that they do occasionally travel in vast swarms, but hardly anything is known about these wholesale migrations. The wind may carry a stray mosquito for a short distance, but not multitudes of mosquitoes for great distances, although it probably affects the direction of their flight. The mosquito has such a modest opinion of its powers on the wing, that at the first breath of wind it hurriedly takes cover in any vegetation that is handy. Even the gentle draught of a punkah will, when started, often drive every mosquito in a room to settle.

It is not easy to say how long mosquitoes will live in a state of nature. They have been known to persist for weeks on ships at sea, and, when protected in cages, for experimental purposes, can be kept alive for months. In the ordinary course of things, they must succumb in enormous numbers to natural enemies, and some of these are not at first sight likely ones. For instance, in the laboratory, ants will speedily destroy mosquitoes if they can gain access to their cages. Judging by captive specimens, the expectation of life appears to be much better for the females than for the males.

(To Be Concluded.)

Wet Silver Assay

Assay of silver by the wet method is described as follows by F. A. Allen in the *Colorado School of Mines Magazine*:

A standard solution of sulpho-cyanide of ammonium is prepared by dissolving 750 mg. of the salt in one litre of water, 1 c.c. of this solution precipitates about 1 mg. of silver. To standardize it, 50 mg. of pure silver is dissolved in 5 c.c. of nitric acid and 10 of water, both free from chlorine, the red fumes are expelled by boiling, cold water added to bring up the volume to 100 c.c., 5 c.c of ferric nitrate (made by dissolving about 5 gm. of the salt in 200 c.c. water) added, and then titrated until a faint pink but permanent end color is obtained.

Another solution is made by dissolving 12.6 gm. of common salt in one litre of water. One c.c. of this solution precipitates about 0.0199 gm. of silver and is standardized as follows: Exactly 2 gm. of pure silver is dissolved in 10 c.c. nitric acid and 20 of water free from chlorine, the red fumes expelled by boiling, cooled, and exactly 100 c.c. of the salt solution added from a 'Dafert' pipette. The solution of the silver is effected in a flask of 200 c.c. capacity, which has been carefully calibrated with an ordinary 100 c.c. pipette, and has a scratch on the neck representing exactly 200.5 c.c. After adding the salt solution the flask is tightly stoppered and shaken thoroughly, pure water added, bringing the volume up to the 200.5 c.c. mark, again shaken, and the precipitate allowed to settle; 100 c.c. is now taken out, free from precipitate, by means of a pipette and after adding 5 c.c. of the ferric nitrate solution is titrated with the solution of ammonium sulpho-cyanide. The quantity of sulpho-cyanide of ammonium used is multiplied by two and its equivalent in silver is deducted from 2 gm., the difference being the quantity of silver precipitated by 100 c.c. of the salt solution. The concentration of the salt solution should be varied so that 100 c.c. precipitates a little less than the fine contents of silver contained in 2 gm. of the sample to be assayed, so that nearly all of it is precipitated by the salt, leaving only a very small amount of the silver still in solution so that the titration may be finished by the more delicate solution of sulpho-cyanide of ammonium.

In the actual assay of silver bars, 2 gm. of the granulated sample is weighed up and treated exactly as described in the standardizing of the salt solution, finishing the titration with the solution of sulpho-cyanide of ammonium, side by side with the 2 gm. of pure silver used for standardizing, so that the pink tinge at the end will have the same intensity in each case.

Mines of Bendigo in 1912 produced $3,363,000 from 353,794 tons of ore, to which lessees in 38 mines contributed 31,788 tons, worth $243,000. Dividends totaled $560,000, and assessments $750,000. In 1911 the figures were: gold output, $3,287,000; dividends, $600,000; and assessments, $800,000. To date Bendigo has yielded gold worth $375,000,000. The mines controlled by the well known Lansell family yielded 47,983 tons, worth $323,000 in 1912.

Mine Surveying

By E. A. Colburn, Jr.

Though much has been said and written about the need of accurate survey work underground in metal mines, many managers, superintendents, and operators fail to appreciate the absolute necessity for reliable stope and level maps of the workings under their supervision. Recently while making an examination in the Southwest, the following costly mistake came to my notice. It could have been prevented by a couple of hours work with a pocket transit, and may be taken as an example of the many blunders made by prospectors, and others, through the lack of any attempt at surveying, even in a crude way.

The prospector had opened some ore in a shallow

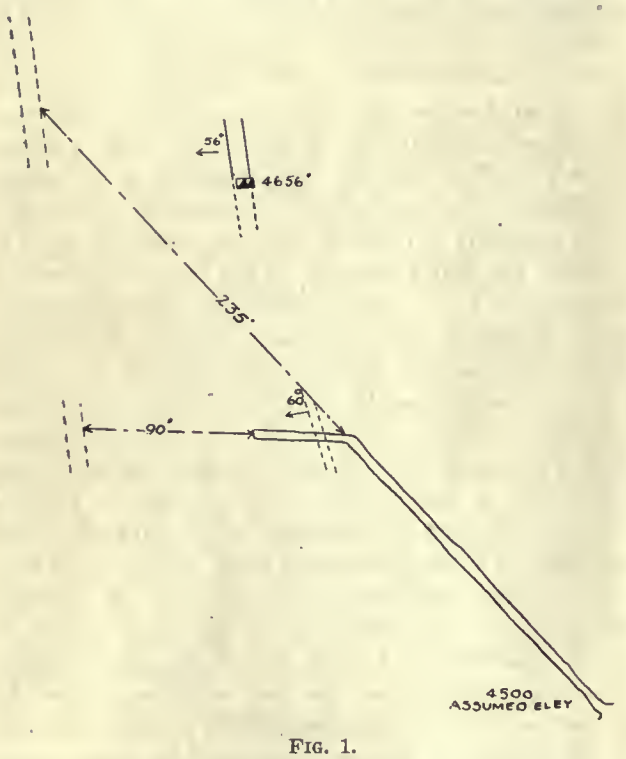


Fig. 1.

shaft (Fig. 1) on a rather steep hillside, and wished to cut the orebody at greater depth. This he tried to accomplish by driving an adit, from the hillside below the shaft, cross-cutting the formation. Why he should have preferred to cross-cut rather than drive an adit on the vein, as he could have readily done, is a question of judgment rather than of surveying, but at any rate he started his adit about 300 ft. down the hill, driving in a course about 10° to the left of his shaft in order to allow, as he supposed, for the dip of the vein.

After driving the adit nearly 200 ft. and not finding the vein, he turned to the left and cross-cut the formation for 50 ft. more in the hope of finding it. At this point his funds were exhausted and he was obliged to suspend work with 90 ft. yet to drive before reaching the vein and 130 ft. to drive on the vein in order to reach the point for which he started. Had the adit been continued upon the course on which it was started, it would have required about 430 ft. to cut the vein, though the owner of the claims had estimated that a little over 200 ft. would be sufficient to reach it. The prospector, in laying out the work, must have used a tape that was correct in about the proportion of 1½ to 1, and estimated the dip of the vein as nearly vertical; or, as is more likely, guessed at the whole thing. The loss caused by this mistake amounts to far more than the cost of the adit, as some ore might have been blocked out if the money had been expended judiciously. It is hard to believe that an engineer could make a similar mistake, but several cases of a like nature have been noted, resulting in large sums being wasted in useless work.

Managers are often to blame for conditions like this, as they prefer to employ poor men, at an average salary, rather than good ones at a slightly higher rate when the money expended through one mistake would pay the additional salary for a year or more. It is imperative that a superintendent, in charge of

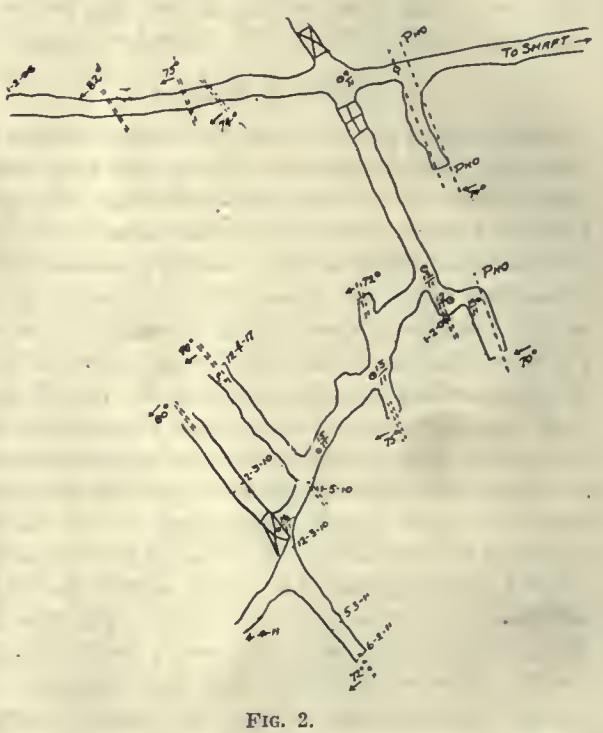


Fig. 2.

a property of any considerable size, should insist on the following things relative to his underground surveying and mapping: (1) The stope and level maps should be brought up to date at least once a month. (2) All level maps should show offsets in the drifts; all veins, dikes, faults, and changes in country rock noted in the work and give the dip of these formations. (3) Stope maps should show monthly progress, either by stipple or cross-hatching, and the average width of each section of the stope. (4) All grades in the levels should be taken and shown on the maps at frequent intervals, and all surveys should be accurate enough to be used in making connections with other levels if occasion should arise. Otherwise the additional expense of an extra survey might be required.

Monthly Surveys

All maps should be brought up to date at least once a month, as otherwise considerable money may be foolishly expended. When machines are being worked on two or three shifts and progress is rather

rapid, the services of a surveyor are often required between his regular monthly visits, especially if the work is at a critical point. A few feet of unnecessary work will pay for the services of an engineer several times over.

Geological Maps

All level maps should show the geology of the country passed through, such as dikes, faults (if recognizable), and all changes in the country rock, together with the dip and strike. This can more readily be done when offsets are taken as the survey progresses and platted to scale on the maps, not

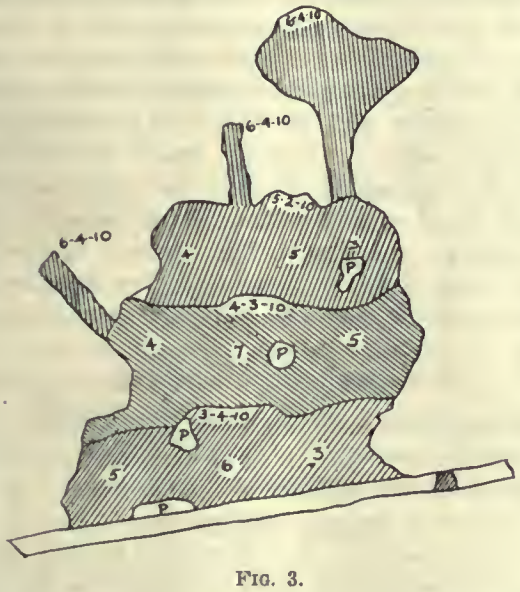


FIG. 3.

relying, as so many engineers do, upon guessing the width of the drifts and the position of the walls. The veins and streaks noted in driving levels should be sampled and the results placed upon the maps, but this is rather the work of the mine superintendent than the engineer, although at many mines surveyors check other samplers on this work.

Geological mine maps are one of the greatest helps to the manager in laying out his development work; an aid which is almost totally ignored in most mines. I have seen map after map with no geology of any nature, showing neither veins nor any change in the rock formation, most of them having only limited data as to the true position of the drift walls in respect to the survey lines. An engineer making an examination of a mine with any considerable extent of workings, and supplied with maps of this sort, must either trust to the memory of the foreman or superintendent (which is usually faulty), or work the geology out himself, which occupies valuable time better spent on other matters. Fig. 2 shows the methods in use at many mines to indicate the monthly progress, geology, and other features.

Stope Maps

Stope maps are of great assistance in finding new ore and tracing downward extensions of oreshoots, and should be kept close up to the actual work. Work done each month should be differentiated from that of the preceding and following months by a difference in the stipple or cross hatching; the day, month, and year upon which the survey was completed should be placed along the line defining the month's work. Any stopes on veins crossing or intersecting should have a separate sheet and not be placed on the main vein maps; if both stopes are placed on one sheet, the superintendent himself, after a year or so, will not know which stope is which. As an example of this, the following incident may be related.

An engineer, examining a property, asked for separate stope maps of two veins intersecting at an acute angle, both being shown upon one stope map in the company's office. After considerable delay, due to the surveyor's inability to tell which stope was which and his numerous consultations upon the matter with the mine foreman, the maps were prepared and handed to the engineer. Most of the stopes shown on the maps as being on these veins were represented underground by unstoped ground, and conversely.

The engineer should also show the average width of each section of the stope and roughly figure the tonnage mined therefrom every month. It is surprising how closely the results check with the actual tonnage at the end of the year. These tonnage estimates are especially useful in figuring the net proceeds per ton of ore mined at properties where a great deal of waste is sorted out and no record is kept of the amount of such waste. Fig. 3 shows a stope mapped in this way.

Accurate Surveys

As the surveys advance with the level work, the grades should always be taken accurately and shown on the map at every second or third station. Thus the maps show at a glance the elevation of any part of the mine with reference to any other part, and the distance between levels may be readily determined without further survey work or looking up of old survey notes. The question of accuracy in all underground surveying cannot be emphasized too strongly, as there are few engineers who will rely on their ordinary mine maps for making connections without making special surveys for this purpose. This should not be true, as the old saying, "What is worth doing at all is worth doing well," applies to the mining industry as well as to any other walk of life. The little additional time necessary to do the work well is more than compensated for by the reliability of the survey and the saving in special surveys for connections.

Conditions of temperature and pressure and the amount of moisture present determine the composition of the secondary minerals formed from others by alteration. How marked this effect may be is well illustrated by a lead pipe, recently described in *Chemische Zeitung*, which had been buried in porous cement for 24 years, and was found on examination to be surrounded by 24 red layers of Pb_3O_4, alternating with 23 yellow layers of PbO, the former having been formed in summer and the latter in winter. Careful study has similarly shown that in the case of many minerals slight differences in the temperature of formation cause marked changes in the composition of the product.

Uses of Manganese Steel

By S. R. Stone

*Manganese steel first came into prominence about twenty years ago. Although recognition of its great commercial value has not been general until recently, some of its possibilities were apparent even then, for up to that time metal hard enough to resist abrasive wear was too brittle for many applications. In the new material, however, metal workers found the then novel quality of hardness without brittleness—not the glasslike hardness of unannealed chilled cast iron, but one associated with toughness. This combination is peculiar in its resistance to cutting tools; yet the metal possesses malleability, so that while it is commercially impracticable to drill or cut manganese steel, it can be forced cold and even drawn into fine wire. It is, however, important to note that such freedom from brittleness can only be obtained when the metal is quenched after being heated to the proper temperature. If allowed to cool slowly, unless of very small section, it is entirely too brittle for useful service.

Manganese steel is used largely in the form of castings, and many of these find their applications in the rough. Where finished, to secure a smooth surface, there are two principal processes employed, namely: rough grinding and precision grinding, or 'machining,' as it is commonly called.

Crushing and Pulverizing Machinery

Manganese steel has found one of its most noteworthy uses in the construction of crushing and pulverizing machinery for rock, ores, coal, coke, matte, slag, cement clinker, or any friable material, with, however, varying success for different parts of the various types, as stated below, and these distinctions should be carefully noted. In not a few cases the exceptions are the most important to learn. For crushing rolls the roll wheels, whether solid or segmental, the side plates, gears, and pinions can be made to advantage from manganese steel. In jaw crushers the jaw and cheek plates, toggle plates, toggle bearings, and breast plates are the parts for which it is usually specified. Gyratory breakers require it for the crusher heads, mantles, concaves, spiders, hoppers, spouts, wearing plates, shaft bearings, gears, pinions, and dust caps. For mills of the Chilean type, which consist of a wet grinding pan and revolving rollers or 'mullers,' manganese steel is recommended by some for the tires, die-rings, and muller shafts; but to my mind this use is at least questionable. For the gears and pinions it undoubtedly is, however, the proper material. The same may be said of Kent mills, Kinkead mills, Huntington mills, Raymond mills, etc. For Fuller mills the yokes, pusher pins, and die-rings are recommended by prominent users to be made of manganese steel. Tube-mills do not offer much of a field for manganese alloy, except as to the screen plates used at the discharge end of certain types, the gears, and pinions; but ball-mills and comminuters show the advantage of using it for breast and wearing plates, end liners, coarse screens, shaft protectors, gears, and pinions. By some authorities such steel is recommended for a stamp-mill, including the dies, liners, and wearing plates, of steam stamps and the mortar liners, chutes, and launder liners of gravity stamps, but by others the use of chrome, vanadium, or other alloy steel is regarded as preferable.

Conveying Machinery

On bucket elevators the use of manganese castings for the buckets, chain sprockets, and pins greatly increases their wearing qualities; but for the buckets this material is relatively expensive, and chilled iron, though more frequently renewed, costs less for the year. For chutes over which rock, ore, or other heavy abrasive material is passed, including linings, deflector plates, and the like, steel containing high manganese offers exceptional wear. For the wire ropeways, manganese steel is used for the carrier wheels, sheaves, and idlers. Such parts not only wear many times longer when formed of this material than if made from any other commercially usable metal, but also give fully 25% more life to the cable.

Screening and Conveying

For heavy screens of all kinds, whether stationary, shaking, or revolving, it is ideal material, while as the lining of bins and chutes for hard rock, ore, and launders, it shows wear qualities much greater than any other material. It is also used to some extent for grates and grizzly bars, but the latter can be so readily renewed as often as necessary that old rails or chilled iron bars ordinarily serve the purpose. In revolving trommels there are not only the screens but also the tires, rollers, sprockets, and chain, gears, pinions, and feed and discharge ends, while in stationary screen plates for special service there may be unusual parts like the screen spiders and protection strips in stamp-mills, which it is desirable to manufacture from manganese steel.

One of the most useful of its applications is in the manufacture of wheels or wheel tires for mine cars and trams, skips, charging buggies, or barrows, slag cars, stripping cars, quarry cars, etc. Not only do these wheels show greatly lengthened service, but they can be made much lighter. On dump cars the use of manganese steel for ratchet wheels and levers is rapidly increasing.

Where pumps are designed for handling sand or tailing, or for gritty fluids (non-acid), the shells, liners, runners, guide vanes, as well as piping, can profitably be made of this steel. No other material, in fact, can be used without very frequent renewal.

Digging Machinery

All wearing parts of steam-shovels are now made of manganese steel, including lips, teeth, dipper fronts, latches, and latch keepers; in fact, complete dippers are now being made, every part of which, except the rivets, is of manganese steel. The life of the metal in this case is easily four times that of ordinary steel. Dredge, ditching machine, and dragline excavator parts commonly made of manganese steel are as follows: bucket lips, teeth, wearing

*Abstracted from the *Iron Age*.

plates, links, pins and bushings, tumblers and removable parts, launder liners and rollers, chute liners, sheaves, chains, sprockets and pins, revolving screen sections, tires, rollers, gears, pinions, sprockets and driving chains, knives in cutter heads, and numerous special parts. The life of a grab-bucket is greatly prolonged by the use of manganese steel for the lips, side arms, sheave wheels, pins, bushings, and to a considerable extent of the trays or leaves and shanks, each made in one piece.

Hoisting Engines

For hoisting engines manganese steel on the drums keeps them in good condition and prevents the wearing of spiral grooves; while sheaves in general for rope haulage, when made of manganese steel, not only last exceptionally long, but are so smooth that they do not hold gritty particles at all in the groove, and lengthen the life of wire ropes very materially. The initial expense, however, appears to have militated against the use of this metal for drums or sheaves of larger sizes. The case is similar with helicoid conveyor parts, such as the sectional casings and screws, gudgeons, conveyor caps, hanger casings and bushings, gears and pinions, but for the casings and screws, which have been found difficult to produce, the costs are high and chilled iron gives good results. In handling hot clinker or other heated material manganese steel will not do at all.

Around the Smelter

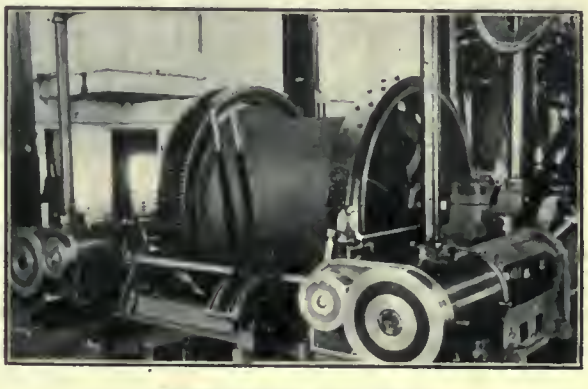
Presses handling gritty material include with benefit manganese steel plates ground on all surfaces. In the maintenance of rotary driers, sintering machines, roasters, kilns, and clinker coolers, its use for the tires and rollers, as well as gears and pinions, effects material economy, but it should not be used where it will be directly exposed to heat. For converters the claim of economy is also made, and with justice in the case of the double-flanged rollers, blank rollers, racks and sectional gears, as well as other parts.

One of the most successful uses to which manganese castings are put is for gears and pinions. In some cases the ratio of wear, compared with cast iron and carbon steel, is as high as 15 or 18 to 1. Gears of all sizes are used in large quantities, varying in weight from a few pounds to ten tons or more. As a rule, the teeth of manganese steel gears are cast rough; but manufacturers have recently been making gears with teeth ground accurately to pitch, such finish being necessary when the gears are to run at high speed. Large gears are often made with manganese steel rims and some steel centres and arms, and sometimes in halves. Gears and pinions in machinery exposed to gritty dust are particularly long-lived when made of manganese steel.

Iron smelting and iron-ore mining during the first half of 1912 made encouraging progress in South Russia, 2,247,966 short tons of cast iron being produced. This was an increase of 339,156 tons over the same period of 1911, due to the rapid building of tramways and progress made in the manufacture of machinery.

Wuest Gears for Mine Hoists

The application of the Wuest system of herringbone gears by some of the leading American manufacturers to mine hoists has directed renewed attention to this interesting type of gearing. That it is an ideal form of tooth has been well known for years, but as practically all helical gears in use prior to the advent of the Wuest system had cast teeth, the inaccuracies in casting produced so much friction in operation as to practically counteract the benefits derived from the great strength of the gearing. The excessive noise was also very annoying, and a hoist with cast helical tooth gears could create enough disturbance, when in operation, to seriously affect the peace of a whole community. The difficulty in cutting with speed and accuracy has made spurs and bevels more successful commercially than gears of the herringbone type until gears made by the Wuest method came into vogue in England about seven years ago. Since that time they have



WUEST HERRING-BONE GEARS.

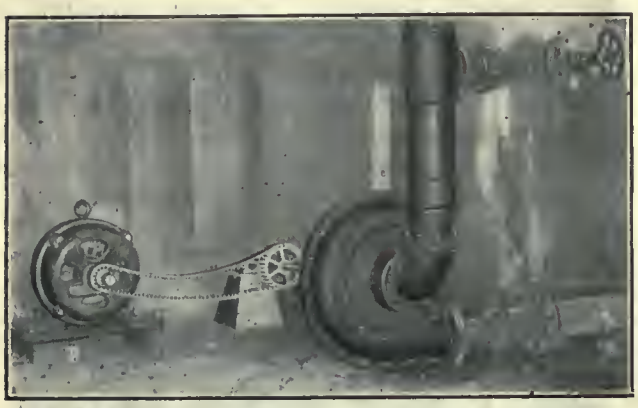
found a rapidly increasing application in the United States, and now are found in use in one form or another on all machinery where accuracy, strength, and efficiency rather than low first cost are the factors governing design. The distinction between the Wuest gears and those of the ordinary herringbone or helical type is that the teeth of the former, instead of joining at a common apex at the centre of the face, are half the pitch apart and do not meet at all. This does not affect the action of the gears, but permits their manufacture by precise methods and makes them commercially applicable to any mechanical power-transmission that permits the use of gearing. All conditions that make for ideal operation are furnished by herringbone gears, provided, of course, that they be accurately cut. The fundamental principle of the action of the herringbone teeth lies in the fact that all phases of engagement take place simultaneously. There is a tendency to concentrate the load near the pitch-line, so that the ends of the teeth, instead of wearing away to a constantly increasing extent from their original involute form, are relieved of some of their load from the moment wear commences. The destruction of the original form is practically nothing, the motion is transmitted from pinion to gear without shock, jar, or vibration. Continuity of action is the second characteristic of herringbone gears. The third feature lies in the fact that the bending stress

on the teeth does not fluctuate from maximum to minimum, as in straight gears, but always remains near the mean value. There is, therefore, no backlash; friction and mechanical losses are so small as to be barely appreciable, while higher velocities and greater degrees of speed reduction may be used than with any other kind of gearing.

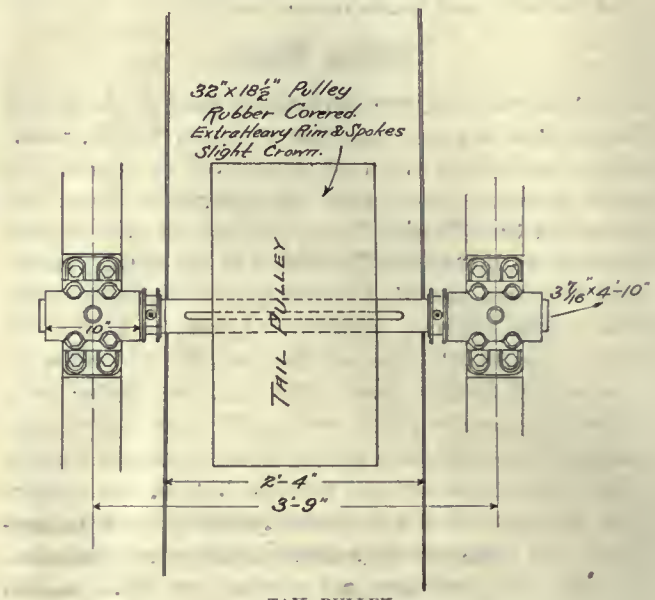
Elevating Pulp

By M. W. von Bernewitz

In Tonopah and Goldfield milling plants quite a variety of ways of elevating and circulating pulp



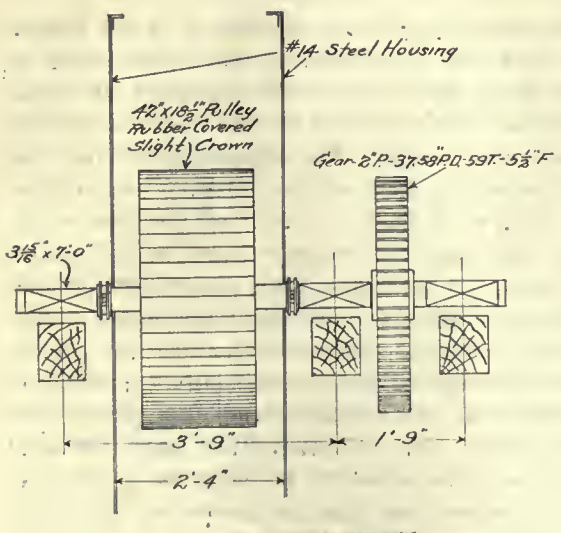
CHAIN-DRIVEN PUMP.



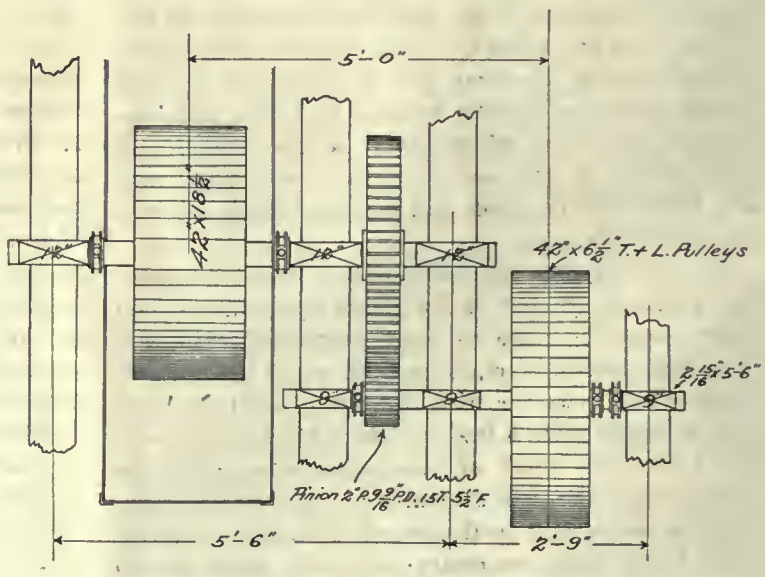
TAIL PULLEY.

are employed, and a short description of these should prove interesting, as millmen are often at a loss to decide what system to use. The new Belmont mill has three-throw plunger pumps lifting thickened

made by the local foundry, and has attracted favorable attention. Liners are made of a special tough steel mixture, and are not cast split in the usual way, which permits pulp to cut them out rather



CROWN PULLEY.

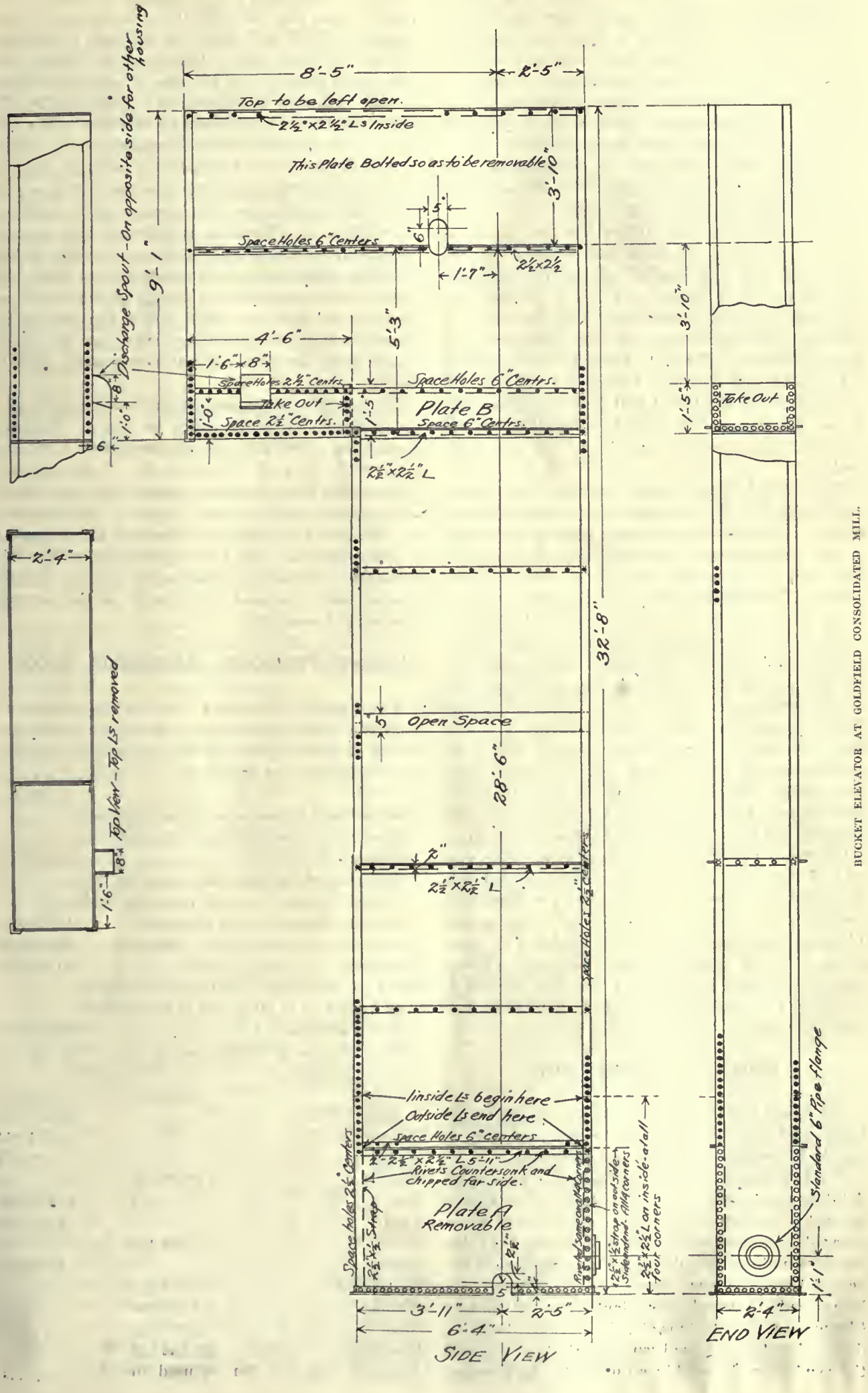


DRIVE-GEAR OF ELEVATOR.

pulp from No. 1 Dorr tanks to the first battery of Pachuca agitators; and from these it is elevated to the No. 2 Dorr thickeners by an air-lift. Excess from the vacuum-filter vat is returned to the stock tank by a bucket elevator with close-connected buckets. This is vertical, and part of the time is heavily loaded, but gives no trouble. At the old Belmont mill, at Millers, a tailing-wheel is used to lift pulp from the stamps a height of 48 ft. to classifiers. The up-keep of this wheel is low, and it is reliable. This plant treated 87,952 tons during the past financial year, and elevating and classifying cost about 3.6c. per ton.

From the Dorr classifier and tube-mill closed circuit in the Extension mill, slime is raised to the thickeners by a Campbell & Kelly centrifugal motor-driven pump, running at 600 r.p.m. The life of liners is from 180 to 240 days, at a cost of $35 per liner and runner. Work of this pump is most satisfactory, and it is used largely at Tonopah. It is fast. The accompanying illustration shows one of these pumps at the MacNamara mill, driven by a chain from motor, a style of drive very popular and satisfactory.

A 5-ft. Frenier spiral pump at the MacNamara lifts tube-mill pulp a height of about 12 ft. to a Dorr classifier. Its work is satisfactory. For circulating slime in the Trent agitators, 4-in. Campbell & Kelly pumps are used, driven by 7½-hp. motors, and consuming about 6 hp. At the filter vat there is another of these pumps, used for filling, return-



BUCKET ELEVATOR AT GOLDFIELD CONSOLIDATED MILL.

ing excess slime to stock tank, and circulating. It is belt-driven by a 20-hp. motor and works well. At this point, all pipes are so fitted that they will drain properly after being used, as in cold weather, at this altitude, pulp would be liable to freeze. At the Montana mill Frenier pumps give good service. In the cyanide department the 6-in. Morris centrifugal pumps, lined with manganese steel, last about 18 months. They are used for elevating all pulp to agitators from settlers, and to stock tank from agitators, and excess from filter vat.

The Tonopah mill at Millers has two wheels at work. No. 1 is 30 ft. diam. and elevates 500 tons of dry ore and 3500 tons of solution per day from the stamps. It is driven by a 7½-hp. motor. The first cost of wheels is considered high, but they are efficient, and maintenance is low compared with bucket-elevators. The cost of elevating and separating is given as 8c. per ton. Campbell & Kelly pumps are used at the West End mill for circulating slime in the Trent agitators, transferring slime to the thickener, and at the vacuum-filter; and are highly praised.

The Goldfield Consolidated has two bucket-elevators lifting pulp from Chilean and tube-mills to classifiers. Details of the gear and housing are shown in the accompanying diagrams. The elevators are each 28½ ft. from centre of tail to centre of head pulley. The housings are of steel plate, and are 28 in. wide and 76 in. long, with a total height of 32 ft. 8 in. The head pulleys are 18½ by 42 in., fitted on $3^{1}/_{16}$ in. by 7-ft. shafts. Spur gears have 59, and pinions 15 teeth with 2-in. pitch, and the driving pulleys are 6½ by 42 in. Tail pulleys are 18½ by 32 in., fitted on $3\,^{7}/_{16}$-in. by 4-ft. 10-in. shafts. Both head and tail pulleys are lagged with 6-ply rubber belting, secured with ⅜-in. elevator bolts, 5 in. apart. Flanges or collars on the tail pulley prevent grit getting into the bearings. The belts travel at 450 ft. per minute, and the carrying capacity is about one-third of the theoretical cubic content of the buckets. The belts are Silvertown rubber make, 18 in. wide and 8 ply, and are fitted with malleable iron buckets, 8 by 8½ by 16 in., spaced 14 in. centres. Each has two ⅛-in. holes, 4 in. apart in the bottom, giving a freer discharge. Power absorbed by each elevator is 7 hp., and the life of a belt is 12 months, during which 400,000 tons of pulp is elevated, at a cost of 1.5c. per ton.

Flotation at Great Cobar

The Great Cobar company, of New South Wales, has erected a flotation plant, and at the annual meeting the following information was published:

We had hoped to have the Minerals Separation flotation plant completed in the latter part of August or September but, on account of our inability to secure sufficient mechanics without increasing the existing rates and the difficulty in securing supplies at the agreed time, this was impossible. Preparations are being made to supply the plant with 500 tons of Chesney ore, and 200 tons of Cobar banded slates per day. After the mill has been properly tuned up and the conditions thoroughly adjusted to the tonnage, which will probably be in February or March 1913, the directors may look for the achievement of that tonnage. Until that time the estimate is between 400 and 500 tons daily. We expect to derive from this source from 350 to 400 tons of copper monthly, leaving from 450 to 500 tons to be produced by the Cobar Gold and Cobar Mines by smelting. This will give an annual production of approximately 10,000 tons of copper with between 40,000 to 50,000 oz. gold, and from 200,000 to 250,000 oz. silver. In the past the Cobar mine has been the keynote of the situation. Any delays or difficulties experienced here immediately reacted on the tonnage along the entire group. With the completion of the flotation plant these conditions will be materially altered and, while still remaining the most important factor, the greatly reduced demands which will be made upon the Cobar should make the above estimates easy of accomplishment.

We have received a cablegram from Mr. Bellinger, dated December 28, in which he says: "Minerals Separation plant test-mill operated from 8:45 December 23, to 3:45 December 24, 31 hr. 50 min., yielding 400 tons jig tailing, assay 1.28 copper, result concentrates 19.35% copper, residue 0.24% copper. For the last 7½ hours, mill operated at the rate of 560 tons per 24 hr. Mr. Faul, representative Minerals Separation Company, authorizes me to state greatly pleased with plant and operation of process; success absolutely assured."

Copper Producers' Association Report

The Copper Producers' Association statement, February 8, shows an increase during the preceding month in accumulation in this country of 17,885,770 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, January 1, 1913	105,312,582
Production of marketable copper in the United States from all domestic and foreign sources during January	143,479,625
Deliveries for consumption, January	65,210,030
Deliveries for export, January	60,383,845
Stock of marketable copper of all kinds on hand and at all points in the United States February 1	123,198,352

The changes in surplus since have been as follows, in pounds:

	Increase.	Decrease.
January, 1912	.....	22,173,252
February	.....	3,301,944
March	.....	572,431
April	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....
October	13,679,380	.....
November	9,419,095	.....
December	19,148,523	.....
January, 1913	17,885,770	.....

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mining in Porto Rico

The Editor:

Sir—In the interest of legitimate mining, I ask you to publish the following warning to the mining public. At the present time there are a number of grafters operating in Porto Rico, to the detriment of real mining; it is purely a stock-jobbing graft. I ask the mining and investing public to at least investigate before they invest. There are several good prospects in Porto Rico, but none of them are on the market now.

M. L. MURRAY.

San Juan, Porto Rico, January 28.

Concentration by Flotation

The Editor:

Sir—In compressing my article on 'Concentration by Flotation' in your issue of January 4 so as to make it occupy exactly two pages, you excised some matter which did not deserve this fact. As its omission did an unconscious injustice to the engineer to whom is due the practical success of the Minerals Separation process, Theodore J. Hoover, I should like you to reproduce the paragraph as originally written, indicating by brackets the matter omitted in the printed article:

"The discovery made by Minerals Separation was the efficacy of minute amounts of oil or analogous substances, when used to produce a froth by means of rapid agitation. The virtue of the smallness of the amount of oil was discovered by Sulman & Picard [and its successful mechanical application in combination with rapid agitation is due to Theodore J. Hoover, who, however, in his new book, gives Mr. Wolf credit for being the first to propose violent agitation]."

EDWARD WALKER.

London, January 24.

Taxation of Mining Claims

The Editor:

Sir—Authorized by an amendment to the state constitution, the Nevada legislature passed a law, which became operative this year, making $500 the taxable value of each patented mining claim in that state, irrespective of whether it contains one or twenty acres, is producing ore (if any) in large or small quantities, or of great or little value; provided, however, that if $100 worth of labor was performed on any one claim during the last year previous to that for which the tax was levied, the taxable value of such claim is reduced by the discriminatory law to $50.

The apparent object of the law in question is to 'freeze out' the absentee, and it is a very unjust one, both to corporations and individuals alike. Excepting when litigation, the settlement of estates, and other unavoidable preventives interfere, or when a company or individual has spent all the money available for exploitation, it seldom occurs that either the one or the other will abandon a mining claim if past developments justify further operation or effort.

It has frequently occurred that an individual has expended all of his money on his patented mining claims, amounting in some instances to many thousand dollars; that he has been compelled to lease them, to seek employment in other places and perhaps at other vocations, to the unavoidable neglect of his own property and in direct opposition to his own will. Is it fair that, in such a case, or in any case mentioned or parallel to it, under discriminatory taxation, the owner of a patented mining claim should be deprived of his property that has cost him years of hard labor and thousands of dollars in hard-earned money? If it is, the prospector had best lay down his tools and quit, and capital had better seek other, safer, and less venturesome investments than mining in Nevada.

M. H. JOSEPH.

Republic, Washington, January 28.

[Our correspondent's letter opens a large subject of great importance to miners. We will be glad to have discussion, reserving for the present our own comment.—EDITOR.]

Nominations for the Institute

The Editor:

Sir—The following statement of the Committee on Nominations of the American Institute of Mining Engineers has been placed in my hands, with the request that I give it prompt circulation. I do so at once, believing this act to be simply one of justice to the Committee, who gave, to the best of their judgment, laborious service to the Institute. The members may not support their recommendations, but all who know of their efforts must realize that rarely in the history of the Institute has service been so freely given without regard to time or personal expense.

JAMES F. KEMP.

New York, February 10.

Dear Sir—A recent circular to the members of the American Institute of Mining Engineers by Karl Eilers and Charles Kirchhoff, presenting the name of Joseph Struthers for Secretary of the Institute, demands comment from the Nominating Committee, whose decisions are severely criticized.

Considered of itself, it is the privilege of any member to present candidates in opposition to a ticket named by an officially appointed Nominating Committee. In fact it is an evidence of interest in the affairs of the Institute, which is most welcome. When, however, the nominators go out of their way to attack the methods of the committee, and by implication at least, to suggest that they were dishonorable, it is proper to explain to the members the attitude of the Committee.

A better understanding of its decision may perhaps be given by clearly stating just what are the duties of the Nominating Committee. It acted upon the theory that its duties were something more than

clerical. It considered itself to be a body, widely acquainted, without axes to grind, appointed by the President of the Institute to recommend candidates who, if elected, shall fitly represent the best ideals of the profession. It sought, however, the widest possible consultation, personal and by letter, with the members, requesting expressions of interest. The many letters received in response were of great assistance. By its request, however, the Committee did not bind itself to accept advice from those whose information was more limited than its own. In making final decision, the Nominating Committee would have been recreant to duty had it failed to give careful thought to recent events in the affairs of the Institute, and to all the facts and arguments brought to its attention through personal discussions and letters regarding the qualifications of gentlemen suggested for nomination. The Institute of Mining Engineers is a body so widely scattered that not ten per cent of its members are so located that they are familiar with its details, even should they so desire. The Committee, therefore, considers itself as a Trustee for its members, bound in all good faith to judge the candidates for office in the light of their past history and by the strictest standards. Acting thus, its refusal of a renomination of Mr. Struthers was because of its belief that such a nomination would mean a vote of approval by it of the past practices of having salaried officers of the Institute conduct its excursions on a speculative basis of profit from the members. A further reason was that many members had been indifferent and dissatisfied for years, feeling scant consideration had been shown them, and that the welfare of the Institute seems to demand a change in order to renew interest and harmony.

The Committee has made no threat that "if Mr. Struthers should be named by the Committee or anybody else, certain alleged vouchers and documents, damaging to the reputation of the late management of the Institute, would be published in one or more technical journals to which they have already been communicated." The Committee had and has no intention to publish any vouchers or documents. It is hardly their province to do more now than to attempt to make their viewpoint clear to members.

The Committee has been criticized because of failure to renominate all the councillors and vice-presidents of the Council whose terms had not expired. Its nominations were made with full consideration of the revised articles of incorporation, and the proposed new constitution, giving geographical distribution to the Directors, in the hope to avoid the former charge of undue local control, trusting that the scattered membership may feel that their wishes are consulted, and that through their representatives they may gain closer acquaintance and greater interest in the affairs of the Institute. Within the membership there are many men who would worthily and efficiently fill any office in the gift of the Institute. Among these surely all those named by your Committee should be included. They are worthy the support of the membership at large.

NOMINATING COMMITTEE.
PHILIP N. MOORE, Chairman.

Secondary Sulphide Enrichment of Ores

The Editor:

Sir—As a contrast to the scholarly contribution of C. F. Tolman, Jr., to the literature of this subject, the following paragraphs, taken from a report signed by 'Wm. C. Haverstick, M.E.,' will perhaps interest and amuse your readers.

COPPER

"A red ductile, tenaceous, maleable metal of great and varied use, originally called brass of cypress, copper sand, alacaunte, C group of minerals, mostly soft, included C cuprite, malaconite, malachite, malconite, chessylite, chrycopyrite, olivnite, etc. Black C ore, malaconite, gray C ore, Chalcocite, C Purite, yellow C ore, variety Chalcopyrite, the common ore.

"The formation of the Harris Copper Company have blended with the iron lime and porphyry with quartz. Many of the above minerals, but more especially the commoner forms with oxides condensed formation on the top with the iron and lime, with a great amount of carbon and sulphur in the schist formation, with an amalgamated condition of the various mineralizations where gold and silver predominates. The schist formation being soft it stands to reason that when the sulphides appear in the lower rocks, I am led to believe from the geological lay of the uplift that is now held and owned by the Harris Copper Company there is beneath the surface of this great iron capped ledge a great body of copper ore. The sulphides appear so close to the surface that in every instance where digging and mining will be done on these great ledges, ore will be found before any great depth is reached in shaft or tunnel. The Copper Reef shaft of this Company's holdings is located on the same ledge as the Kay Copper Company's mine and will produce ore of as great value when sunk to same depth. This district of the Bradshaw Mountains has the ear-marks and the ledges, and they are not hidden by an overlap of porphyry and boulders, and faulted in any way to make mining expensive. There is a gold and silver bearing formation on the surface, copper glance is visible, and the lime shows the copper stain in the formation of the Last $ No. 2. Sulphur appears on the surface of the walls of the tunnel in great bodies and at the surface the rocks show copper. This ledge has the appearance of being the center of the massive body of this iron and lime dyke in the center of the uplift, as the rocks are regular and not faulted.

"The natural conditions of the ledge shows a perfect leaching of the copper on the surface, and the oxidization zone is well developed and distributed by nature. There exists a perfect distribution of the metal through the length and breadth of the entire contact of this monster ledge."

In the light of this contribution it may be suggested that possibly the reason why some copper mines have not proved profitable is that their oxidation zones were not sufficiently well distributed by nature throughout the geological lay of the uplift as to produce the necessary blending and amalgamation of the mineralizations.

MINER.

Oakland, January 29.

Special Correspondence

MEXICO

NEW INVESTMENTS IN MEXICO.—DEVELOPMENT IN HIDALGO.—LIGHTING PROFITS.

English concerns already heavily interested in Mexico apparently are willing to increase their investments, notwithstanding the disturbed condition of the country. For some time Esperanza, Ltd., has been seeking another big property in Mexico, and the Camp Bird option on the Noria mine in the Sombrerete district of Zacatecas was recently announced. Now the Exploration Company of England & Mexico, a subsidiary of the Exploration Co., Ltd., has taken an option on the old Espiritu Santo mines in the Taxco district of Guerrero, and the A. Goerz interests have taken over the Veta Grande, one of the famous old producers of the Zacatecas district of Zacatecas. The price named in the Espiritu Santo option is said to be over ₱1,000,000, and engineers of the Exploration Co. are now making an examination. This company was the purchaser of the Bueno Tierra mine in the Santa Eulalia district of Chihuahua, and of a controlling interest in the Santa Rosa property in the Concepcion del Oro district of Zacatecas. The Goerz interests are doing extensive work at the La Fe y Anexas properties in the Zacatecas district, and are building a 30-stamp concentrating and cyaniding plant. The initial payment on the Veta Grande was ₱10,000, and plans for extensive work there are being made. There is a big dump on the Veta Grande property.

The 1912 production of the Greene-Cananea was 48,346,300 lb. of copper, 460,816 oz. of silver, and 7425 oz. of gold. The Miami concentrate and other custom material handled made the total copper output for the year approximately 80,000,000 lb. It is expected that the 1913 production of Greene-Cananea will be considerably in excess of that of 1912. A preliminary report issued by the Mines Company of America, operating the Dolores and El Rayo mines in Chihuahua and the Creston Colorado and La Dura properties in Sonora, shows a net profit of $600,000 for 1912. The gross production was approximately $2,400,000, and the expenses $1,800,000. The company's report shows a claim against the Mexican Government of $36,000 for damages suffered at the hands of rebels. The Mines Company has returned to its former dividend basis, and now is disbursing, from the earnings of the last quarter of 1912, a total of $104,500.

Engineers report that the extensive exploration and development work of the Robert Towne interests at the Flojonales copper properties, in the Zimapan district of Hidalgo, has resulted in proving over a million tons of copper ore. Work was stopped recently, and attention now will be given to the metallurgical questions, preliminary to erection of reduction equipment. The Flojonales properties and those of the San Antonio Copper Co., a Cole-Ryan concern, in Sonora, are expected to figure prominently in Mexico's copper production during the next few years. In the Zimapan district the Hidalgo Copper Mining & Smelting Co., which has been operating a 25-ton copper furnace, has blown in a lead furnace of the same capacity. In the El Chico district of Hidalgo the Mancera interests are building a 100-ton plant to treat the ores of the Arevalo vein, which was cut recently by the big Nepton drainage and transportation adit at a depth of 350 metres. A 50-ton plant built to treat ores from the mines of Ludlow Bros. and associates will be in commission in March.

The Mineral Development Co., which is running a cross-cut from the Nueva Luz shaft to reach the 'mother lode' of the Guanajuato district at depth, has cut 2½ ft. of sulphide ore assaying 100 gm. ($2) silver and 2 gm. ($1.33) gold per metric ton. The cross-cut is on the 600-metre level (1966 ft.), and while the vein is of no commercial importance, it shows the presence of gold and silver at that depth. It is expected to cut the 'mother lode' within 700 ft. of the point where the vein was cut. The Providencia Mining & Milling Co., a Guanajuato concern that started milling in 1911, reports a gross production in 1912 of ₱627,380, and profits of approximately ₱105,517. The company's mill handled 55,852 tons of ore.

Mining concerns of the El Oro and Pachuca districts contributed materially to the success of the Mexican Light & Power Co. in 1912. This Canadian concern, owning the big Necaxa hydro-electric plant and supplying the districts mentioned as well as the Mexican capital, has gross earnings in the year just closed of ₱8,918,700, an increase of ₱672,441, and net earnings of ₱6,478,088, an increase of ₱884,905.

ZACATECAS.

BUTTE, MONTANA

HEARTLESS CORPORATIONS.—MODOC SHAFT.—CLARK CONCENTRATOR.

Under the new three-year contract between the unions and the mine operators of Butte, the miners should have received $3.75 instead of $4 per day in January. In other words, the price of copper for the month averaged lower than 17c. per pound. The contract calls for $4 per day when copper is over 17c., $3.75 when copper is between 15 and 17c., and $3.50 per day when copper is lower than 15c. The mining companies of Butte paid $4 per day in January regardless of the agreement. In other words, they gave the miners and other employees about $75,000. But it will not take the agitators long to trump up a motive for this generosity.

The feat of raising and sinking a shaft at the same time is a common occurrence at Butte. Sinking the Modoc shaft of the Anaconda Copper Mining Co. from the 1600-ft. level and raising at the same time from the 2800-ft. level of the High Ore mine has just been completed. The connections were exactly correct and reflect much credit on the surveyors in charge. The Modoc shaft has been equipped with a powerful hoisting engine and will be used as an auxiliary to the at present overworked High Ore shaft.

The Timber Butte Milling Co., a W. A. Clark enterprise, is rapidly rounding into shape its final plans for the concentrator in course of erection south of the city. An electric railway has been built to the site, a large machine-shop erected and equipped, and receiving ore-bins with a capacity of 1000 tons are in course of construction. The mill is to treat ore from the Elm Orlu zinc mine. It will be completed and in operation some time this summer, according to present plans.

Creditors of La France Copper Co. who recently bought in the assets of the company for $100,000 at sheriff's sale, have organized the Atlantic Mines Co., with a view to reopening the Lexington mine. Details of the new company have not been learned other than that the stock is to be sold at $10 per share.

After much talk and considerable delay, Butte is soon to have a cyanide plant in operation. The concentrator and cyanide plant of the Butte Central Copper Co. is expected to be operating full blast before February 15. The equipment of the mill is new and first-class in every respect, so that if the complex sulphides of Butte can be

cyanided profitably, this plant should do it. Also, if this plant proves a success, a marked revival in the silver zone of Butte will result, as the Ophir mine of the Butte Central has ore deposits typical of many of the silver veins in the western section of the district.

The Bullwhacker leaching plant is supposed to be in operation, but not much has been said about it lately. It is apparent that the details of operation are not successfully worked out as yet.

The Minneapolis, St. Paul & Sault Ste. Marie railroad is to spend $25,000,000 in the construction of a line across northern Montana, connecting with the Canadian Pacific again, north of the Idaho line. This work is to begin forthwith. It will open up new coal territory in eastern Montana and will tap some heretofore inaccessible mineral districts of western Montana.

JOPLIN, MISSOURI

ZINC PRICES SLUMP.—DECREASED PRODUCTION.—ACTIVITY IN AURORA.

Both spelter and zinc ore have rapidly decreased in price during the past few weeks, spelter now being quoted at less than $6.60 per cwt., East St. Louis, while zincblende has fallen to less than $50 per ton, assay basis of 60% zinc. The basis offerings range down to $40 for small and less desirable lots, while the choicest ores bring as high as $53. Only a few months ago zincblende sold for as high as $67 per ton, while the basis was as high as $64. Spelter, which reached $7.50 toward the close of 1912, has been falling steadily. The high price of this metal made it possible to import European spelter at a profit, and heavy importations were a big factor in 'bearing' the local offerings. As a result of low ore prices virtually every sheet-ground mine in the Missouri-Kansas-Oklahoma district has discontinued running double shift, and in some cases the mines have shut down altogether. Some of the larger producers are talking of forming a selling agency, disposing of the entire output of the district through a central office. This plan has been advocated, but as yet the operators have never been able to agree on any definite plan of action.

The United Zinc Companies has begun pumping operations in the Aurora district on a big scale, and as a result 29 new shafts have been started by lessees on the grounds of the companies. A centrifugal pump, with a capacity of 1600 gal. per minute, has been installed and is draining the ground to a greater depth than the level of any previous mining operations. Two other smaller pumping stations are now in operation by other companies in the Aurora district. The American Zinc, Lead & Smelting Co. has also begun extensive deep drilling in that district with the view to blocking out orebodies to permit milling on a large scale. The American company has been drilling at both Miami, Oklahoma, and Sarcoxie, Missouri, but has withdrawn from both.

H. C. Felker, a local abstractor of titles, has sold for fifty times the price he paid for it, a 4-acre tract of land in the heart of the Klondike district, 7 miles northwest of Joplin. Two months ago, while looking for a mining lease near the new Yellow Jacket and Yellow Pup mines, which have proved such prolific producers of high-grade zincblende, he decided on a location in the very heart of the mining region, but on which there was no trace of mining. In trying to find the owners of this land he discovered, to his amazement, that these four acres had never been taken up. He immediately placed a claim on this small strip of 'no man's land' and procured a title, the total cost being $10. He sold it to a mining company for $500 a few days ago.

One of the longest underground channels yet found in the district has been discovered at the Heather mine, Thoms Station. At a depth of 130 ft. the operators came into the cavern, which extends from the southeast to the northwest. It has been explored for a distance of almost a quarter of a mile with no trace of its end being found. Further exploration will be conducted when the water can be lowered sufficiently. The channel is unusually large and the sides carry ore, zincblende and galena being found.

With more mining development under way in all parts of the district than at any previous time, the gradual removal of the mine waters is of interest. Everywhere the water has been growing less, and in many districts it has been found necessary to extend pipe-lines to the nearest creeks or rivers for water with which to operate the mills. In the West Joplin group of mines, where there was too much water, instead of too little, prior to the recent activity, the drifts of all the mines are now dry and water is pumped from Short creek, several hundred yards distant. Similar conditions exist almost every place where mining has been conducted on a big scale. At Miami, Oklahoma, the water is being drained to a depth of 300 ft., and shallow operators are no longer forced to do any pumping. Formerly all the mines of this district found the water problem difficult of solution.

LONDON

FLOATING TIN MINES.—AUSTRALIAN TIN.

At the present time every promoter in London has some sort of Cornish property in hand, waiting for a favorable opportunity of floating it. But political affairs on the Continent are supposed to be preventing the ready subscription of capital. All sorts of properties have been acquired, including has-beens, 'never-wasers,' and unproved surface prospects. New companies are being registered every day. One has made its bow to the public this week, and as it has secured sufficient underwriting, the scheme will go forward without interruption. The company is called the Treburland Wolfram & Tin Co., and it has been formed to acquire a new property in the north of Cornwall, near Launceston, and situated at the contact of the Bodmin Moor granite batholith and the Devonian slates. On this property four veins are exposed for 1000 ft., varying from 5 to 20 ft. wide, some parts being in the nature of a stockwork. The depth so far attained is not great, 20 ft. being the maximum figure mentioned. The average content of the ore is given at 1% tin oxide and 3% wolframite. At the present time wolframite does not bring so high a price as tin oxide, and it is, moreover, difficult to sell, for tungsten has a limited consumption. Bodmin Moor is a district that has been neglected of late years, but with the high price of tin development ought now to be possible. The Treburland is evidently an outcrop property of great promise.

The tin people in London have been particularly interested in the developments at the new tin lodes discovered at Ardlethan in New South Wales. Not much London money has ever been invested in the tin industry of New South Wales, though it is well represented in the silver-lead-zinc mines at Broken Hill, and in the copper and gold mines in the Cobar and Mount Boppy districts. Hitherto the tin mines have been almost entirely gravel properties, situated in the Inverell, Emmaville, and Maryland districts in the far northeast of the state. Some years ago a lode deposit discovered at Buddigower, in the centre of the state, 300 miles west of Sydney, but it did not last long. The new discovery at Ardlethan is not far away, so that, though the outcrops are fabulously rich, the Government Geologist is chary about prophesying persistence in depth. Possibly the Australian correspondent may have something to say about this property, and I only mention it in its bearing on the spirits of London speculators. Though any participation in Ardlethan by English people is improbable, the richness of the deposit is being quoted as a 'bull' point for everybody interested in the future of tin properties in any part of the world. Comment is also made on the fact that the outcrop in the outskirts of a fairly populous town should go unnoticed for so many years. Boulders up to a ton weight assaying 40% tin have formed a feature of the landscape, but as they are covered with iron oxide and carbonate formed from the pyritic content of the ore, their true nature was not realized. The fact that surface deposits are still awaiting recognition is another point seized by those whose business it is to keep the investing public interested in min-

ing speculation. All sorts of facts of this kind are being collected as a counterblast to H. C. Hoover's recent gloomy prophecies as regards the future possibilities of the discovery of new orebodies on the surface.

SPOKANE, WASHINGTON

WORK AT CHEWELAH.—PRODUCTION FIGURES.

During 1911 the mines of the Chewelah district shipped a little less than 700 tons of ore to the smelters. During 1912 the shipments aggregated nearly 3500 tons. The International Diamond Drill Co. has taken contracts from the United Copper and Aurora companies for several thousand feet of boring. Drills for the work have been delivered on the ground, but operations will not begin before March 1. According to the report of Conrad Wolfle, president and general manager, the gross revenue from the United Copper mine for the year 1912 was $226,000, and he estimates that the output in 1913 will amount to approximately $660,000. A contract for 200 ft. of an adit on the Widow's Mite claims, one of the United Copper group, has been finished, and the showing is so encouraging that the adit will be continued. The United Copper Co. paid $40,000 in dividends in 1912, but suspended dividends after the November payment, in anticipation of a hard winter and increased costs of mining.

At the Standard-Chewelah mine two north-south veins have been opened by shafts, and a vertical shaft about midway between them, formerly sunk to a depth of 200 ft., has been re-timbered. Ore assaying about $75 per ton in copper was found in the east vein at a depth of 75 ft. In the vein west of the vertical shaft a shaft was sunk 40 ft. on a 30-ft. vein, showing ore up to about $50 per ton value in copper and 2 oz. silver per ton. From the vertical shaft a cross-cut has been driven eastward 175 ft. and has about 75 ft. farther to run to strike the east vein. A cross-cut from the same shaft is in 200 ft. toward the west vein and is expected to reach it 35 ft. farther. A 75-hp. boiler and pump have been installed in the vertical shaft, and an air-compressor and hoisting plant will be erected as soon as the cross-cuts are completed. The company expects to begin shipping ore in 60 days. The boiler and other equipment lately purchased by the Gold Cube Mining Co. are now on the ground. An adit has been driven 150 ft. by hand.

The Blue Star Mining Co.'s affairs have been adjusted, and operations will be resumed about March 1. The Allandale Mining Co. has closed a contract for 150 ft. of development work on claims near Blue creek. From the Clugston mine the first carload of ore has been shipped, making 40 tons, and smelter returns show an approximate profit of $21 per ton. At the High Grade mine exceptionally rich copper oxide and silver ore has been developed on the 120-ft. level. The company will sink deeper and drive on it.

The Nellie S. Mining Co. has been reorganized, and is now the Arcade Mining Co. The capitalization has been raised from 500,000 to 1,500,000 in $1 shares. It is planned to sink to the 200-ft. level and explore for shipping ore. A shaft is being sunk and timbered on a small vein on the Juno-Echo mine. At a depth of 200 ft. a cross-cut will be driven to a wider vein, and ore will be stoped. The wider of the two veins has been developed by open cuts and large quantities of ore have been mined. The Chewelah Development Co., organized by local men, has secured a 2-year bond on two tracts of land at the north end of the Chewelah district, with the mineral rights, and have started an adit to develop two veins at respective depths of 200 and 220 ft. The adit is now in over 20 ft. On the Copper Jack claim of the Metahorn group rich ore 3 ft. wide has been cut in a shaft at a depth of 40 ft. The U. S. Copper-Gold Mining Co. is extending an adit from the east side of a group of claims, under contract, expecting to reach the vein about 60 ft. ahead. The Castle Creek Mining & Smelting Co., at Park City, 25 miles east of Republic, is erecting a 100-ton concentrator, expecting to ship concentrate to the Granby smelter.

NEW YORK

EASTERN FINANCIAL SITUATION.—COPPER MARKET.—GUGGENHEIM REPORT.

The situation at Eastern financial centres can probably be best described as one of feverish interest, but altogether without activity. For the past two years or more the public support given to the financial institutions of the East has taken the form of purchases of preferred industrial stocks and public utility issues as distinguished from any kind of speculative trading. The increased cost of living has created an unparalleled demand for securities of higher yield than the so-called gilt-edged railroad bonds and similar issues that return to holders but 4½ to 5% per year. The result has been a distinct change in the manner of the inflow of capital to Wall Street. The trader who sought for market profits in the fluctuations on the floor of the Exchange has been very largely educated into an investor. The recorded volume of business on the Stock Exchange and in the outside market has shrunk to what is very nearly an irreducible minimum. Along other lines the activity was never greater. The public has absorbed many millions of the securities of manufacturing companies, traction companies, hydro-electric light and power companies, and all this to the exclusion in large part of the flotation of anything pertaining to mining. "The old order changeth," and there must necessarily be some striking readjustments before Wall Street as a whole can hope to enjoy a steady, thrifty, and well distributed volume of business.

The copper situation cannot be said to have improved. The figures of the Copper Producers' Association show an increase of 17,885,750 lb. of copper in accumulated stock. January production was a trifle larger than for the month of December. So far as the copper market is concerned, the consumers seem to be as fully in command of the situation as were the producers a few months since. The price concessions which have been made so far seem to have in no degree altered the attitude of the manufacturers, who have been so unbroken in their stand against accumulating any copper. It has been found during the past few days practically impossible to elicit any kind of an opinion or discussion of the situation among copper people. Among those who will talk at all, no two agree. Some copper was offered this week at less than 15½c. per pound, with no takers, and it is stated that some sales were actually made as low as 15c. The red metal seems to have something that makes it most attractive to big, wide-visioned speculators, but it seems also to be, as a vehicle for speculation, exceedingly hard to control. If, as might possibly be argued from the present outlook, those powerful interests who have succeeded in advancing copper from below 13c. to above 17c., and whose activities began with the inception of the so-called policy of curtailment, and whose circle includes so much of the banking strength of the world, are now to find themselves unable to dominate the situation, then it must hereafter be considered foolhardy to attempt any regulation of the copper-metal market.

Some encouraging news regarding discoveries in several of the younger properties has been finding its way to the market-places. Superior & Boston, a neighbor of the Old Dominion at Globe, Arizona, is stated to have recovered the Old Dominion vein after having driven along a fault for several hundred feet. Where the vein has been picked up it has been found to be very rich and the orebody extensive. There has been, especially for Boston account, quite a little quiet accumulation of shares. The Shattuck-Arizona, one of the showy producers among the smaller and newer copper mines, has reported a discovery of a large body of lead ore on the 600-ft. level. Shipments of one carload per day will be made to the El Paso smelter. From present indications this new source of revenue will add somewhere between $30,000 and $40,000 per month to the company's income. Evidently, all of the negotiations which some three months ago were under way for the purchase of the Shattuck have been dropped. Recent developments at the property have been so encouraging that

the differences between buyers and sellers have been increased rather than diminished. The history of the Majestic Copper Co. has been for the most part one of reorganizations and disappointments. Perhaps the present shareholders are now to receive some reward for their patience. On the Old Hickory ground, according to announcement, there has been found in an open cut a 20-ft. face of ore, 8 ft. of which shows a copper content of 25 to 35%. Twenty carloads of ore are said to have been shipped, and what is apparently the same body of ore is thought to have been opened in one of the mine workings on a level 135 ft. below the open cut.

The board of directors of the Butte & Superior has been partly reorganized, with N. Bruce MacKelvie, of Hayden, Stone & Co., as president, succeeding A. B. Wolvin. It is the general understanding that the greater part, if not all, of Mr. Wolvin's holdings in Butte & Superior have been purchased by Hayden, Stone & Co., though Mr. Wolvin retains his place as one of the directors. The board is reduced from nine to five in number, and the new board consists of Mr. MacKelvie, Kurnal R. Babbitt, who is the head of the legal department of the various Guggenheim organizations, D. C. Jackling, Mr. Wolvin, and C. W. Peters, the last named being a part of the organization of the New York office of Hayden, Stone & Company.

The annual report of the Guggenheim Exploration Co. appeared this week, the chief item of interest being the increased holdings in various subsidiary enterprises. As compared with a year ago, the company's holdings in Yukon Gold have been increased by 65,000 shares, while during the same time there have been purchased 97,750 shares of Chino and 121,200 shares of Ray Consolidated copper. Both of the latter are expected to pay their first dividends during the current year. This is foreshadowed by the statement of the president that, while the new purchases have necessarily reduced the earnings available for dividends, it is expected that such earnings will be materially increased in the near future. Ray Consolidated is expected to produce 50,000,000 lb. of copper during 1913 at an average cost of not more than 9c. per pound, while Chino is expected to hold undisputed first place among the low-cost producers; some of the monthly reports showed a copper cost for Chino of 7c., and the management is promising to turn out a year's output at not above this figure. Realization of this prediction will make Chino easily head the list of producers.

The annual report of the Giroux Consolidated Mines Co. has just been given out, and evidently has not been any too well received by the shareholders, as the issue has been one of the 'soft spots' of the market for the past three or four days. During August, September, and December, which were the only months when exclusive underground mining was carried on, there was produced about 3,750,000 lb. of copper at a cost of 10.8c. per pound, exclusive of extraordinary development and construction costs. The financial report shows current assets of $717,000, liabilities of $649,000. Present shipments to the Steptoe smelter total about 1100 lb. per day, the ore averaging from 2.15 to 2.31% copper.

The Cripple Creek merger is gradually taking shape. The Colorado Mines, Railways & Utilities Corporation has been incorporated, with a capital of $25,000,000, under the laws of Delaware. The merger is to include the El Paso, whose stockholders are to be taken into the new company on the basis of 6 shares of the new stock for 5 shares of their present holdings. The Golden Cycle mine and smelter are to be bought for cash by a syndicate, which will underwrite a sufficient amount of new stock to furnish the cash required to make the purchase. The Golden Cycle mill treats a large part of the ores from the various mines of the district, and the company has very few shareholders outside of John T. Milliken and his immediate associates. The president of the new corporation will be Allan L. Burris. The operating staff will be headed by Richard A. Parker, who was at one time associated with the late Cecil Rhodes. The consulting engineer will be J. H. Hammond, and the engineer in charge will be John H. Nichols, who has heretofore been superintendent of the El Paso.

The annual report of the San Toy Mining Co. is interesting in the light that it throws on the conditions prevailing in Mexico. During the year there was mined 7321 tons of ore of a gross value of $314,884, producing net earnings of $106,458, out of which dividends to the amount of $60,000 were paid, leaving $46,458 to be carried forward to surplus account. Covering the unsettled conditions, the report says: "The unsettled political conditions which have prevailed during the past year have made operation difficult and results disappointing. While production has not been greatly curtailed, and while our direct losses have been confined to a ransom of $2500 paid for the release of our superintendent, who was captured by outlaws, the indirect adverse effects have been many. Chief among these is the delay in carrying on diamond-drill exploration. For this reason no progress has been made toward the discovery of orebodies at depth, and all that it is possible to say on that point is that if, on the one hand, nothing has been done to prove the correctness of our theories, on the other hand nothing has occurred to cause any lack of confidence in them.

JOHANNESBURG, TRANSVAAL

DIAMOND MINING.—GOLD MILLING COSTS.—MEYER & CHARLTON PROFITS.

Outside the gold-mining industry, diamonds perhaps attract the most attention just now, as prices are slowly advancing and are expected to be maintained for some time. No new mines of any promise are being opened, and the total production of mine diamonds is not increasing, as is the case with alluvial stones. Copper and tin are not produced to any extent in the Transvaal, only one promising copper mine, the Messina, being at work, which in November shipped 214 tons of concentrate. Of tin, 198 tons of concentrate was shipped, but this shows a marked falling away as compared with a short time ago, and is far from coming up to expectations when full consideration is taken of the huge tin-bearing areas in the northern Transvaal and the high price ruling for tin today. Miscellaneous minerals to the amount of £12,330 were produced in November, but are divided into so many items that detailed notice is unnecessary.

The improved grade of ore sent to the mills on the Rand since the beginning of 1912 was maintained in November, the average for the whole of the Rand being 28s. 2d., as against 28s. per ton in October. Working costs were, however, 2d. per ton higher, so that, as is usual on the Rand, what was gained by sending better ore to the mills was neutralized by the higher cost of working. Another feature of the November returns was the maintenance of increased working profits every month in 1912 so far, showing quite a respectable increase in the working profits, until at the end of November the increased profits reached £1,196,557 as compared with the corresponding period of 1911. The position will be perhaps best explained when it is stated that the increased gold output in 1912 may be somewhat similar to that of last year, but the increased working profit, £1,196,557, for the first eleven months of 1912, compares with an increase of only £157,704 during the corresponding period of 1911. The lowest working cost in November attained on the Rand was 11s. 3d. at the Simmer & Jack Proprietary Mines, the Knights Deep following with a cost of 11s. 8d. per ton, thus confirming the estimate of the consulting engineer of the Consolidated Gold Fields that the acquisition of the Simmer East property by the Knights Deep would add but little to the working cost. About the highest yield obtained on the Rand in November was 42s. per ton, and only three mines were able to show such a yield, the Meyer & Charlton showing the highest profit with 25s. 6d. per ton. The only mine of any importance to show a loss was the Lancaster West, where with a yield averaging 21s. per ton, a loss of £1814 was made. Several mines on the Rand are making good profits with a similar yield, while, with no better yield, the Langlaagte Estate is paying good dividends.

General Mining News

ALASKA

There are now 16 incorporated towns in the territory. Reports from eight of them which have caused an assessment of property to be made, and a tax levied, showed a valuation of $8,432,603. The average tax is 1.14 per cent.

During the year 1912 the Alaska Packers Association's pack was 1,202,779 cases of salmon, 15 canneries being operated and their value being $4,336,262. The Association owns 9 ships, 11 barks, and 62 steamers, the total number of vessels being 86, valued at $1,362,000. Six medical stations are maintained in Alaska, and two salmon hatcheries, from which 107,520,000 red salmon eggs were taken.

Cordova

On January 19 a serious fire occurred at the Bonanza mine, an overheated stove setting fire to the loading station, resulting in the tramway being put out of commission, as the heavy cables fell into the gulch below, carrying away 10 towers. The loss will be about $50,000.

Fairbanks

Lawrence & Albrecht, working on 9 Below, bench claim, Tenderfoot creek, uncovered gravel 5 ft. deeper than a former prospector went some years ago. At the Hudson quartz claims, between Ready Bullion and Moose creeks, drifts are being driven 200 ft. from the bottom of the 100-ft. shaft. The 2-stamp Nissen mill is idle at present. The Chatham mill, of two 2-stamp Joshua Hendy mills, is kept busy on 3 Above, Chatham creek. The Newsboy mill is crushing ore from the Overgaard mine.

At Ruby, there are about 13 parties busy on Long creek, some of which are getting encouraging results. Next spring American creek, in the Hot Springs district, will be busy. There is no continuous deposit there, but good gravel has been worked for three miles, and the coming season is expected to be better than 1912.

Valdez

From the Fidalgo Mining Co., 150 tons of ore, worth $20 per ton, is to be shipped to Tacoma. Ten men are employed at present. From the adit, a surface tramway 900 ft. long is connected with a 100-ton bin, from which an aerial tram 2000 ft. long connects with a 500-ton bin. The wharf is 150 ft. long, and has 26 ft. of water at low tide. At the Alice mine, on Shoup bay, three shifts are sinking the shaft. To date $30,000 has been spent on development. It is intended to drive an adit 200 ft. on the Golden Eagle claim, at Golden, Port Wells. The vein has been opened for 100 feet.

ARIZONA

Cochise County

It is stated that the American Smelting & Refining Co. has taken charge of the properties of the Development Company of America, including the Silverbell, Tombstone, and Christmas, and the smelter at Sasco. F. C. Earle, manager of the El Paso smelter, is arranging to reopen the mines and smelter, which will be operated independently of the El Paso plant. The *Bisbee Daily Review* contains a report by B. O. Pickard on the Gleeson district of this county. The town of Gleeson is reached by two railroads. The Warnekros mines are close to the town. The Copper Belle, leased to the Shannon Copper Co., ships 200 tons of heavy pyrite ore daily to Clifton, Globe, and Tucson smelters. From the Gleeson mine a good deal of ore has been shipped. In the El Tejon, a shaft is being sunk to 500-ft. depth. The Silver Bell mine is a rich lead-silver property, but has been the subject of litigation for many years. An important development has been made in the Uncle Sam workings of the southwest shaft of the Copper Queen mine. Now that its length and width are known, it will be prospected at 200 ft. lower.

In January the Phelps-Dodge mines produced 12,237,331 lb. of copper, of which the Copper Queen produced 6,828,346 lb., Montezuma 2,913,294 lb., Detroit 1,769,071 lb., and custom ores 726,620 pounds.

Gila County

(Special Correspondence.)—The 50-ton test plant for the Minerals Separation flotation process, recently built at the Inspiration mill, was erected and put in operation in 16 hr., which must be a record for construction work.

Globe, February 7.

A promising copper and gold district exists near Payson, in the northwest part of this county. It is connected by stage with Globe, 100 miles; Winslow, 75 miles; and Mesa, 125 miles. Most of the ores are free milling. The Golden Wonder has been opened to the sulphide zone, a depth of 150 ft., and yielded $50 per ton by amalgamation, the tailing containing $10, owing to pyrite. The copper lodes are in porphyry. The altitude of Payson is 5000 ft., climate is good, and there is plenty of water and timber. There are many ancient ruins in the vicinity.

Graham County

The Shannon Copper Co. produced 1,232,000 lb. of copper in January, as against 1,360,000 lb. in December.

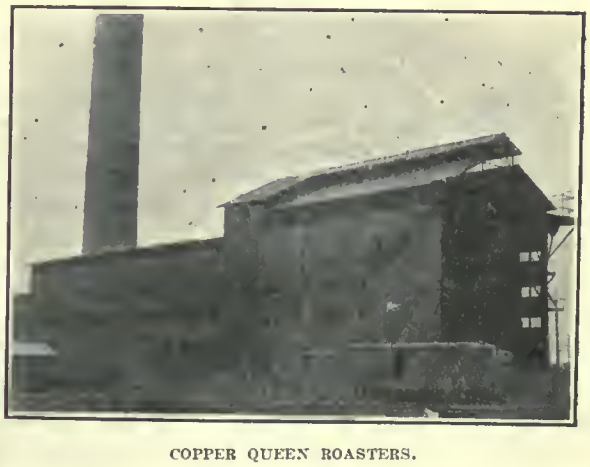
Mohave County

Eighteen miles of copper wire, leading from the power-station at Needles to the Tom Reed mines, has been stolen, and 8 tons was shipped to Los Angeles. The poles were also taken by the thieves. The wire was worth $1000 per mile, and that portion which was not sent to Los Angeles was found coiled on the banks of the Colorado river opposite Needles.

At the Gold Road mine 140 men have been laid off. The mine has a lot of ore broken in stopes, and the mill is being overhauled. The Tennessee mine is shipping 200 tons of ore per day to Needles, and the Golconda, two cars to Oklahoma. From the Smith-Hoffman mine, a Saurer truck recently brought in 6 tons of rich silver-lead ore.

Yavapai County

At the Climax mine the new air-compressor and three machine drills are at work, while the mill is being overhauled. The Big Seven group, near Harrington, has opened 36% copper ore. A mill will be erected at the Hooper mine on Ash creek. Good progress is being made at the Black Chief mine, in the Black Hills, in unwatering and cleaning out old workings. Good ore has been opened in the old Gladstone claim. The dredge of the Speck Mining Co. is being moved 1½ miles down Lynx creek. Preliminary work is being done at the placer claims of J. Philips, about 10 miles south of Prescott. From the Silver Tip mine, on Turkey creek, 7½ tons of ore, averaging 54 to 110 oz. of silver, has been sent to El Paso. The Monte Cristo shaft is down 650 ft., and rich silver ore has been opened.



COPPER QUEEN ROASTERS.

The Humboldt Consolidated Mines Co. will sink its North Star shaft to 250-ft. depth. At the Haynes mine 30 men are doing development, including shaft-sinking. Ore 2 ft. wide has been cut on the 800-ft. level of the Pick and Drill mine. A cave-in at the Laura claim exposed a vein of good ore. The Anderson patent amalgamator at Mayer has been moved to Lynx creek, where there is plenty of

water. Ten per cent copper ore 11 ft. wide has been opened in a drift from the winze in the Commercial Mining Co. mine at Copper Basin.

CALIFORNIA

Amador County

(Special Correspondence.)—The 20-stamp mill at the Hardenburg mine is about finished, and it is expected that milling will commence before the end of February. The plant has a daily capacity of 100 tons. An option has been taken on the Crown Point and Yellow Jacket claims, in the Drytown district, by H. DeC. Richards, of San Francisco. The property has been idle for 20 years. It is rumored that good ore has been intersected in the upper portion of the Plymouth Consolidated mines. Considerable prospecting is being done at the 1600-ft. and upper levels. It is stated that George W. Brown is reported to have sold his South Jackson property for $25,000 to Eastern people. The shaft at the Memphis is down 200 ft. and is being sunk 100 ft. farther. From this point a cross-cut will be extended to intersect the vein. The mine is near Drytown, a short distance north of the Fremont-Gover group. It is being operated by Monteverde & Scharoni Bros. Small shipments of rich ore continue to be made from the Mountain Queen mine, near Pine Grove, 9 miles from Jackson. Fair progress is being made cleaning out débris from the caved portion of the South Eureka shaft, and about 125 ft. has been placed in working condition. It is still impossible to accurately estimate the extent of the damage, although sufficient work has been done to allow escape of the gas from the lower workings. Meanwhile, operations continue suspended at both the South Eureka and Central Eureka mines.

Jackson, February 2.

Nevada County

Some rich ore has been opened in the Osceola vein, in the Rough and Ready district, by E. W. Tarr. The claims in this locality have not been worked to any extent during latter years.

Shasta County

The Stowell group of copper claims, between the Balaklala and Iron Mountain mines, has been bonded to the United States S. R. & M. Co., the parent company of the Mammoth Copper Co. of Kennett. The bond is for $75,000, for one year. Development has begun by the Mammoth company. These claims were once bonded for $200,000, but the price was too high. They are near the Mammoth smelter.

Sierra County

Water in the Sierra Buttes flume has reached the mine, and work underground can be resumed after a shut-down caused by the water freezing. A small snowslide started at the side of the dump-shed of the Monte Cristo gravel mine last week, but no damage was done; while at the Telegraph and White Bear mines timber and air pipes were scattered about by another slide. At the Keystone work has been resumed, the danger of snowslides having passed. Owing to the heavy fall of snow this winter, there will be plenty of water for all mining purposes in the coming spring and summer. The Alleghany Mining Co., which owns the Balsam Flat mines on Lafayette ridge, will extend its adits to cut the gravel to the east of the old workings. B. Gordon is superintendent. The Mt. Alta mine at Pleasant View has uncovered a large gravel deposit which will be worked as soon as possible. At the New York tunnel a snowslide over 300 ft. wide demolished all the buildings. A good deal of the timber will be recovered. Probably an electric-power plant will be erected near Sierra City to supply power for the Sacred Mound property. It is stated at Forest that the Covotoman and Young America gravel mines will be reopened.

COLORADO

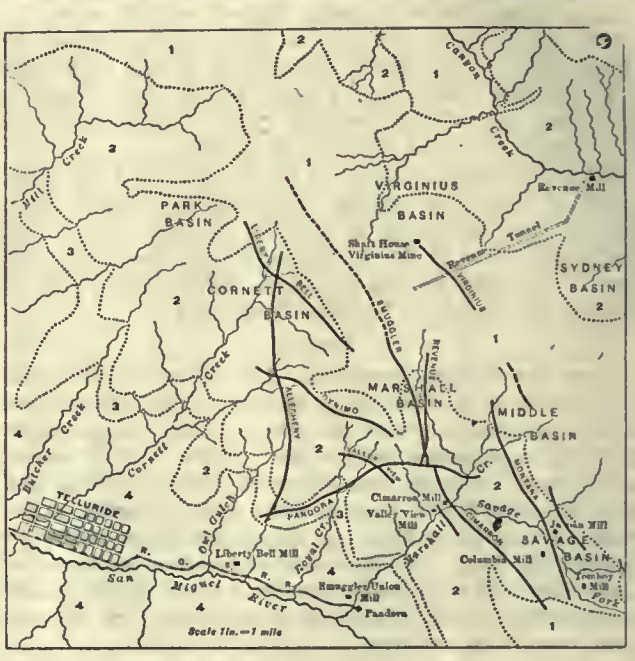
Clear Creek County

(Special Correspondence.)—Work will start this week in preparing the Capital adit for the installation of the electric trolley system. Under the terms of agreement the Onondaga Mining Co. pays all costs of the improvements in lieu of being granted a perpetual right of way. Construction work on the new mill building for the Dives-Pelican and Seven-Thirty mines will be instituted soon. G. W. Tarkington, general manager, has returned from a southern trip, and funds have been secured for large development. The operating company will build an aerial tramway from the dumps of the Colorado Central mine, the terminus to be at the new mill. Shipments have been started from the Tobin mine in East Argentine. The first-class ore mills from $275 to $300 per ton in gold, silver, and lead. Johnson & Co. are operating under lease. Hanson & Co. have secured a lease on a block of ground on the Paymaster vein that was intersected by the Wilcox adit 4000 ft. from the portal. The streak is 10 in. wide, and will mill close to $80 per ton in silver and lead. It is stated that work will be resumed during the present month on the Marshall-Russell adit on Miller mountain. The adit that has been driven 7000 ft. will be extended 5000 ft. farther.

Georgetown, February 3.

Gilpin County

The claims of the Calhoun Consolidated Mines Co., on the east slope of Quartz hill, have been leased for three years by the Mountain States Investment Co., which will do extensive development, the mines already being opened



MAP OF SAN JUAN DISTRICT.

from 290 to 980-ft. depth, and a length on the Calhoun vein of 3500 ft. These claims were located in 1859. The Bullion Mining & Milling Co. is opening rich silver ore in its adits. In the Evergreen mine, at Apex, three ore-shoots have been cut on the 350-ft. level, carrying 8 to 20% copper ore.

Gunnison County

The Maid of Athens and Citizens mines, seven miles from Pitkin, shipped 23 cars of ore in January, making 45 cars since last October. Both mines are worked by one adit, and 20 men are employed, by the lessee, F. Ballou, of Denver. J. F. Robinson is superintendent. Total production is about $500,000.

Lake County (Leadville)

Owing to the drop in prices of zinc, all ores below 25% will not be accepted by smelters, and consequently a number of mines are not being fully worked. The flow of water in the Yak tunnel winze became so heavy that another pump had to be installed.

Ouray County

During January the Mountain Top adit was extended 360 ft. in hard rock, equal to about 12 ft. per day. In the Humboldt, the north drift has opened high-grade ore

for 150 ft. in length. At the old Ouray foundry, an effort was made to smelt a quantity of copper ore in the blast-furnace, and pyrite smelting was tried with a fair degree of success. It is proposed to sell the Red Mountain property again, the owner, J. F. Thompson of California, having bought it in September last. During January 65 cars of ore and concentrate were shipped from Ouray. Total costs on the Monntain Top adit in January were $14.76 per foot driven.

The Smuggler-Union 60-stamp mill is in full operation after a shut-down of 30 stamps for a few days. The traction cable of the Tomboy new tramway is about finished. The Rico-Argentine company has constructed a short tramway, which will reduce haulage costs. The Suffolk mill at Ophir is handling 150 tons of ore per day. The Kuehn patent amalgamator is to be tried in the district shortly.

SAN JUAN COUNTY

Following are the shipmenta of concentrate and crude ore from the Silverton district during January. Concentrate: Sunnyside 675 tons, Iowa Tiger 250, Silver Lake 300, Vinyard & Co. 125, and Gold King 550 tons; total 1900 tons. Crude ore: Gold Tunnel 225 tons, Dives 75, and Ed. Fiant 50 tons; total, 350 tons.

SAN MIGUEL COUNTY

The Ophir Gold Mines, Milling & Power Co., at Ophir, is operating the Suffolk group of mines, which produced $2,000,000 in three years. The ore averages $5 per ton in gold, and will be treated in a 20-stamp mill, with 850-lb. stamps, the boxes having ¼-in. screens. Ore will be crushed in cyanide solutions, and classified in a Dorr classifier, the coarse material being reground in an 8-ft. Hardinge mill. The slime is thickened in a Dorr thickener, and agitated in a new Dorr machine. Pulp is then to be treated by continuous decantation. Solutions are kept up to 85° Fahrenheit.

TELLER COUNTY (CRIPPLE CREEK)

According to local statistics, the January output was as follows:

	Tons.	Value.	Total.
Smelters	3,872	$65.00	$ 251,680
Golden Cycle	28,500	20.00	570,000
Portland	9.876	21.00	207,396
Portland (C. C. district)	15,100	3.14	47,414
Stratton's Independence	11,100	2.76	30,636
Colburn-Ajax	4,650	3.20	14,880
Wild Horse	1,100	3.80	4,680
Gaylord-Dante	1,200	3.00	3,600
Kavanagh-Jo Dandy	1,500	2.10	3,150
Isabella	740	1.50	1,110
Total	77,638	$15.40	$1,134,540

The Isabella mine produced 85 cars of ore, shipped mostly by the 20 sets of lessees. During the past year 11,000 ft. of development was done, and the tonnage was between 1600 and 1800 tons per month. At 1275-ft. depth, a shoot is being mined near the shaft. Four Chilean mills are being installed and four Dorr classifiers at the Blue Flag mill. The biggest suit known in the district involving apex rights has been started by the El Paso Consolidated Gold Mining Co. against the C. K. & N. Mining Co. It involves $1,000,000 damages and complete ejectment from operation. Last week the El Paso attorneys served notice on ore buyers that ore from the C. K. & N. mine was the property of the former. The annual meeting of the Portland Gold Mining Co. was held at Cheyenne, Wyoming, on February 3. The old directors were re-elected, the consulting engineers being M. Boehmer, Hills & Willis, and C. W. Merrill. The report of the president, F. G. Peck, dealt with the treatment of the ore, especially in the low-grade mill. At the Colorado Springs mill, two Merrill filters, each of 200-ton daily capacity, were installed. The Victor mill is doing well. The concentrating department was enlarged, and more agitators added. The year's production in this mill was 173,361 tons, yielding $547,424, of which $203,413 was profit. The average value was $3.15, and profit $1.17 per ton. The plant is now treating 500 tons per day. The mine is in first-class condition, and No. 16 level is opening satisfactorily. The Roosevelt drainage tunnel should lower the water 600 ft. below the present workings. During 1912 the total output was worth $1,534,840. Operating costs were $1,091,020, and net profit $322,745. Dividends paid were $240,000, or 8% on the capital of $3,000,000. On January 1, 1913, the balance was $1,782,019. There is some talk in Cripple Creek of erecting a mill to treat 1000 tons of low-grade ore per day, of which apparently plenty can be procured worth $3 per ton and over.

IDAHO

SHOSHONE COUNTY

Records at Wallace show that 9 ft. of snow fell in the Coeur d'Alene mining region in January. The Kearns tunneling machine is to be tried in one of the mines. The Snowstorm mill at Mullan is treating 150 tons of ore per day, this averaging between 2 and 3% copper. The capacity will soon be up to 200 tons. The Federal Mining Co. will probably extend the Standard-Mammoth lower adit through the Cleveland-Greenhill ground recently acquired, into the Tamarack & Custer Consolidated, and eventually into the Hercules, cutting the latter lodes at 500 ft. from the surface.

A 50-ton concentrating plant and a 150-ton capacity aerial tramway will be built for the Idora Hill Mining Co. The latter will be 2000 ft. long, with a drop of 1100 ft., and will discharge automatically into a 500-ton storage-bin. From here the ore will pass over a grizzly and crusher into a 200-ton mill-bin. The silver-zinc ore will be crushed by rolls and concentrated by jigs, revolving screens, and some tables. Power will be supplied by the Washington Water Power Co. The mine has been opened to a depth of 600 ft. and can be developed 1100 ft. deeper by an adit. The mill product will average 50% lead, 25 oz. of silver, and 45% zinc, the crude ore being worth 10% lead, 4 oz. of silver, and 3 to 5% zinc. Glen A. Collins is general manager at Wallace.

MONTANA

CASCADE COUNTY

At the 500-ft. level of the Florence mine at Neihart, driving south of the fault is in progress, the value of the ore is improving, and stoping will be soon started, after which work will be done on the 300-ft. level, south of the fault. Since January 18, seven cars of ore have been shipped, the last two cars giving a net return of $600 per car.

DEER LODGE COUNTY

At the Southern Cross mine all machinery is on the property and the main shaft will be sunk a further 200 ft. The Oro Fino group promises to be a good producer. Ore shipments from the Hold Fast lease will be made this winter to the smelter. The Butte & Anaconda, Red Lion, and Big Bill groups, on the western slope of the Cable mountains, are being actively worked. Good ore has been opened in the Hidden Lake mine, on the eastern slope.

GRANITE COUNTY

The Sunday mine has been acquired by the Royal Mountain Mining Co., and will be developed under the direction of J. L. Meixell, of Butte.

LINCOLN COUNTY

(Special Correspondence.)—S. G. Ratekin and John Flaveli left on January 31 for the St. Paul mine, near the Snowshoe property, where they will continue work on the adit which is being driven on the lode. This adit is now in about 450 ft., work having been kept up almost continuously for a long time. The vein shows good metal content on the Snowshoe side of the mountain, but the adit is being run from the Cherry creek side, as it is possible in this way to get about 1500 ft. lower down on the vein. The ore-shoot has not yet been cut from this side; but that one exists not far ahead is almost certain, as it shows in the outcrop above. The owners expect that the ore-shoot will be reached 50 to 100 ft. farther on. The St. Paul is owned by F. M. Plummer, S. G. Ratewin, and M. A. Shanahan, all of Libby, and has long been considered one

of the most promising silver-lead properties in the Libby district.

Libby, February 4.

SILVERBOW COUNTY

(Special Correspondence.)—The North Moccasin mine of the Barnes-King company is opening well, and during the first five weeks of the run the net value of ore treated was $32,000, of which $18,500 goes to the company, and $13,500 to the owners of the North Moccasin. Good results are also reported from the Piegan-Gloster mine.

Butte, February 8.

The production of the mines at Butte segregated according to properties, was as follows during January:

	Tons.	Copper per ton, lb.	Total, lb.
Boston & Montana group	102,120	65	6,637,800
Anaconda group	160,000	61	9,760,000
Butte & Boston	13,720	62	850,640
Washoe	7,100	61	433,100
Parrot	2,900	60	174,000
Trenton	12,200	61	744,200
North Butte	30,120	70	2,108,400
Butte Coalition group	34,000	70	2,380,000
East Butte	10,820	110	1,190,200
Tuolumne	4,600	120	552,000
Original	10,200	60	612,000
Alex Scott	7,500	110	825,000
Davis-Daly	2,400	110	264,000
Total	397,680		26,531,340

The Washoe and Great Falls smelters produced 20,948,000 lb., a decrease of 2,500,000 lb. compared with January of 1912.

NEVADA

LINCOLN COUNTY

The Mendha Nevada Mining Co. is to resume ore production. A large Hancock jigging plant will be installed, and about 400 tons per day will be treated for shipment. Water has given a lot of trouble at the Nevada Des Moines.

LYON COUNTY

The Mason Valley smelter received the following ore during the week ended January 28:

	Tons.
From Mason Valley mines	1,844
From Nevada-Douglas	3,287
From outside mines	975
Total	6,106

Fourteen carloads of matte were shipped from the smelter. Development on the 750-ft. level of the Mason Valley mine continues, and the sprinkling system installed is keeping the dust down. From the Malachite mine regular shipments are made to the Thompson smelter; while the Bluebird & Aurora, Yerington Bullion, Shay, Nevada-Denver, Bialne, Guthrie Fraction, Boulter, Copper Belt, Blue Jay, and New Yerington are busy on development and shipping ore.

NYE COUNTY

During 1912, the Tonopah Midway Mining Co. produced 694 tons of ore worth $20,925. The total revenue, including sale of stock was $70,475, and expenditures $63,951, leaving a balance of $6524. Development covered 2627 ft., making a total of 38,063 ft. The new shaft is down 330 ft., and it is hoped to cut the Merger vein by cross-cutting.

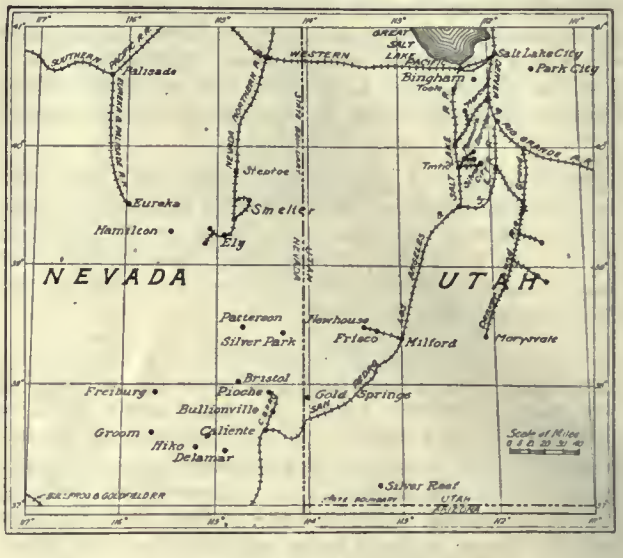
During the week ended February 8, Tonopah mines produced 11,071 tons of ore worth $231,590, making a total for the current year of 63,941 tons and $1,336,420.

S. H. Brady has enjoined the Manhattan Amalgamated Mining Co. from working within the lines of the Manhattan Earl, and is suing for the recovery of the value of 1000 tons of ore worth about $20 per ton, alleged to have been extracted by the company. The total damages are $66,000. The suit is somewhat complicated and has been expected for some time.

At the Mushett-Wittenberg lease on the Big Pine, an electric hoist and head-frame have been erected. Sampling of the Big Four shows 200,000 tons of $10 ore available for treatment.

WHITE PINE COUNTY

The Giroux Consolidated mine is producing 1100 tons of ore per day, from about 200-ft. depth. During January the 700-ft. cross-cut in the Ely Consolidated was advanced to 401 ft. from the Zack shaft, the last 30 ft. being in iron-stained porphyry. During its past year, the company spent $52,460 on development, and had $15,000 on hand at the end of 1912. Work is to be resumed at the Gladys shaft of the Ely Calumet.



PART OF EASTERN NEVADA.

NEW MEXICO

GRANT COUNTY

(Special Correspondence.)—At the Chino mill the double-decking of all Garfield roughing tables, on three sections of the plant, is finished, and the other two sections will be done as soon as possible. It has been stated that the mill capacity will be increased to over 20% by these alterations; but this is not so, although the recovery effected by the roughing system circuit will be increased, due to the relief afforded a machine of this type when the tonnage per deck is reduced by 50%. It has been possible to treat 1500 tons of ore per 24 hr. per section, with the single-deck Garfield tables included in the flow-sheet, but the vanners are fully loaded and further increase in tonnage would be of doubtful benefit.

Hurley, January 30.

The copper production of the Chino mine in January was 3,055,821 pounds.

SAN MIGUEL COUNTY

The Tecelote Copper Co. owns 12,000 acres, on which 25 lodes have been found, but only one has been developed. One shaft has been sunk 600 ft., and about 10,000 ft. of driving and cross-cutting done. One dump on the surface contains 75,000 tons of ore. It is stated that 3,000,000 tons of ore has been opened, which will average 4% copper and $15 per ton in gold and silver. Foundations for a smelter to cost $200,000 have been laid, and by October it should be in operation. There are about 1200 men employed in the Tecelote district, which is 40 miles west of Carbo, on the Southern Pacific de Mexico railroad. W. B. Duvall, of New York, is president, and Ricketts & Banks consulting engineers.

UTAH

JUAB COUNTY

The Yankee Consolidated Mining Co. paid a dividend of 1c. per share on February 1. During the past year, ore shipments totaled 11,406 tons, and total revenue was $86,817. Expenses were $66,918, leaving cash at January 1, $19,909. Development on the 1800, 1900, and 2000-ft. levels covered 3314 ft., and thirty-one 50-ton cars of ore were shipped, av-

eraging 35 to 40% of zinc, yielding net smelter returns of $23 per dry ton. Since January 1, fair ore has been opened on the 1800-ft. level. Twenty-eight Tintic mines produced 43,250 tons of ore in January, worth about $20 per ton. During 1912 the Chief Consolidated Mining Co., covered 5576 ft. in development, and ore shipments totaled 30,028 tons, yielding 7682 oz. of gold; 895,885 oz. of silver; and 817,090 lb. of lead, yielding a net return of $481,474. The mine is in splendid order.

Summit County

It is stated that in the Ontario mine there are 700,000 tons of ore worth about $8 per ton in the old stopes, put there for filling purposes, and the Mines Operating Co. has a 10-year lease above the 900-ft. level, also on the mill, which is now treating up to 100 tons per day by a new process, and will be increased later to 300 tons daily capacity. The Silver King, Daly-Judge, and Daly West mines shipped 2000 tons of ore during the past week, while in January, 11 mines produced 7105 tons.

WASHINGTON

Spokane County

(Special Correspondence.)—Through the operation of the Companies Act, 2000 companies, in many of which are Spokane stockholders, have been denied the right to transact business in British Columbia, and will have to reincorporate at a cost of $5000 to each of the companies affected. Sharp & Irvine, of Spokane, have received an official list of the companies which have been declared under ban from the registrar of the province of British Columbia, at Victoria. Included in the list of companies are some of sound financial standing, owning valuable property, and some of them engaged in the production of ore. The action of the registrar is said to have been the result of the neglect of the companies to comply with that section of the Companies Act which provides that the corporations file with the registrar lists of stockholders, their vocations, places of residence, and other information.

MAP OF WASHINGTON.

Efforts are being made by Idaho legislators to enact a measure governing investment companies doing business in the state, and a bill, similar to the Kansas 'blue sky' law, has been introdnced in the legislature. The act provides for the creation of a state board of control of investment companies, inclnding mining corporations, and carries with it a sufficient appropriation for making it effective, a fund for the purpose to be created by fees paid in by the corporations coming under the jurisdiction of the board. The proposed bill makes it unlawful for any company that sells bonds, contracts, shares, or stocks to nttempt to do business without first filing with the board a complete report of its capitalization, assets, and other pertinent facts, and a severe penalty is provided for non-compliance. Local mining brokers are divided in opinion regarding the effect it will have on their business, as they deal largely in Idaho mining stocks, but many are inclined to believe that such legislation will stimulate rather than decrease interest in mining investments.

Spokane, February 6.

The Washington Water Power Co. made net earnings of $959,493 in 1912. The capital is $14,081,000, and assets are $21,461,374. The number of stockholders is 1231, and prospects are good.

CANADA

British Columbia

It is reported that the 2000-ton smelter at the Hidden Creek mines of the Granby company will be ready by July 1. Five steamship companies will run vessels between Granby bay and Pacific coast ports. During January the smelter at Grand Forks treated 102,149 tons of ore, the copper output being 1,828,245 lb. During 1912 the British Columbia Copper Co., Ltd., smelted 687,256 tons of ore, yielding 11,267,681 lb. of copper, 25,643 oz. of gold, and 141,222 oz. of silver.

Ontario

An English company, the Aladdin Cobalt Mining Co., has bought the Silver Cliff and Chambers-Ferland mines, which are well known in the district. During the week ended February 1, 198 bars of bullion weighing 216,370 oz., worth $134,684 were shipped to England by the Nipissing and Buffalo mines. In January the Cobalt mines sent out 2020 tons of ore and 463,805 oz. of bullion.

MEXICO

Chihuahua

Owing to the inability of the railroads to carry coal to Chihuahua, the 1000-ton smelter has been shut down. If it remains closed it is probable that 3000 men in the district mines will be laid off. The fuel situation is serious; any coal which reaches the city is confiscated by the railroad company to operate its trains. A rush set in for an old Spanish mine near Cusihuiriachic, which was held by an American named Carr, but who failed to pay his taxes. On January 27 there were 178 applications for the claim.

Guanajuato

El Gigante Quicksilver Mining Co., which owns a mine in La Luz district, is producing 20 tons of rich cinnabar per day. H. H. Miller & Co. is erecting a 5-stamp mill. The Mexican Mines, Ltd., controlled by Oregon people, owns La Bonita and Neuva Idria mines, near Mineral del Cubo. The main adit, 8 by 8 ft., will be extended, and an incline shaft sunk. In the former it is expected to cut the famous Nayal vein.

Sonora

After a two months' campaign, the Democrata company's smelter has been shut down, owing to molten matte splashing and setting fire to the wooden parts of the building, causing a loss of about $11,000. The ore-bins were also destroyed. The furnaces will be in operation again in March. The Babiconova mine, in the Chispas district, has been sold to a Pennsylvania company. The new mill of the Moctezuma-Arizpe company is at work and the daily output of concentrate is 12 tons, which is sent to El Paso. This mine is 18 miles from Cananea. The new smelter of the Cobriza Mining Co., 17 miles west of Noria, is being blown in. It is of the Macdonald hot-blast type, of 150-ton capacity.

The Mines Company of America made a profit of $585,000 in 1912, against $834,000 in the previous year. Dolores and La Dura mines were shut down for two months on account of the revolution, the former being looted to the extent of $50,000, partly covered by insurance, and a claim has been made against the Mexican Government. All the properties are working at full capacity now, the Creston-Colorado treating 10,500 tons; Dolores, 5000; El Rayo, 5000; and La Dura, 500 tons per month. Cash, bullion, and supplies total $1,130,000. On the 600-ft. level, the Creston-Colorado has opened 15 ft. of ore averaging from $6 to $10 per ton.

NICARAGUA

(Special Correspondence.)—The Streter interest in El Golfo mine has been bought by L. de Tourniel, who is now the sole owner. Work was continued during the war, and the new mill is now in operation.

Jicaro, February 1.

Market Reports

LOCAL METAL PRICES

San Francisco, February 13.

Antimony	12—12½c	Quicksilver (flask)	40
Electrolytic Copper	18—18¼c	Tin	53¼—54c
Pig Lead	4 60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, February 13.—Copper prices unchanged; slightly better in tone. Lead is quiet. Spelter remains weak. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Feb. 6	15.50	4.33	6.19	62⅛
" 7	15 38	4 33	6 19	62⅜
" 8	15 25	4.33	6.15	62¼
" 9	Sunday.	No market.		
" 10	15.38	4.33	6.10	61⅛
" 11	15.38	4.33	6.10	61⅛
" 12	Holiday.	No market.		

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. February 13.		Closing Prices. February 13
Adventure	$ 3⅛	Mohawk	$ 50
Allouez	36⅛	North Butte	26⅜
Calumet & Arizona	62	Old Dominion	46⅛
Calumet & Hecla	460	Osceola	92
Centennial	16	Quincy	71
Copper Range	44⅛	Shannon	11
East Butte	12⅛	Superior & Boston	3⅛
Franklin	7	Tamarack	29
Granby	62¾	U. S. Smelting	40
Greene Cananea, ctf.	7⅜	Utah Con.	9⅜
Isle-Royale	26	Victoria	1½
La Salle	4½	Winona	2⅜
Mass Copper	4⅜	Wolverine	65

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 13.

Atlant	$ .16	Midway	$ .31
Belmont	7.75	Montana-Tonopah	1.73
Big Four	.85	Nevada Hills	1.35
Buckhorn	.95	North Star	.20
Con. Virginia	.28	Ophir	.27
Crown Point	.20	Pittsburg Silver Peak	.64
Florence	.40	Round Mountain	.35
Goldfield Con	2.17	Sierra Nevada	.17
Halifax	1.00	Tonopah Extension	1.90
Jim Butler	.72	Tonopah Merger	.81
Jumbo Extension	.31	Tonopah of Nevada	6.00
MacNamara	.21	Union	.15
Manhattan Consolidated	.09	West End	1.35
Mexican	.88	Yellow Jacket	.23

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. February 13.		Closing Prices. February 13.
Amalgamated Copper	$70⅛	Mines Co. of America	$ 2⅛
A. S. & R. Co.	69⅛	Nevada Con.	16⅜
Braden Copper	8⅜	Nipissing	8¾
Chino	40½	Ohio Copper	⅜
First National	2	Tenn. Copper	33⅜
Giroux	3	Tonopah Belmont	7⅜
Goldfield Con	2⅛	Tonopah Ex.	1⅞
Greene-Cananea	8	Tonopah Mining	5⅞
Kerr Lake	3¼	Trinity	4⅛
La Rose	3	Utah Copper	51¾
Mason Valley	6	West End	1⅛
McKinley-Darragh	2	Yukon Gold	3
Miami Copper	22¼		

MANGANESE producers in the Sharopan district in the Kutais government of Russia have requested permission to call a congress of manganese producers to discuss statistics of mine production; quantities of ore in railroad stations and exported; means of transportation to the warehouses of the Transcaucasian railway at Tchiaturi and elsewhere; construction of elevators at Batum for loading ore; construction of branch railway lines in mining regions; bringing water to mines; measures for preserving health of mine employees; organization of insurance of workmen and hospital funds according to the recent law, and other questions.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. F. DUVAL is at the Palace.

J. V. N. DORR is at Panama.

J. N. NEVIUS is in New York.

H. F. DAVIS is at Keeler, California.

J. E. JOHNSTON is here from Los Angeles.

E. B. KIMBALL has returned from Mexico.

SUMNER S. SMITH has returned to Juneau.

GUY A. R. LEWINGTON is in San Francisco.

EDMUND JUESSEN is at Carson City this week.

WALTER STADLER was in the city during the week.

O. B. HARDY, of French Gulch, is in San Francisco.

THOMAS KIDDIE is now at West Alhambra, California.

STANLY EASTON has been in San Francisco this week.

W. H. BASSET has gone to Oakland, California, from Tonopah, Nevada.

F. H. MORLEY is at Rome and expects to go to London early in April.

L. DE TOURNILL is now sole owner of the El Golfo mine, Jicaro, Nicaragua.

HOWARD R. STEWART is now at 5 Rodway Road, Roehampton, London, S. W.

WALTER C. ADAMS has left Montreal, Canada, and is now at Durango, Mexico.

JUAN BLANQUIER, who has been visiting the works at Ely, is in San Francisco.

WALTER G. SCHMIDT was in San Francisco and has returned to Los Angeles.

E. M. ROBINSON is manager for the Crown mine, Ainsworth, British Columbia.

S. H. BALL is in Europe, but expects to return to New York by the end of the month.

H. HARRIS is now general manager for the Tasmanian Smelting Co., at Zeehan, Tasmania.

R. G. HALL, former manager for the United Zinc & Chemical Co., was in San Francisco and has gone to Los Angeles.

W. L. POLSON is returning to Alaska to continue development work in South Prince of Wales island, in the Ketchikan district.

W. W. BREEN has accepted the position of mill manager at the Bishop Creek Milling Co., Sonora, Cal.; ALGERNON DEL MAR is superintendent.

A. SYDNEY ADDITON has completely recovered his health, after two years enforced retirement, and is again engaged in consulting work in San Francisco.

L. V. BENDER is now assistant superintendent of the Anaconda smelter; HARRY WARES is superintendent of blast-furnaces; and ROY E. HOWE is chief chemist.

C. T. NICOLSON sailed from New York February 11 for Portuguese East Africa to take charge of construction work on the 7½-ft. dredge the Bucyrus Co. is building for the Andrada Mines, Limited.

FREDERICK LAIST has been made general superintendent of the Anaconda smelter of the Anaconda C. M. Co., succeeding William Wraith, who is now general manager of the International Smelting & Refining Company.

W. A. IRWIN, a mining engineer who has just returned from Alaska, is authority for a statement that Juneau and its vicinity is about to enjoy a substantial mining boom. Several immense low-grade enterprises are being launched, and Mr. Irwin states that he expects to see developed in this district some of the largest gold-producing properties in the world.

F. LYNWOOD GARRISON, with a staff of assistant engineers, among whom are H. L. Mead, H. B. Barling, Lloyd Hoffman, and H. R. Griffin, has sailed for Barranquilla, South America, where a steamer has been chartered to meet the expedition, which will later land at Caceres, near the property of the Breitung Mines Corporation, and as soon as camps can be established Mr. Garrison and his crew of engineers, drillers, and laborers will begin the work of thorough exploration of the company's dredging ground.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

COMMERCIAL HANDBOOK OF CANADA, 1913. HEATON'S ANNUAL. By Ernest Heaton and J. B. Robinson. 400 pp. Heaton's Agency, Toronto, 1913. For sale by the *Mining and Scientific Press*. Price $1.

This differs from the ordinary year-book, in that it is devoted to matters of business. Especially useful are the chapters on Canadian commercial regulations, customs, and transportation.

AMERICAN MINE ACCOUNTING. By W. H. Charlton. 367 pp.; ill. McGraw-Hill Book Co., New York, 1913. For sale by the *Mining and Scientific Press*. Price $5.

Though the keeping of accounts is one of the most important phases of the business of mining, and one in which considerable sums can easily be lost or gained, it is the topic on which the least amount of literature has been available. A few books by English authors have appeared, but the methods described are so little in accord with modern American practice as to be of little service, while the discussion of the subject by American writers has generally been confined to the operations of a single company. Mr. Charlton has done a real and valuable service, therefore, in gathering together examples of methods covering a wide enough variety of work to fairly cover the field. The methods of the Oliver Iron Mining Co., the Ojibway Mining Co. (native copper), Utah Consolidated Mining Co. (copper mining), Calumet & Arizona Mining Co. (copper smelting), Utah Fuel Co. (coal mining and coke making), and the Portland Gold Mining Co. (gold mining and milling), are described at length and illustrated with blank forms. A chapter on recording engineering and geological data concludes this book, which is the best we have seen upon mining accounting, and is one which should be of wide interest and service.

MINING ENGINEERS' EXAMINATION AND REPORT BOOK. By Charles Janin. Part I, 94 pp.; Part II, 58 pp. For sale by the *Mining and Scientific Press*. Price $2.50.

Mr. Janin has done useful service in gathering together so compact and useful a compilation of data bearing on the determination of the worth of a mining property. Books of the sort commonly devote too much space to the field of the author's experience and include too much that can easily be obtained from any good civil or mechanical engineer's pocket-book. Mr. Janin's wide experience in the examination of mining properties has evidently well fitted him to select that which is most necessary, for he has included only 'live wood' in the matter he presents. For the same reason, evidently, he has made the book of a size and weight which permit it to be conveniently carried in the coat-pocket, while Part II is intended to serve as a supplementary field note-book from which the final report can easily be prepared. Of great convenience to engineers engaged in examination work, the book is likely to prove equally or more useful to owners and prospective purchasers of mining properties as a concise and accurate summary of the facts necessary in determining the worth of a prospect or mine. Too often the claim or prospect owner is unable to attract the attention of the possible investor merely through ignorance as to what facts are necessary for the business man to form a judgment as to whether the property is worth careful examination. The recent graduate should abstain from attempting the rôle of consulting engineer during his first years of work, but may profit greatly by devoting careful attention to the business side of mining, as a preparation for later work. To all such this book, or others like it, will be extremely useful as an indication of what is most significant and a guide to the determination of necessary facts. For the convenience of those who may care to use Part II as a field notebook, it is sold separately at 50c. The book merits popularity.

Recent Publications

PRODUCTION OF COAL AND COKE IN CANADA IN 1911. By John McLeish. P. 35. Canada Department of Mines, Mines Branch, Ottawa, 1912.

BIBLIOGRAPHY OF NORTH AMERICAN GEOLOGY FOR 1911, WITH SUBJECT INDEX. By John M. Nickles. P. 162. Bulletin 524, U. S. Geol. Survey, Washington, 1912.

PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA FOR QUARTER ENDED SEPTEMBER 30, 1912. By W. H. Wallace. P. 14. Department of Mines. Hobart, 1912.

TRANSACTIONS OF THE ILLINOIS ACADEMY OF SCIENCE. First Annual Meeting at Bloomington, Ill., February 23 and 24, 1912. P. 182. Ill., plans. Published by the State, November, 1912.

THIRTY-THIRD ANNUAL REPORT OF THE DIRECTOR OF THE UNITED STATES GEOLOGICAL SURVEY FOR THE YEAR ENDED JUNE 30, 1912. George Otis Smith, director. P. 175. Maps, index. U. S. Geol. Survey, Washington, 1912.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1910. PART III. OHIO RIVER BASIN. By A. H. Horton, M. R. Hall, and H. J. Jackson, under direction of M. O. Leighton. Water-Supply Paper 283. P. 158; ill., index. U. S. Geol. Survey. Washington, 1912.

PHOSPHATES IN IDAHO AND MONTANA. By A. R. Schultz, R. W. Richards, and J. T. Pardee. Bull. 530-H, U. S. Geol. Survey. P. 27. Maps. Advance chapter from Bull. 530, 'Contributions to Economic Geology, 1911, Part I.' U. S. Geol. Survey, Washington, 1912.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1911. PART I. NORTH ATLANTIC COAST. By C. C. Babb, C. C. Covert, and R. H. Bolster, under direction of M. O. Leighton. Water-Supply Paper 301. P. 221; ill., maps, index. U. S. Geol. Survey. Washington, 1912.

MINERAL RESOURCES OF MISSOURI. Pp. 22. This is a neatly illustrated vest-pocket pamphlet issued by the Missouri Bureau of Geology and Mines, illustrating the wealth of mineral to be found within that state. It is an excellent example of the high-class advertising a geological survey may do for a state.

IOWA GEOLOGICAL SURVEY, ANNUAL REPORTS, 1910 AND 1911. WITH ACCOMPANYING PAPERS. P. 1214. Ill., index, maps. Des Moines, 1912. This, constituting the twenty-first volume in the present series of reports issued by the state of Iowa, is the first carrying the name of G. F. Kay as State Geologist, and is a fitting companion to the twenty excellent reports issued under administration of the late Samuel Calvin. The body of the report consists of a monograph on the underground waters of Iowa, prepared by W. H. Norton and assistants, based upon twenty years of consistent study, first at the expense of the state alone, and later in coöperation with the U. S. Geological Survey. It is the most complete study of its kind issued by any state, and makes it possible for the cities and towns of Iowa, as well as individuals and corporations, to determine with a minimum cost, the possibility of securing adequate water supplies from underground. It is not too much to say that the underground structure of no area of equal extent has ever been studied with equal thoroughness, and aside from the light thrown on water problems, material aid to solution of other questions is afforded. The report is not only well prepared but well printed, and the two colored geological maps that accompany it are models of clearness. Prefacing the report is a brief statement covering the mineral production of 1909 and 1910, prepared by S. W. Beyer, and excellent though out of date. The administrative report by Mr. Kay makes it evident that the new State Geologist has a thorough grasp on the essential problems of the Survey. The whole volume illustrates the benefits that flow from continuous maintenance of a non-political organization for the study of the mineral resources of a state. The amount of money available for the work in Iowa has always been small, $5000 to $10,000 per year, but the work has not been interrupted for twenty years and the benefits have been cumulative.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

NATURAL GAS in western Canada costs 33 to 40c. per 1000 cu. ft. to deliver, and sells for $2 per 1000 cubic feet.

PLACER-MINING in British Columbia has produced $71,639,103 to the end of 1911. There are no dredges at work, all attempts at this method of working having failed.

BELT CONVEYORS at many mills pass under circular magnets, 18-in. diam., which extract drill-steel hammer heads, and other articles dangerous to crushers, from the ore.

ERUPTION of Mt. Katmai, in Alaska, in May 1912, caused much ash to be scattered over the adjacent territory. The air also became quite acid, resulting in the extermination of all mosquitoes.

CORLISS inlet-valves were not at first used on air-compressors, the use of poppet valves being almost universal. It is only of late years that the advantages of the Corliss inlet-valve, both as regards efficiency and durability, have been recognized.

VACUUM-FILTER cycle at Yuanmi mill, Western Australia, is as follows: Filling filter-tank, 4 min.; forming cake, 40 min.; emptying filter-tank, 4 min.; running in wash-solution, 4 min.; washing, 50 min.; emptying wash-solution, 4 min.; discharging cake, 10 min.; total time of operation, 116 minutes.

SAND for concrete is being shipped from Seattle, Washington, to Honolulu, Hawaiian Islands, as there is no suitable sand on the islands, which are of volcanic origin and surrounded by coral reefs. Many volcanic rocks which are low in silica and high in magnesia, lime, and alumina, tend to decompose, like pyrite in building stone, and are therefore not suitable for concrete work.

GOOCH FILTER TUBES are subject to breakage, especially when a strong suction is used, and may be effectively replaced by first boring a 7/8-in. hole half way through a No. 7 rubber stopper and then reaming or burning it to an exact fit with a hot crucible. The broken stem of an old funnel inserted in a smaller hole completes the device, which is convenient for filtering liquids which will not affect the rubber.

ORE of the Falcon Mines, Ltd., property, in the Blinkwater district of Rhodesia, contains copper and gold worth $14 per ton, and 15,000 tons per month is to be treated by crushing with 36 Nissen stamps, concentrators, sintering plant, blast-furnace, and converters. Near the mine is a good supply of iron and limestone for fluxes, and water. The new plant should be ready for work at the end of the current year.

GYPSUM has long been mined and calcined in Iowa, being derived from a small area of buried Peruvian rocks in Webster county. It is now announced by the Iowa Geological Survey that a second body of gypsum has been found, this time in Appanoose county. The rock is of good quality, is 5 ft. thick, and is overlain by 5 ft. of anhydrite. It lies at a depth of 550 ft., presumably in Mississippian rocks, and was discovered by drilling.

BUCKET elevators are used to a large extent at Broken Hill. At the Junction North mill, the following is the experience: In an elevator raising ordinary wet table feed, running at 353 ft. per min. with a 24-in. head pulley, the top of hood requires to be at least 3 ft. above the pulley; the delivery should be 18 in. below the bottom of head pulley; while the front of hood should extend 30 in. from face of pulley, then there will not be 50% of the material elevated returned to the boot, as is often the case. All the elevators scoop up the feed from the boot, and there is rarely any trouble through buckets jamming at the bottom. A properly designed elevator takes comparatively little power, causes no trouble, and can be built quite cheaply. The best method is to support the head drum and gearing independently, and then the housing can be of light material.

OXYACETYLENE outfits have been ordered by the New York Fire Department, following the experience in cutting with a hack-saw the heavy steel bars which guarded the windows of the Equitable building, in order to rescue men in the cellar. With the temperature near zero the hack-saw is too slow, especially for the man whose life depends on the bars being sawed before the fire reaches him. This is supposed to be the first instance of these outfits being used by fire departments.

SLIME concentration system at the Junction North mill, Broken Hill, consists of the slime feed-elevator, having two belts with 6 by 12-in. buckets, spaced 10 in. centres, and travelling at 400 ft. per min., delivering to a 7-ft. cone settler, the spigot from which feeds a Wilfley table. The overflow goes to a series of V-shaped settlers, the overflow from which runs to six large rectangular settlers, while the spigot from each flows to a 5-ft. diam. settler feeding a slime vanner, of which there are eight, running at 220 r.p.m. with 3/4-in. stroke. They treat 1500 lb. per hour, and produce a 68% lead concentrate. The Wilfley table treating slime from the settler produces 280 lb. of 72% lead concentrate per hour.

TASMANIA gold mine, consisting of 532 acres, situated 27 miles north of Launceston, produced during the quarter ended September 30, 1912, 13,602 tons of ore yielding $91,000, making the total to date 969,710 tons, and $15,257,000. The mine and mill employ 433 men. Water has given a great trouble at this mine, and pumps capable of dealing with 7,000,000 gal. per day, from a depth of 2000 ft., have been installed. The plant is divided into three sections and consists of compound condensing engines made by Hathorn, Davey & Co. of England, having cylinders 50 and 108 in. diam., with a 120-in. stroke, steam pressure being 150 lb. The quadrants are built of steel plate, blocked with pine, the main bearings being 18 in. diam. and 24 in. long. The spear rods are each 22 in. sq. and 37 ft. long, and the pump plungers 20 in. diam., there being 8 suction and 8 delivery valve-boxes to each plunger.

PROTECTION of mills by standpipes and hose largely depends upon the volume or quantity of extinguishing water as contrasted with mere velocity and little volume. In the presence of a real fire, water is converted either into steam or passes into the spheroidal state, when it is practically powerless to extinguish. There must be a sufficient volume of water thrown to cool the objects which it strikes below the temperature of their ignition. What is called a standard fire stream means the delivery of not less than 250 gal. of water per minute through a 1 1/8-in. nozzle. This means a pressure at the base of the nozzle corresponding to 45 lb. per square inch. Such a pressure will give a reach of 63 ft. horizontally and 70 ft. vertically where sufficient head room can be commanded. The usual pipe hydrant and hose, with their necessary service pipes which belong to any building equipment, may very properly be supplemented by the fire-bucket, chemical extinguisher, and the sand-pail. The sand-pail is particularly effective where the fires take place where oils, varnish, or other combustible fluids are stored. The sand should be distributed from the pail with a scoop. No mention is made of the large number of proprietary devices which are continually urged upon the attention of careful works managers. Some of these belong properly in the chemical extinguisher class, and may safely be urged where the fire is of electrical origin. Some of them, however, by reason of the released gas which is not a supporter of combustion make the air in a confined room irrespirable by the fire-fighter, and are therefore more of a danger than a safeguard, unless used only in the open air. The tetra-chloride of carbon extinguishers are in this class.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

ARIZONA mining engineers have joined in the formation of a local society, as noted in our news columns. There is enough engineering talent in the new state to make a highly useful and influential society. We trust that the hopes of the founders may be amply realized.

FIRE destroyed the School of Mines building at the University of Minnesota last week. A state with such extensive interests in mines as Minnesota may, however, be expected to rebuild upon a generous scale. The Minnesota school has done excellent work, and even a temporary crippling is to be regretted.

WATER has been turned into the Los Angeles aqueduct and substantial completion of one of the greatest pieces of public work in the United States is announced. Congratulations are due the engineers not only on the ending of a big work, but upon the freedom from scandal and the high class of technical performance which has characterized the enterprise.

SUGGESTION of Mr. Charles G. Yale for the position of superintendent of the San Francisco Mint, a suggestion recently made, we believe, without his previous knowledge, is exceedingly appropriate if the exigencies of politics are to require a change in the position. Mr. Yale is excellently qualified for the place, and we should be glad to see any honor or promotion come to him.

COMPLETE extinguishment of the land debt was announced at the meeting of the American Institute of Mining Engineers this week by Dr. James Douglas, chairman of the committee having the matter in charge. This satisfactory end of a troublesome matter is due more to the generosity and activity of Dr. Douglas than to any other one man. So long as the Institute can command such service its future is secure.

CALIFORNIA, according to our interesting contemporary, *The Financial World*, is about to spend $25,000 in ferreting out fraudulent mining concerns operating within the state. Unfortunately the announcement in this case is so prompt as to anticipate the facts. The California Miners' Association has proposed that the state set aside the amount mentioned for that work, and it would be an excellent thing to do. With, however, 4000 bills before the legislature and expenditures exceeding anticipated revenues, there seems small probability of the action being taken.

CRITICISM of the United States Reclamation Service by the House Committee on Expenditures in the Interior Department is generally discounted by the knowledge of the active campaign that has been made to discredit the Service. It is easier to believe that the committee has been imposed upon than that Mr. F. H. Newell, Mr. A. P. Davis, and their associates have been seriously at fault. It is to be remembered that in every previous instance the Service, when carefully studied, has been found to be clean and able and its officers have given excellent reasons for their actions. Knowing the men in the Service, and much of its work, we have no doubt that adequate investigation will show the same to be true now as in the past.

MINING companies operating where labor must be imported suffer a serious handicap. To them sickness as well as accident is a serious cause of loss. The whole laboring population being dependent on the one enterprise, and overhead expenses being heavy, demurrage of men as well as machines enters into the yearly balance. Such mines in particular find the addition of a medical man to the staff effects marked economy. It is not so much that the physician cures the sick men; his chief value is in keeping men from being incapacitated. When colored labor is employed, malingering is common, but before the stout asseveration of a 'misery' the ordinary engineer is hopeless. One American company operating in the tropics imported a doctor and required all men on the pay-roll to report daily to him for treatment, or to the shift-boss for work. After about two attempts to fool the doctor, the negroes gave it up. On the other hand, Mr. P. R. Bradley notes that the white foremen and shift-bosses are apt to delay going to the doctor too long, and hence to have a serious break-down with resulting loss of time and expense to the company. This can only be met by requiring regular medical inspections. In this and other ways a company doctor may become an important help. Mine managers can not be expected to know medicine, but they should know enough to observe general precautions and to know when and how to employ a doctor. Such general statements as that of Dr. H. G. F. Spurrell regarding the habits of mosquitoes, of which we print the concluding part this week are of great service to engineers in just this particular.

MEXICAN conditions have changed rapidly in the last week and there is general hope that the triumph of the revolution may at least spell peace. There is general disappointment that the result should have been attained through treachery. Mr. Francisco Madero, however much we may differ as to his fitness for the trying position he has been holding, is conceded to be an honest patriotic citizen who purposed well for his country. General Huerta has shown himself to be an excellent soldier, one who has fought valiantly, and often against odds, for the Government in power, whatever may have been his personal prejudice. We can readily understand how such a soldier may have come to believe that further fighting was useless, and that peace and order were of the first consideration. Of General Felix Diaz we have excellent impressions. Incidentally, he has large interests in mines and considerable familiarity with their operation. The discouraging feature of his triumph is that it seemingly reduces Mexico to a military dictatorship, and that he is apparently the accredited representative of the *Cientificos*. While we believe thoroughly that Mexicans must work out their own salvation, we should regret to see any check in the democratization of the country. One form of government can not be held to be best for all people at all times, but that government is most secure that rests on the broadest basis. Americans generally will watch with the greatest interest and sympathy the efforts of the group now in control to restore to our neighbor peace and prosperity.

A Geological Survey Building

It is with unusual pleasure that we note that in the public building bill passed by the House of Representatives at Washington last Monday provision is made for a building for the United States Geological Survey. We have already discussed at length the need of this building, and, aside from the pleasure that mining men will take in the feeling that the valuable records of the Geological Survey are hereafter to be adequately protected from fire, there is added satisfaction in the evidence afforded by this and other items that the public building bill is not wholly a 'pork' measure. It is right and proper that the Government should own the buildings necessary for the conduct of its business. It is certainly better to pay interest at a low, than rent based upon the high rate that private building owners naturally ask. For many years to come, if not for always, a large public building appropriation is to be expected. The petty politician who gets into Congress has looked upon the matter solely from the standpoint of getting money spent in his district; and his constituents have too often forced him to adopt that point of view. We are glad to believe that the day is rapidly coming when a Congressman can be more independent, when he may work for the common good and treat the business of the Government from a business point of view. The blame for past excesses is by no means all to be assessed to the men at Washington; but the better leaders they prove, the quicker will days of the 'pork barrel' end.

The Geological Survey has given a third of a century of service to the country, and it has been devoted service of high class. The organization has been an important factor in the rapid development of the West, and now that the Nation is taking serious thought of its public lands, the field of activity for the Survey and the Bureau of Mines will be rapidly enlarged. Good service, effective business-like administration, is only possible when the men are given suitable quarters and facilities. The two and a half million dollars which it is proposed to expend on a modern office-bulding is none too much, and will, we believe, prove an excellent investment. The members of the House committee have done well, and we hope the Senators will follow their lead.

Statistics and Ethics

Good statistics are vital to sound industrial development. They not only afford a solid basis for correctly judging past performance, but the surest known means of estimating the future. In the United States the best statistics for the mineral industry as a whole have come from the United States Geological Survey. There are those who maintain that it is no proper part of the work of the Geological Survey to publish figures of production, and our New York contemporary, the *Engineering and Mining Journal*, has, at times, been especially insistent upon this point. For our part, we have felt that much at least of this work belongs properly to the United States Bureau of Mines, but, regardless of who may do the work, accuracy and promptness in publication are clearly of first importance. In order to secure the latter, the Geological Survey has been in the habit of preparing brief advance statements which are furnished free of cost to the press and which are widely used. The annual estimates of production issued the first of the year have been especially well received, and, on the whole, have proved surprisingly accurate.

In a recent circular letter issued by the Director of the Geological Survey, the following statement occurs: "The technical papers and journals, whose editors are perhaps best qualified to judge of the value of these preliminary Survey data, were especially generous in the space given to them. One of the leading mining journals, however, even added to this type of approval, in that it printed as of its own compilation, the table of gold-silver production issued jointly by the Bureau of the Mint and the Geological Survey, but only slightly changed. In other columns of this issue the credit given to the Survey data was incomplete and in most cases entirely lacking, although the data were generally used with very slight modifications. In one case, an obvious error in the Survey statement was repeated, though with sufficient change of form to make it appear altogether original with the technical paper, a device frequently used in this issue. Whatever might be said regarding the withholding of proper credit concerning official government statements, it is certainly unfair to the reading public not to fix the responsibility of authorship for all parts of a statistical statement."

Thanking the Director for our part of the compliment addressed to technical journals, we join him heartily in condemnation of the use without credit of the figures collected by the Survey men. In our own review number issued January 4 we printed, along with other statistical matter, the detailed figures of gold and silver production in the United States, crediting them, as we were glad to do, to the courtesy of the Directors of the Geological Survey and the Bureau of the Mint. A week later the *Engineering and Mining Journal* published the identical figures except for four minor changes due possibly to errors in transmission. There was, however, nothing to indicate that the statistics had not been independently collected by the reputed author of the article in which they appeared, one of the regular members of the staff of the *Engineering and Mining Journal*. The distinguished metallurgist who edits that journal is at the same time secretary of the Mining and Metallurgical Society of America. This society recently printed the preliminary draft of a code of ethics, of which Section 24 reads as follows: "The engineer should take care that credit for engineering work is attributed to those who, so far as his knowledge of the matter goes, are the real authors of such work." Apparently, as to the control of the *Journal's* policies, the editor in question is in the position that Lincoln once averred himself to be—of having "no pull with the administration." We have repeatedly insisted, and the case in point illustrates the need, that technical papers should be owned and controlled by technical men. If an engineering paper is to represent engineers and be more than a lure for advertisers, it must be conducted along lines that engineers recognize as ethical. In practice this often fails to be true when the engineer is the employee rather than the employer.

The Institute Election

At the business meeting of the American Institute of Mining Engineers held in New York last Tuesday, the new constitution was adopted with only six dissenting votes. The amendments proposed by Messrs. C. R. Corning and George C. Stone were also carried by a substantial majority, but the proposal for creating an order of fellows was defeated. In consequence of the substantial vote for the new constitution and the new order of business there was no need to count the vote for members of the Council, and election of a secretary devolved upon the new board of directors. They endorsed the action of the nominating committee and chose Mr. Bradley Stoughton for that position.

Of the two ballots for directors, the green ticket won by a substantial majority. This, it will be remembered, differed from the official ballot in that a definite selection had been made for each office and all those now serving either in the Council or as a director, were included. The nominating committee, in providing a better geographical distribution, had omitted some of the names appearing on this ballot. The winning ticket, as also that which lost, was an excellent one. Every man upon it is an engineer distinguished in the profession and for his high character. In the whole contest there has been, fortunately, nothing personal, and we, who advocated the other ticket, offer our hearty congratulations and good wishes to the winners. We are frank to say that we believe the majority of the members merely voted the ticket that was easiest; the one ready prepared and which they ran no chance of spoiling. That the new constitution was adopted by so overwhelming a vote indicates, we believe, that the members favor a new regime. The action of the directors in selecting Mr. Stoughton as secretary indicates that they are in accord with this spirit and not among those who worship at the shrine of Dungara, the "God of things as they are."

Principles of Mine Valuation

By James R. Finlay

*Almost all enterprise is based on valuation of some kind. Practically all transactions in mining property, whether in stocks, bonds, or actual ownership, are based on some kind of an appraisal. If you expect to be employers instead of employees you should begin at once to study the factors which give value to things. You cannot buy intelligently nor sell intelligently until you know how to form an estimate of what a given property is worth to you, to the man you are dealing with, and to anyone else who might be brought in.

Engineers and Business

This generalization has no more application to mining than to any other form of business; but it certainly does not apply to mining less than to other forms of business. I think that no more unfortunate idea is taught to young mining engineers than that they are to consider themselves merely as professional men, like doctors or ministers. I would not speak of this if such an idea had not been cultivated in certain quarters. It is true that some mining engineers are employed to do technical work as referees between conflicting interests. Professional honesty is, of course, an absolute essential, but the honesty of a mining engineer is the honesty of business and of common sense. It is not in the least desirable for a mining engineer to avoid business transactions; on the contrary, he should go into them as soon as possible and study the subject in every possible way. I do not see how any man can make a success of mining who does not realize that it is a strictly commercial business; that the only result to be sought is commercial success; that the only scientific and technical attainments that are worth anything are those which contribute to commercial success. Attainments of a different character are, of course, worth while; but they are valuable to a mining engineer because he is a man and a citizen, not because he is a mining engineer. They would be equally valuable in every kind of profession. Success in business is measured in money. Technical skill is efficient only if it pays. One can judge of the value of technical excellence only if he is prepared with a knowledge of what constitutes the money value of the results.

Undoubtedly this view of the mining business, or profession, has been gaining ground in our universities and technical schools. Formerly, I think, education was considered to be merely a training in principles. Technical training was a discipline in the science of action (I coin the expression), an exposition of the principles of doing things. Whether it was worth while, in dollars and cents, to do a thing was to be found out later in actual business. Now I think it is recognized that, while making money is of course a matter of actual occupation in business, there are certain general principles underlying the value of things, which are well worth study. This is the study of political economy, which is cultivated in all our universities. The mining engineer sooner or later comes into contact with this subject and is bound to find it interesting and important. I shall try now to advance a few ideas about the valuation of mines, which I think are basic enough to come under the head of general principles.

What Fixes Prices?

The first thing to which I wish to draw your attention is the general subject of valuation. What is it that causes a price to be fixed for commodities or properties? In general, there are two methods of fixing prices; one is the empirical method, and the other, the constructive. The empirical method of fixing prices is simply to obtain a record of facts—of transactions. A man will assume that a town lot is worth $100 because he finds that people have bought and sold similar lots for $100 apiece. Nearly all commodities of a retail nature are valued in that way, and it is perfectly logical that they should be, because each actual transfer is a bargain between the buyer and the seller, theoretically at least. The man who sells for a certain price does so because he believes he can do it profitably. On the other hand, the man who buys computes in the same way. Consequently wheat, iron, and copper, as commodities, are valued empirically by merely ascertaining what sales are made; and fluctuations of price are established by supply and demand.

The constructive method is that which determines the value of commodities in a more or less scientific manner; builds up logically an estimate of what it properly should be worth. This naturally applies to properties which are dealt in only occasionally, for which there is no precedent of an actual sale of the equivalent thing. You will easily see that mines belong to that class of property.

Fundamental Factors

Hardly any two mines are exactly alike; therefore you cannot say logically that because one mine is worth $1,000,000, another mine is also worth $1,000,000; at least you cannot say so until you have gone through the factors which give both properties value, and have found that they are identical. It is to those factors which do give value to mines that I wish to call your attention now. I have always supposed, and I think that nearly all mining engineers agree with me, that there are three or four fundamental factors about a mining property which determine its value. These are:

1. The average cost of securing the product of that mine.
2. The average sale price of the product.
3. The rate of production of the mine.

*A lecture delivered before the Department of Mining, Columbia University, December 2, 1912, and published in the *School of Mines Quarterly*.

4. The time for which the output can be maintained.

I do not intend to go into detail as to any of these factors, but to point out some things which I think are worth considering, in the hope that later you will think about them and learn the details for yourselves.

In regard to the average cost: In the case of going concerns, that average cost can be obtained empirically by simple reference to the books; to what has actually been done on the property. That seems and sounds exceedingly simple. As a matter of fact it is not easy. I made the mistake once of thinking that it was. I bought a mine in Joplin, Missouri, to be specific, on a record of its working cost for six months. The reason I did not go further back was that older records were not to be had, and also because during this particular six months the property had reached a substantial basis. I figured that concentrate from that mine could be produced for about $20 per ton, and I also estimated that the property should produce so much ore, and that the price would be a certain figure. It happened that developments proved that I was right about the price and quantity of ore on the property, but they also proved that I was wrong on the question of costs. It cost us nearly 75% more to produce concentrate from that ore than the record of the property showed. There were times when we produced concentrate for $15 per ton, but that was not representative of the whole period of working the mine. I think you will find today that a great many of the cost statements given out by different companies for fixing the value of their stocks are only temporary or occasional costs, and will not stand analysis.

Capital and Operating Accounts

Then there is another factor in which people deceive themselves, unconsciously, but in the simplest and most obvious way imaginable. They keep on doing it, always have done it, and I suppose always will do it. That is, by failing to see the relation between expenditures that are for plant and those for keeping it going. In keeping books it is very easy to say that the construction of a building, the remodeling of a mine, or the building of a new mill, is something that will not happen again, that it belongs to the property and not to the operation; to a certain extent that is true, but it is a fact, which I have verified by looking up a great number of mines, that the so-called operating costs are ordinarily not more than 60 to 80% of the total cost. Until a mine is shut down, there is always some expenditure to be undertaken which a bookkeeper may think will not be repeated, that it belongs to the plant, but these things keep occurring so constantly that one who is figuring on costs must count on them.

Another thing I believe to be true is that any estimate of cost, or valuation, or anything relating to the future, is a good deal of a guess. One who thinks he can estimate a cost, whether of a going concern or a concern to be started, to a fraction of a cent, or to any fixed amount, is simply mistaken. All you can do is to put a round figure which seems to be pretty near the facts. Of course, the difficulty of estimating costs at a mine which is not yet opened is greater than at a going mine.

The next fundamental factor in forming an idea of the value of a mine is the average price of its product. I will go so far as to say that this is the most important factor to be considered. The literature on this subject, I think, has not done justice to the importance of prices because apparently a good deal of the best thought given to the subject of valuations has been by English engineers who had in mind principally gold mines. Gold, of course, is the only product of mines the value of which is fixed; consequently most of the discussions on mine valuation among engineers have been devoted to the third factor, which I will come to later, namely the uncertainties regarding the amount of ore in a mine and the part that developed ore plays in the estimate of a total valuation.

Valuing Copper Mines

As an example of the tremendous importance of the price of a product in mine valuation, I will cite from my report on the Michigan mines. At the time of that report, the price of copper was 12¼c. per pound. A group of copper mines in Michigan were producing, and had been producing 200,000,000 lb. of copper per year at a cost of 10c. per pound, in round figures. I valued the mines on the assumption that the average price of copper would be 14c. per lb. as against the current price of 12¼c., and I put a valuation of about $70,000,000 on that basis. Roughly, at 14c. per lb. the earnings would be $8,000,000 per year, and the total value of the group would be nine times that, or $70,000,000. You will find that it is a difficult thing in commercial transactions to figure steadfastly on a price that is different from the present price. When I talked about copper averaging 14c. per lb., many said, "That is not the present price, it is 12¼c." Some thought the price might go even lower instead of higher. I think if I had not been prepared by several years' study of that very subject, I would certainly have used a lower figure than 14c. per lb. for the average price of copper. At any rate, the value I put on them was nine times their annual income at 14c. If I had used the current price of 12¼c., their annual income would have been only $4,500,000. As a matter of fact, within less than 12 months after the report was made the price of copper had gone up to 17¾., and the usual proportion of people thought that the price would go still higher, and that this might be the average. If it had been the average, the earnings of these mines would have been nearly $15,500,000 at that price of copper.

Effect of Price Estimates

Now let us look at what these figures mean in terms of the life of a mine. If I had figured that the mines were worth $70,000,000 at a price of 12¼c. per pound, I would have had to believe that the mines, on the average, were good for 40 years' life, instead of about 13 years. If, on the other hand, I had assumed that the price would be 17¾c., in order to make the mines worth the price I put on them, they would have to last only 5 or 6 years. Therefore the

fluctuations of price in less than a year corresponded to an extension in the life of those mines from 5 or 6 years to 35 or 40 years. Here again I am dealing in a mere approximation. I suppose these mines produce about 20 lb. of copper per ton; therefore to get 200,000,000 lb. of copper per year, you would have to mine 10,000,000 tons. Therefore, the figures that I actually used meant that I believed there was 130,000,000 tons of copper ore which could be depended on. That is an enormous amount of ore. Figured roughly, that would mean a lode of solid ore five miles long, of the average width of 12 ft., and 5000 ft. deep; it was actually obtained by projecting the production of the mines and the development of the mines far below their present position. Now if I had to estimate on 12¼c. copper, I would have had to figure on 40 years' life, or I would have had to believe that there were 270,000,000 more tons there than I thought I was justified in believing. On the other hand, if we put the value at 17¾c., I should have had to figure on only 50,000,000 or 60,000,000 tons of ore. Therefore, I say, as affecting the value of mines, the actual fluctuations of price within one year were equal to an uncertainty in the ore production in those mines of more than 300,000,000 tons. An engineer is not likely to make a mistake like that when a mine is so fully developd as these Michigan properties, many of which are worked to a great depth, are well managed, and have their outlines very well shown. He could, however, easily make just as important a mistake as that in figuring on his average price of copper.

Average Price of Copper

As a matter of fact, I do not think the 14c. price I used was an accurate figure. I believe that copper will average more than 15c. per pound, taking into view the development of the business, but 14c. was as far as I thought I could go. I do know that mines have been valued within the last five years on prices estimated all the way from 12 to 20c. Just imagine what a difference that makes in the estimated value of those mines! I know a very important mine in Mexico, the organizers of which believed that copper would not average less than 20c. per pound. I know of mines, on the other hand, that are being valued on an expectation of 12½c. per pound.

I ran against the same difficulty with another group of mines during that same Michigan study. In the iron mines I assumed a price for iron which happened to be almost the same as the price for the year 1911, which was a dull year in the iron business. In this case, however, the price, instead of going up, as the price of copper did, went down about 50c. per ton the next year. Now the margin of profit for those iron mines, during the period that I figured on was just about $1 per ton, so that if you take off 50c. per ton you cut the profits in two. Of course, during all this last year, I have been exposed to a good deal of criticism by the iron miners, because they say I assumed a wrong price. While it may have been wrong for the year 1912, I notice that prices for the year 1913 have been fixed lately and at a figure very close to my average, in fact, almost identical with it if certain reductions in freight rates be considered.

In both the iron and copper calculations, I have been asked a great many questions as to how I arrived at the prices I assumed. Here there are certain evidences which can be used as guides, and are well worth studying. One general fact about the prices of all mining products is that they vary in cycles or in waves, irregularly of course. If, after a period of high prices, you find that prices are definitely going down and reach a new level, it is pretty safe to believe that the lower level of prices will continue several years. On the other hand, after a period of low prices, when once the metal rises markedly, it is pretty safe to assume that it will stay at a higher level for several years. Those fluctuations are things well worth studying. It is a matter on which you cannot at once form opinions.

Present Price and Average Price

The valuation of a mine, while in the long run it depends on the average, is influenced a good deal by the present price. If you have a copper mine that is going to last ten years, and you expect 18c. copper for three years out of those ten, it is a matter of considerable consequence to your property whether that 18c. price comes during the first three years or during the last three years of the life of your mine. If it comes in the first three years you will get your profits and may invest them, perhaps in other directions, and the interest on that money for the following years will be worth a great deal to you. I must confess, in regard to the question of profits, that I was wrong when I wrote 'Cost of Mining,' in laying too much stress on average price. I now believe the public is right when it puts a higher value on properties during periods of high prices for metals. That is merely an assertion which I offer you to think about. It is a curious thing, which anyone can observe by watching stock quotations, that the prices of mining stocks vary almost with the price of the metal itself. When copper metal goes down, copper stocks go down. I always used to think that this was illogical, but I have come to the conclusion now that the public, which bases its valuations on present commercial conditions, has been more logical, on the whole, than the mining engineer.

Life of Gold Mines

The question of the life of a mine is not to be overlooked by any means. In many cases that is the most vital factor, particularly in the case of gold mines, because fluctuation of price does not then enter into the problem. Take, for instance, the Goldfield Consolidated. That property has made a spectacular showing in dividends, but it has always been recognized that its life was uncertain; and now, in spite of the fact that for two years it has been paying very large dividends, the price of the stock has been so low that the dividends have equalled 50% on its market value. Recently the stock has been selling for $1.75 per share; the actual dividends paid during the past year have been $1.60 per share. Now, if the mine were valued in the way some copper mines are valued, paying dividends, say, at the rate of 6% of the selling price, the price to be put on Goldfield

stock would be $20 per share. In that mine the whole question centres on the length of its life. I speak of it because this is so contrary to usual experience. I do not know of any other case in which the public has been warned, or has become convinced of a mine's exhaustion so long in advance.

On the other hand, there are some mines with an expectation of long life which cannot show any ore reserves at all. Certain mines at Tintic, Utah, which I should be willing to value on an assumed life of five or ten years, do not show ore reserves for even three months. The reason is that the form of the orebodies is such as to prevent ore reserves from being developed. The ore occurs in an immense mass of limestone, through which mineralizing solutions have passed, and have been diverted by various intersecting fissures. The orebodies are irregular, sometimes small and sometimes swelling to large size; sometimes they go down vertically four or five hundred feet, forming a pipe, then abruptly go off horizontally for four or five hundred feet, and then up again, then shooting to the right or to the left. If nothing were known about the persistence of these orebodies, one would be justified in being exceedingly skeptical about the future; but the experience of 30 years has shown that these deposits, in spite of their irregularities, are exceedingly persistent. In making his valuation the intelligent engineer will, of course, consider this fact a pronounced asset.

Russia's Gold Century

ST. PETERSBURG CORRESPONDENCE

This year is the centenary of the publication of the ukase by which all Russian subjects were allowed to exploit gold vein deposits; for until 1812 the production of gold was a state monopoly. Although it was well known at that time that the wealth of Russia in gold was almost inexhaustible, the annual production by the government amounted to only an insignificant figure. In the first years of the rise of the gold-mining industry it amounted to no more than about $10,000 per year, inclusive of all three known gold areas at that time; the Urals, where gold was found in 1744; the Kemsky district; the Archangel Government, in 1745; and at Altai. It was only at the beginning of the nineteenth century that the annual production of gold reached as high as $250,000.

The permission then extended to private persons to exploit gold deposits considerably extended the Russian gold industry; and it began to develop with great rapidity from 1819, when private people were allowed to exploit alluvial gold as well. Thus in the five years 1816 to 1820 the gold produced was worth $924,000, and from 1821 to 1825 it had already nearly reached $7,000,000. The increase continued and the following five years the output was $19,000,000. In the period 1848 to 1855 the production of gold reached $88,000,000. At the end of the seventies the average annual production reached the respectable figure of $27,000,000. In the year 1911 the quantity of gold extracted in Russia amounted to $33,540,000. But a large quantity of gold produced in Russia now is not registered. Thanks to the difficulty of superintendence in such out-of-the-way places as Siberia, no small quantity of gold when it is extracted falls into the hands of poachers, who clandestinely manage to transfer it to other countries.

The United Verde Smelter

The United Verde Copper Co. has under construction at Clarkdale, about six miles from the present plant at Jerome, a new smelter of approximately 3000 tons capacity per day. For the following details concerning the new construction we are indebted to the *Jerome News*. The plant will consist of four blast-furnaces, 48 in. by 26 ft., three reverberatory furnaces, 19 by 100 ft., and five 12-ft. converters, together with the necessary receiving and storage bins for ore and coke, a well equipped sampling mill, ore-handling system, dust chambers, and stacks.

Most of the power for operating the smelter will be supplied from waste heat boilers, connected with the reverberatory furnaces. The main power plant will be equipped with one Southwark compound blowing engine; one Rateau-Smoot steam turbo-blower; one Diesel double-unit six-cylinder oil engine, driving through rope transmission; one No. 11 Root blower, 300 cu. ft. per revolution; two No. 11 Root blowers, 300 and 400 cu. ft. per revolution respectively; one 300-cu. ft. blower, driven by a reciprocating engine; one Westinghouse-Parsons steam turbine generation unit, 500 kva., A.C.; one 1500-kva. unit; and two Weise condensers, capacity each, 41,000 lb. steam per hour, with auxiliary apparatus.

The shops will be equipped with modern machinery. The warehouse and main buildings will be of steel structures, designed with a liberal allowance of operating space. Approximately 10,000,000 brick and 8000 tons of steel will be used in the construction of this plant. A modern brick plant, to make the brick, is in the course of construction. The material will be handled in and around the plant by a modern industrial system, including the latest design of electric locomotives, conveyors, and trams.

The townsite of Clarkdale will be controlled by the United Verde company. It has been laid out on strictly modern and sanitary lines. The buildings have been carefully designed with due regard to climatic and other conditions. The fire and water supply system has received careful attention. A 40,000-volt transmission line, connected with the Arizona Power Co. mains, supplies the necessary power for construction requirements.

The new smelter and townsite are connected with the standard-gauge Verde Valley railway, extending up the Verde valley a distance of 40 miles, and connecting with the Santa Fe, Prescott & Phoenix railroad at Cedar Glade. This gives the new townsite and smelter a decided advantage in transportation facilities over the old smelter and Jerome narrow-gauge connection. It has been estimated that it will take approximately two years to complete the new plant.

Regrinding at the Pittsburg Silver Peak Mill

By S. J. Kidder

In the treatment of comparatively low-grade ores the rather high cost of all-sliming has in some instances made this procedure of doubtful value. On the other hand, there are numerous cases in which careful classification of the sand product, followed by the regrinding of the coarser sand particles, will result in a material saving above the cost of regrinding. The latter condition obtained at the Pittsburg Silver Peak mill, where crushing to 30-mesh with 120 stamps was followed by amalgamation, separation into sand and slime, direct treatment of the slime in Merrill slime-presses, and leaching of the sand.* Repeated screen analyses of the sand residue showed that the material remaining on 80-mesh, amounting to from 52 to 56% of the whole, contained 85 to 90% of the total value in the residue.

Screen Analysis of Sand Residue

Mesh.	Per cent.	Value.
On 40	22.82	$1.83
60	29.32	1.00
80	10.05	0.80
100	10.47	0.59
150	7.75	0.28
200	10.72	0.18
Through 200	8.87	trace

By careful hydraulic classification, 50 to 60 tons per day of the coarsest sand is now returned, by means of a bucket elevator, using 6 by 10-in. buckets, to a 13-ft. Akins classifier feeding a 5 by 18-ft. Allis-Chalmers chain-driven tube-mill. The discharge of the tube-mill undergoes secondary amalgamation before being returned to the main classifying cones. As an aid in regrinding the fine sand, and at the same time with a view to increasing the mill tonnage, one battery discharges directly to the Akins classifier through a 4-mesh screen. The Akins classifier has worked for six months with no repairs other than increasing the size of the truss rods from ⅝ to ¾ in. The mill was originally lined with 4-in. silex, which lasted six months on the hard quartz which is being reground. Mine quartz, sorted out and sacked on the crusher-room floor, is used almost exclusively in place of pebbles. The quartz at the lower tramway terminal is spalled to the right size for feeding into the tube-mill spiral on the feed end of the mill. The quartz is much harder than that in either Tonopah or Goldfield ores and stands up well in the tube-mill. The screen analysis of the discharge pulp is practically the same as when using all Danish pebbles. For elevating the sand and for regrinding, 4 hp. is required, and 49.5 hp. for operating the Akins classifier and tube-mill. The total saving by regrinding the coarser sand amounts to from $1200 to $1600 per month. The additional milling cost on account of regrinding amounts to 3.9 cents per ton of ore milled, as follows:

Labor	$0.004
Supplies	0.015
Power	0.020
Total	$0.039

On account of the additional slime produced by regrinding, and an increasing amount of slime in the ore, it was necessary to increase the filtering capacity of the plant. This was done by enlarging the three 64-frame Merrill slime-presses by the addition of 22 frames and plates to each press. Arrangements were made for sluicing the enlarged presses from both ends instead of from one end as formerly. The cost of installing the 66 additional frames was considerably less than three-fourths of one 64-frame press. Each press was out of commission but from 24 to 32 hours in making the extensions. The only concrete required was for the three piers supporting the rear end of the presses, and no additions were required to the building.

The total operating costs for 1912, during which time 172,482 tons of ore was milled, was as follows:

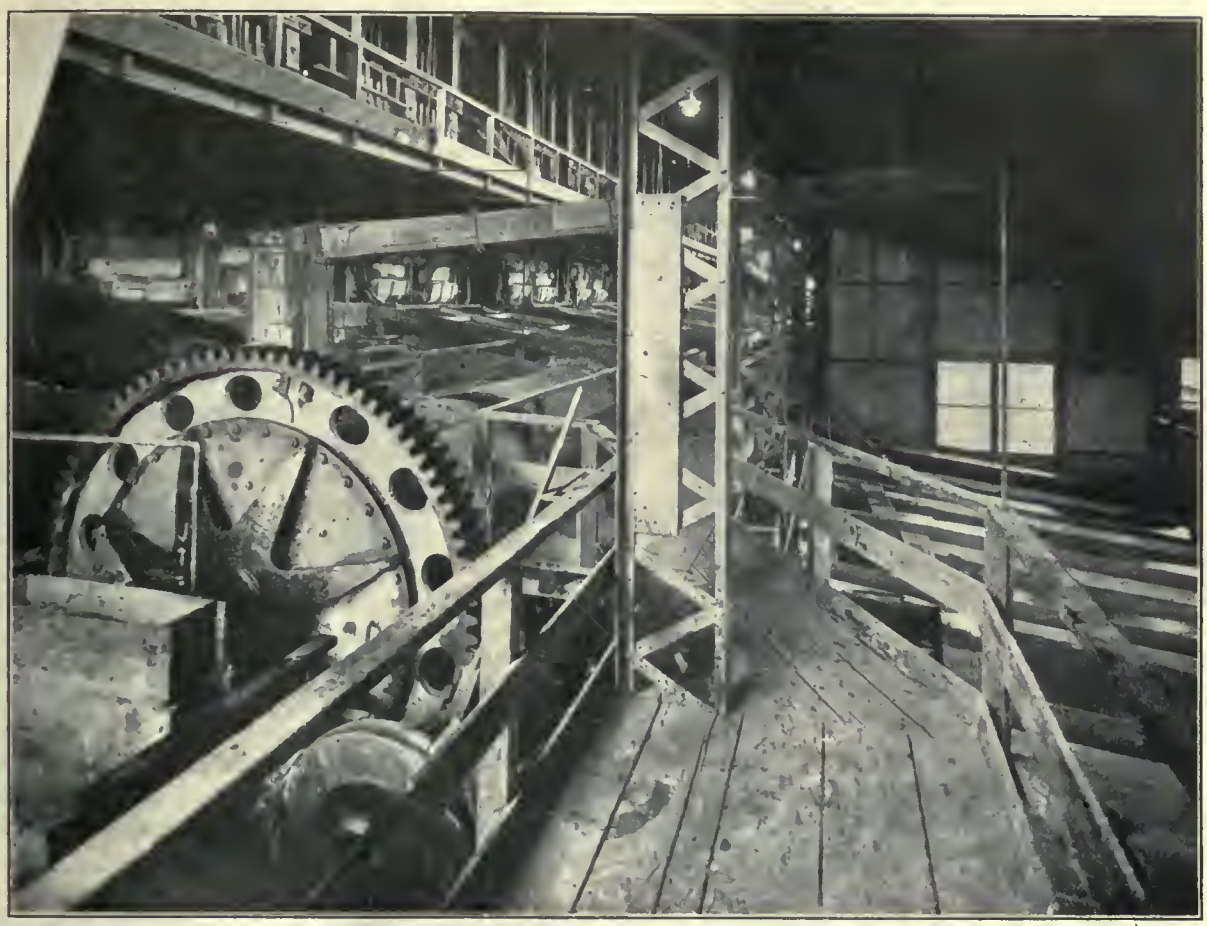
	Labor.	Supplies.	Power.	Total.
Stamping	$0.067	$0.092	$0.155	$0.314
Amalgamating	0.039	0.004	0.001	0.044
Tube-milling	0.001	0.013	0.012	0.026
Neutralizing and settling	0.028	0.053	0.002	0.083
Leaching and sluicing	0.047	0.079	0.014	0.140
Filter-pressing	0.035	0.061	0.018	0.114
Precipitating	0.004	0.036	0.001	0.041
Refining	0.018	0.028	0.001	0.047
Assaying	0.016	0.012	0.003	0.031
Water service	0.024	0.016	0.027	0.067
Heating	....	0.003	....	0.003
Superintendents and foremen	0.067	....	....	0.067
Total direct operating	$0.346	$0.397	$0.234	$0.977
Pro-general	0.034	0.060	....	0.094
Suspense account	....	0.050	....	0.050
Total operating, 1912	$0.380	$0.507	$0.234	$1.121
Total operating, 1911	$0.370	$0.477	$0.186	$1.040

The slight increase in operating costs in 1912 over 1911 is to be explained: (1) by an increase of 4.8c. per ton of ore milled in the contract price for power; (2) by a decrease of 10,000 tons in the amount of ore milled for the year, due largely to labor conditions in the summer months; and (3) by an increase in the suspense account of 5c. per ton, to pay for the improvements made during the year.

Treatment costs at the Yuanmi mill, Western Australia, the ore consisting of kaolinized material, mixed with a hard silicious matrix, are as follows:

	Cents per ton.
Rock-crusher	11.6
Ore transport	4.9
Milling	54.3
Fine grinding	54.5
Vacuum-filter	8.6
Precipitation and clean-up	8.9
Disposal of residue	4.4
Total cost per ton	$1.472

*For further details of the plant see *Mining and Scientific Press*, May 8, 1909, and Feb. 10, 1912.



STAMP BATTERIES, TUBE-MILLS, AKINS CLASSIFIER, AND SECONDARY PLATES.

MERRILL PRESSES AFTER ENLARGING TO 86 FRAMES, PITTSBURG SILVER PEAK.

The Habits of Mosquitoes—II

By H. G. F. Spurrell

*The life history of the mosquito has now been traced from the egg to its close, and the dread with which these insects are generally regarded has so far been left unexplained.

This is because the mosquito under normal conditions can inflict no greater injury on man than a few irritating papules on the skin. It is important to remember this. A mosquito can only become dangerous by feeding on the blood of some person who is in a particular stage of some infectious disease. If a culex mosquito happens to choose for its victim a person suffering from filariasis, and bite him during the night, it will probably become infected with the microscopic worms which are then active in the blood immediately under the skin. If a stegomyia mosquito ingests the blood of a patient suffering from yellow fever during the first three days that the fever is running its course, it will become infected with the germ of yellow fever. An anopheline mosquito biting a person with malaria in his blood during the right phase, will, in the same way, become infected with malaria. These will serve as examples.

Period of Infection

Supposing that a mosquito after becoming infected as just described, retires for the requisite three or four days to digest the diseased blood and, as soon as she is ready to feed again, bites some person who has not already acquired that particular disease, it might have been expected that she would infect him with it. On the contrary, she can do him no more harm than a mosquito which has never tasted blood before. The germs of the disease mentioned are not carried about in the mosquito's proboscis like bottles of poison in a man's pockets. They are living creatures, each with a life history of its own, quite as varied as that of the mosquito itself, and before they are ready to pass into the blood of another human being, from the body of the mosquito, they have to complete, in that environment, a phase in their own cycle of existence comparable, though of course different, to the larval stage of the mosquito which has to be lived in the water. The time necessary to complete this development in the case of the filaria is from 16 to 20 days, in the case of yellow fever about 12 days, and in the case of malaria about 8 days. Until this period has elapsed the mosquito may bite but will not infect her victim with the disease she carries. After the germ has had time to mature it will pass, each time she feeds, from her proboscis into the blood of the person she bites and there start another stage in its life-cycle the results of which, to the person who harbors it, may be fever or even death. In some diseases, notably in malaria, every stage in the parasite's development can be followed by means of the microscope, from the time when it makes its way through the wall of the mosquito's stomach, to the time when it reaches the salivary gland and is ready to be injected into the blood of the next person whom the mosquito bites. The mosquito, from the time when this happens, until the end of its life, is a danger to mankind. These are not high probabilities based on general observations, but facts ascertained by careful and often-repeated experiments. Men have exposed themselves in countries where malaria and yellow fever were rife, to every source of infection, except the mosquito, and not contracted the disease. Mosquitoes which had been induced to bite infected persons were then allowed to feed upon the experimenters, who rarely failed to manifest signs of the disease when the known incubation period was over. Other infected mosquitoes have been sent long distances, and set to bite persons who had never been exposed to any other form of infection, and the result was no less convincing. It may make the precise knowledge we have on these subjects appear of greater value if we reflect, that in only too many cases it has been obtained at the cost of the experimenter's life.

Means of Infection

Two questions immediately suggest themselves, namely: Can mosquitoes become infected in any other way than by feeding on diseased human beings, and, can mosquitoes transmit the diseases they carry to other mosquitoes, or to their own progeny? In the case of malaria, at any rate, these questions, so far as our present knowledge goes, may be answered with an emphatic negative. In countries where malaria is endemic, the anopheline mosquitoes draw their infection mainly from the native children. In such places the malarial parasite is early introduced into the blood of every native child, and only those whose powers of resistance are high live to grow up. The adult natives usually seem to have attained immunity, and the parasite, which can easily be demonstrated in 100% of their children, cannot be found in the parents' blood at all. They not only cannot be infected, but do not, like the children, carry infection. Even the children, though their blood may be teeming with parasites, appear to suffer little if any discomfort. Elimination of the susceptible through many generations has produced a strain which is indifferent to a germ that will kill people of unselected ancestry. The stegomyia mosquitoes probably derive the yellow fever infection from a similar source; but what we know at present of this disease lags behind our knowledge of malaria.

Taking the anophelines as typical of the mosquitoes we have to fear, and malaria as the example of the diseases they may transmit, one may venture on a few more generalizations. It is obvious that the mosquito should never for a moment be allowed to usurp the first claim to our attention. Mankind wishes to stamp out malaria and wars against mosquitoes only as a means to that end. So far as mos-

*Continued from p. 274.

quitoes themselves are concerned, our real object is to avoid being bitten not by any mosquito, not even by infected mosquitoes, but by infected mosquitoes which have become infectious. It is only because any given mosquito may be a carrier of disease that war, with no quarter, must be carried on against all mosquitoes.

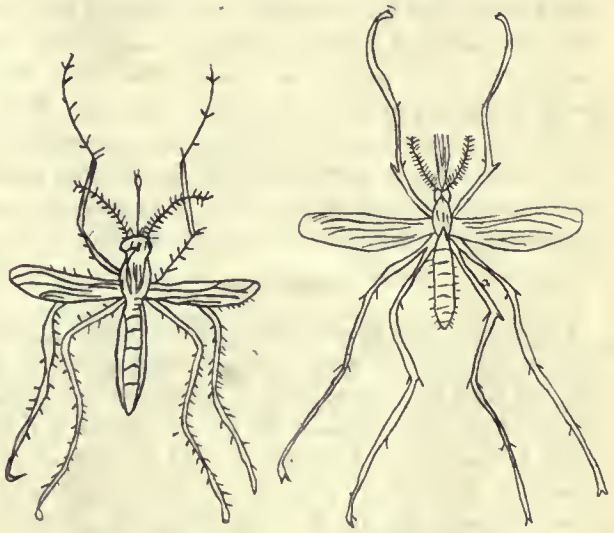
Extermination of Mosquitoes

A study of the habits of mosquitoes shows that it is possible to deal with them in the hope of attaining three totally different, but not irreconcilable ends. We may aim at destroying all mosquitoes, at preventing any mosquitoes from biting human beings, or at avoiding, so far as we can, the possibility of being bitten by infectious mosquitoes. To take these in order: The first is a counsel of perfection. I think most authorities are agreed upon this. "Manifestly, the extermination of the anopheles is a task before which the labors of Hercules pale" (Bullock). "Yet, although complete extermination of mosquitoes is not to be expected, relative extermination of mosquitoes is worth attempting, and certainly much can be attained in this direction by the vigorous use of the now well known measure" (Manson). These measures have been discussed already, for they resolve themselves almost entirely into devices for preventing the mosquitoes from breeding. In such a city as Rio de Janeiro, which is magnificently laid out on a splendid site, the task is comparatively easy. With well built houses laid out in wide streets over a large area, throughout which the drainage and water supply are on the best models, and with inspection carried out and sanitary rules enforced by a strong central authority, mosquitoes may be reduced to a minimum.

There are towns, especially within the United States, where each house-holder is required to make considerable efforts for the public safety and is fined if mosquito larvae are found by an inspector on his premises; but some of the most important measures can only be carried out by a public body. At Athens, for instance, Professor Cardamatis "attacked the state of the Ilissus, a sluggish stream which spreads itself into many wide shallow semi-stagnant pools, the very place for mosquito larvae, further sheltered as these are by the weeds which grow in slow-moving water. He cleaned out the river bed, and by embankments and deepenings narrowed its course and expedited its flow" (Lancet, 30, 9-11). Where such conditions prevail, sanitation must be begun on a large scale before the efforts of private individuals can be effective. Yet, even at Rio I have seen cases of malaria, and yellow fever is not entirely extinct, though Rio is a Paris 'built with second thoughts,' and has sometimes led the way in tropical hygiene. Even in England the anopheles mosquito still survives, though malaria has long disappeared from places where it was once endemic.

Other Precautions

The means which have been successful in making mosquitoes rare in Rio and Havana would, however, be insufficient in cities like Para in the delta of the Amazon, or New Orleans in the swamps of the Mississippi. Here it is necessary, as well, to make the houses mosquito-proof, and by staying indoors from sunset to sunrise to afford the mosquitoes no opportunities of biting. Houses can be made mosquito-proof in two ways: either by screening every door and window separately, or by putting wire gauze around the whole veranda. The latter method is infinitely preferable. I had some experience with screened windows and doors at Para, and found that on the one hand they made the rooms so close that people soon relapsed into the habit of leaving them open; while on the other, it was difficult to keep them all in sufficiently good order to prevent the mosquitoes from finding a way in. Neither of these defects applies to the practice common in the Southern states of having a wide veranda all around the house and screening this veranda. Then with the entrance to the veranda passing through a short passage guarded by double doors, invasion by mosquitoes can really be prevented. There are people who object to the idea of living in a 'meat-safe,' but personally I am content to be where I can sleep without a mosquito net, and eat my food without an admixture of flies.



TIGER FEMALE. (Carries yellow fever.)

ANOPHELINE FEMALE. (Carries malaria.)

Avoid Being Bitten

Lastly, those who, like many of us in West Africa, have not mosquito-proof houses, or are not able to stay inside them from sunset to sunrise, can at least try to avoid infectious mosquitoes. This is not so difficult as it may at first appear, if we consider what are the habits of mosquitoes. Mosquitoes rarely travel so great a distance as half a mile and they become infected chiefly by biting native children. Consequently, if the native villages are not allowed to encroach within half a mile of a European camp such mosquitoes as it contains are not likely to become infected. Since, moreover, mosquitoes are not likely to bite by day unless they are too young to be infectious, it is possible by only paying the visits to the native villages which may be necessary, by day, and avoiding them at night very greatly to reduce the chances of being infected. Though among natives it is mainly young children who infect the mosquitoes, and a European may direct the work of

adults night after night without running much risk, a white man who has got the malaria parasites into his system is just as great a danger as a native child, and should be most careful in the use of his mosquito-net out of consideration for his neighbors. A man who is suffering from yellow fever may, if he likes, discard his net after three days, but it is very difficult to say when a man who has had malaria ceases to be infectious to mosquitoes. Needless to say, it is absolutely essential that every ward of a hospital in the tropics should be made mosquito-proof, and that where it is known that infected mosquitoes are in possession of a room, they should be exterminated by fumigation.

Having mentioned mosquito-nets, it will be as well to add one or two practical hints relating to them. Anyone who has lain under one and watched his enemy outside, working up and down, carefully trying every mesh, will know that a single small rent in a net will make it almost useless; while a net which is not carefully tucked in all around the mattress, but allowed to hang down in loose folds, will merely serve to gather in mosquitoes which have spent the hours of daylight under the bed. Where much dependence has to be placed on a mosquito-net it is important to remember the conditions under which mosquitoes prefer to take wing and to keep the house well lighted and well ventilated.

Conclusion

I hope that this short review of the habits of mosquitoes may be of some use in making clear the reasons why they constitute a danger to man, and, in outlining the methods to be employed against them, I would like, however, to add by way of conclusion, a few words of caution. Important as the mosquito undoubtedly is, it must not be exalted at the expense of other matters of equal importance. It should not, for instance, be forgotten that, while anti-mosquito measures are so difficult, costly, and often, unfortunately, only partly successful, we have in quinine a weapon which can be used directly against malaria itself. I might have said, when I spoke of avoiding the bites of infectious mosquitoes, that one method of doing so is to remove the mosquitoes' source of infection by dosing the whole local population with quinine. There are places where this has seemed the only way of fighting malaria and has produced excellent results. Certainly those who, from a study of the mosquitoes' habits, recognize that they cannot altogether escape the danger of being bitten by them, may well be glad that they have the simple defence against malaria that is provided by the daily quinine.

We have learned a great deal from the work of the men who first studied the anopheles mosquito and malaria. It has revealed the fact that a large number of diseases are due to vegetable parasites, which can be transplanted directly from one person to another, but to animal parasites which, as they must pass through alternating phases of their development in different animals, cannot be transmitted directly from man to man.

The work upon malaria has been so splendidly done, and its practical applications are of such immediate importance that the great principle which it has revealed is apt to be overlooked. It would be little short of a disaster if the first discoveries of the pioneers made us forget, even for a while, that in those climates which are peculiarly suited to the lower forms of life, malaria is not the only disease nor mosquitoes the only insects to be feared. Already we know that anophelines are not the only criminals in their family, but that several species of mosquitoes are concerned in disseminating different diseases; that the tse-tse fly carries the fatal sleeping sickness and perhaps other disorders, too; that various ticks transmit disease, among them, relapsing fever; that while bugs are under suspicion on several counts, fleas are known to be active agents in spreading plague; that the common housefly so often has contaminated feet that by some it is called the 'typhoid fly'; that, in places, the soil abounds in minute worms which will burrow through the sole of a bare foot, and, having thus gained entrance to the system, take up their abode in the intestines and give rise to an exhausting and sometimes fatal anemia. Yet this is only the beginning of a list which will, without doubt, be greatly extended within the next few years. In fact the days may be coming when we shall recall with a smile the exclusive interest we once felt in the mosquito. The memory of the early work may indeed be needed soon to remind us that increased knowledge does not multiply the number of diseases, but, by bringing our enemies into the open, adds to our power of resisting them.

Mining Laws of Peru

The unit of the mining claim is the pertenencia of 100 by 200 metres, being 2 hectares, or 4.94 acres, in the form of a prismoidal solid of infinite depth. In placers, coal, and petroleum deposits the pertenencia is 200 by 200 metres, or 9.88 acres. A concession may embrace up to 60 pertenencias. Prospecting and exploration concessions are granted, in size from 60 to 600 pertenencias, but one person or company may obtain several such concessions. These are granted for one year, but may be extended for another year. A small tax of 2s. per hectare per year is paid on prospecting grants. Mining concessions pay £3 per pertenencia per year, payable semi-annually. Nonpayment during three half-years cancels the title, but arrears may be paid before that time with 20% fine for the part a half-year overdue, and 40% for that a year overdue.

Any Peruvian citizen or foreigner capable of owning property in the Republic may acquire mining property, except certain officials having to do with the issue of titles or local administration, and except employees, who cannot denounce mines within 10 kilometres of the nearest point to their employers' property. The right exists of expropriation of surface area for necessary buildings and shafts. Persons interested will naturally secure a copy of the mining laws, which are published in Spanish and in English, the latter being a translation by Fernando C. Fuchs, engineer, a member of the mining board and of the faculty of the School of Mines.—*West Coast Leader.*

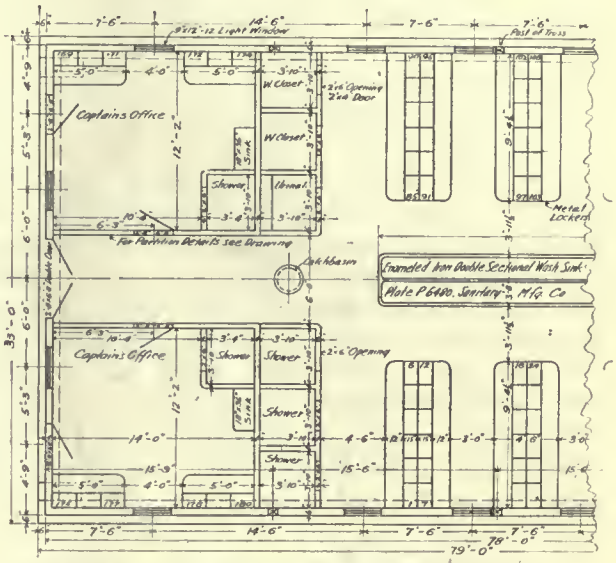
A Concrete Wash-Stand

By Frank A. Bowman

The design for a concrete wash-stand shown in the accompanying illustrations is novel and may be of interest. The idea was to make something cheap, serviceable, and of neat appearance. The stand was never constructed, because it was thought that the class of labor available would be unable to make a good job and that the cement would be apt to chip off, and also become discolored and unsightly from the iron ore.

The specifications called for 'Medusa' white cement and an approved waterproofing material incorporated with it, the cement to be troweled smooth. Hot and cold water lines are provided under the trough, with suitable connections to pass up through the sleeves, terminating in a double faucet so as to have a hot and cold water faucet in each half at intervals of about 8 ft. The miners use individual wash basins, which they keep in their lockers. While the design was not constructed, I believe it might be used successfully under other circumstances, and submit it for what it is worth.

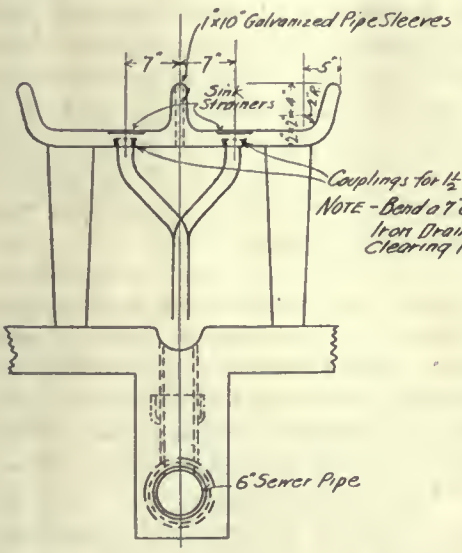
The floor plan of the 'dry' or change-house in which the concrete wash-stand was to have been used shows the general arrangement of the lockers and also shows the type of wash-stand that was chosen. It was built in two sections 24 ft. long, with a 3-ft. aisle between the water pipes, which passed overhead from one sink to the next. The 'dry'-house can accommodate 168 miners. It is 32 by 78 ft., with 2 by 6-in. by 10-ft. studs placed 16 in. centre to centre. The roof has 1:3 pitch and is covered with National asphalt-gravel surfaced roofing. It is supported by four Fink trusses and 2 by 10-in. purlins, and the building is sheathed all

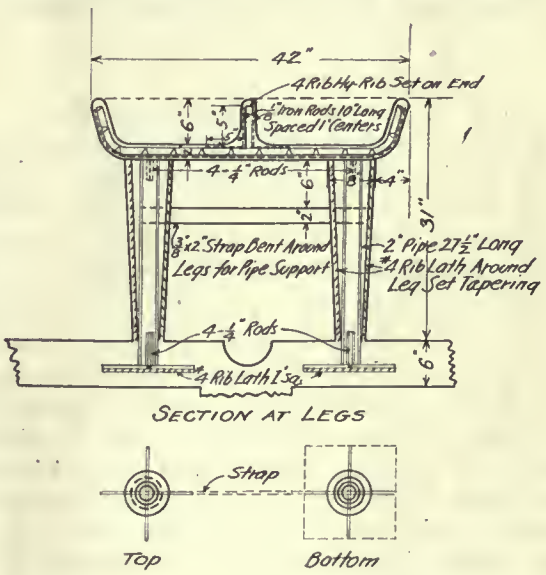


PLAN OF CHANGE HOUSE.

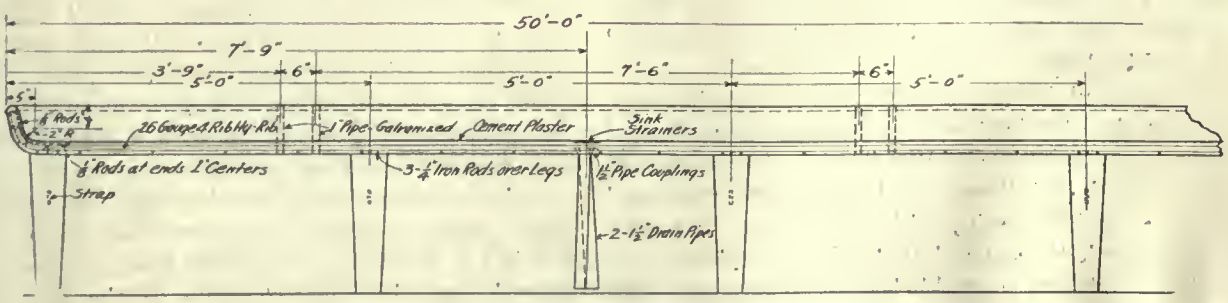
over with No. 4 shiplap. The sides and ends are covered with 26-gauge galvanized corrugated iron. The floor is of concrete 4 in. thick, with a 2-in. finishing coat which extends over the rubble foundation to the outside. The sills are bolted to the foundation, which is 18 in. thick. No. 2 rib-lath is used on the walls, and the ceilings are lathed to the gables with No. 4 rib-lath. Cement plaster is used with some hair and lime paste in the first coat.

The only piping under the floor is the drain pipe.


1"x10" Galvanized Pipe Sleeves
7"
7"
5"
Sink Strainers
Couplings for 1½" Drain Pipes
NOTE - Bend a 7" Offset in 1½" Galv. Iron Drain Pipe Clearing Floor ½"
6" Sewer Pipe



SECTION AT LEGS



LONGITUDINAL AND CROSS-SECTIONS OF CONCRETE WASHSTAND.

which is arranged so that any obstructions can be removed. The floor slopes to the centre ⅛ in. per foot, and the openings to the drain are covered with cast-iron gratings to prevent any large pieces of refuse from getting into the drain to clog it up while washing down the floor with the hose. The heating and water pipes enter the building from an underground trench and pass along the walls on the east side of the building. The hot and cold water pipes pass overhead and down to the sink. The Van Auken vacuum heating system is used. Rococo wall radiators are used under the radiators and on the end walls. Three 18-in. crown ventilators with dampers are set in the gables. The partitions are 2 in. thick, of cement plaster on hy-rib set vertically, and exposed corners are protected with metal corner beads. This design presents several features which are an improvement over present practice on the Mesaba range, particularly with reference to cost and serviceability.

Standard Screens for Sizing Analyses

By R. H. Richards

Great interest has been shown in recent years, and rightly so, in the importance of having standard sizes of screens, or sieves, in laboratories where sampling and screen sizing has to be done. The need of such standard is occasioned by the fact that without it the worker on mill or furnace products in one part of the country cannot read articles written by workers in another part of the country, and translate the figures obtained into the measures to which he is accustomed in making his own experiments, unless he knows the sizes of grain that are dealt with in the experiments described.

Efforts have been made in this direction from time to time, and I will refer to two. The sieve scale adopted by Rittinger, in his classic work on ore dressing, began with 1 mm. and the sizes for the screen holes above 1 mm. were obtained by multiplying each lower size by 1.414, or $\sqrt{2}$, in order to obtain the size next larger, going up in this way until he reached 64 mm., about 2½ in., the largest size that, in all probability, would be needed, and similarly obtaining sizes below 1 mm. by dividing the size of the hole in each screen by 1.414 in order to obtain the size of the hole in the screen next smaller, and so on down the series until the smallest possible size of screen hole was reached. So far as we know, Rittinger simply worked out this sieve scale as a desirable plan, but apparently no manufacturer took up the making of the screens, and no standard set of screens was to be had.

The second instance to which reference is necessary is the standard set of sizing screens adopted by a commission appointed by the Institution of Mining and Metallurgy, of London, and presented at its twentieth session, 1910 and 1911. This commission took the ground that miners, millmen, and metallurgists are so wedded to the use of the word 'mesh' as descriptive of the size of a sieve that it was unwise to try to introduce any other mode of designation. It is known to all who have given any thought at all to the matter, that the word mesh does not define the size of the sieve hole, and therefore the size of the product which the sieve makes. For example, I have before me the catalogue of a prominent manufacturer of screens in which it is stated that a 1-mesh screen with the coarsest wire that is used by this company would have a hole 0.030-in. diam., while the 14-mesh screen with the finest wire would have a hole 0.061-in. diam. There are sieves made by this manufacturer that have 14 different sizes of wire, ranging between these two extremes. The 14-mesh sieve therefore has 16 different sizes of hole, according to the 16 different sizes of wire used. Therefore the writer who speaks of a 14-mesh sieve in his descriptive article may mean to his reader that he is talking about grains anywhere from 0.030 in. to 0.061 in., failing utterly to convey an accurate concept to another experimenter.

The Institution commission, in making its screen set, known as the I. M. M. standard screens, fully realized this difficulty and met it by arranging to use wires of the same diameter as the width of the holes. This gives definite information as to the size of the grain that is meant when a given mesh of the sieve is used. These screens, however, do not have a constant ratio between two consecutive sizes: in fact, the ratio between the width of 100-mesh holes and 90-mesh holes is 1.095, while the ratio between 30-mesh and 20-mesh is 1.508. Other lesser variations occur all through the series, and there is in fact no attempt at a uniform ratio. There is another difficulty which this method develops, since in order to have screens of uniform size of opening, double-crimped wire cloth must be used. A prominent manufacturer of screens informs me that it is quite difficult to make double-crimped wire cloth where the wire is as large as the size of the holes, particularly when one gets to the coarser sizes, and if single-crimped wire cloth is used the wires are not fixed and the sizes of holes vary to a fatal extent by the slipping of the wires.

I believe there are strong reasons in favor of using a constant ratio between the apertures in a consecutive series. In making a series of sizing tests from a crushing machine it is necessary to know the proportional amount of the sizes at different points down the series, so that a curve may be drawn. If one pair of sieves has a small ratio of aperture of holes, and another has a very large ratio, then no regular statement of quantities of products made by the oversize of the successive sieves will give its full meaning, nor will it be possible to make a curve which will truly represent the result of that crushing operation. Also, if the series of products obtained are to be subjected to any concentrating operation with a view to ascertain the possibility of concentrating the ore, there will be no fair comparison between two products where in one instance the coarsest grain in the product is 1.5 times the size of the finest, while in the second case the coarsest grain in the product is only 1.09 times the size of the finest grain. The

results of concentrating two products differing so completely in their limits of size as this would fail entirely of being comparable one with the other. Again, the very fact of using 'mesh' as the standard of size of sieve invites the man who has not obtained the I. M. M. standard sieves to talk about his products by use of the word mesh, when his products are made by sieves of different make and therefore have different sizes of holes from the I. M. M. standard screens.

For these three reasons: (1) the difficulty of making double-crimped wire cloth of such coarse wire, (2) the difficulty of drawing deductions from curves and of comparing results, and (3) the difficulty of others not provided with the I. M. M. standard using the word mesh, it seems to me that a standard set of screens, standardized according to the size of the aperture instead of according to the number of meshes, having a constant ratio throughout—for example, Rittinger's ratio of 1.414 or $\sqrt{2}$—and using wires that are smaller than the aperture, thus permitting the use of the most suitable kind of double-crimped wire cloth, cannot fail to have great advantages over any series of standard screens based upon mesh.

Such a set of standard screens has recently been prepared by the W. S. Tyler Co. of Cleveland, Ohio. This set of screens begins with a 200-mesh screen that has been standardized at Washington by the United States Bureau of Standards officials, and uses the ratio 1.414 from 200-mesh to the maximum size. Since the ratio between the apertures of two consecutive screens is always the same, a sizing test made with these screens will show the proportional quantity of material according to a perfectly definite law. That is to say, the largest grain in any product will always be 1.414 times the size of the smallest grain in that product. As a consequence of this, the series of products obtained can be plotted as curves which truly represent the quantities according to a definite law. If concentrating tests are desired upon these products, the results of concentrating will be comparable throughout the series of products, ranging from the coarsest to the finest.

I warmly commend this effort to make a standard set of screens for use in sizing tests. I hope that they will generally be adopted by mining engineers, mill men, and metallurgists in order that papers written on ore dressing topics may possess the uniformity in the description of the products described.

Elevating tailing at the Calumet & Hecla mills is done by wheels of the following dimensions:

	No. 1.	No. 2.
Diameter of wheel..	62 ft. 6¾ in.	51 ft. 4¼ in.
Width of wheel.....	11 ft. 9 in.	11 ft.
Number of buckets..	544	244
Size of buckets.....	4ft. 3½in. by 2ft. 9in.	4ft. by 2ft. 4in.
Size of shaft.....	26ft. 5¼in. by 25in.	23ft. 6in. by 22in.
Height pulp is lifted.	54 ft.	43 ft. 2 in.
Method of driving pinion	rope from motor	belt from motor
Capacity at 10 ft. per sec., per day..	40,000,000 gal. water 8000 tons sand	30,000,000 gal. w. 4000 tons sand
Est. weight of wheel.	.....	400,000 lb

Development Work in Colombia

By An Occasional Contributor

A property is under development about 45 miles above Quibdo, Colombia, on the Audagadua river, a branch of the Atrato, which flows into the Gulf of Darien, over 600 miles from Cartagena and about the same distance from Colon. The gravel deposit is a pre-volcanic river channel about 30 ft. below the present normal river level, with an overburden of tough volcanic blue clay and big boulders, thus requiring good timbering. This material is locally called *agomassa*, the bedrock is decomposed diorite, and width of the pay-gravel is from 50 to 60 yd. Its depth is about 2 yd., the gold content is satisfactory, and $1 per cubic yard will cover the cost of mining and washing.

The altitude at the river level is 650 ft. The surrounding country is rough, broken, and precipitous, densely covered with a tropical growth, mak-

ALONG THE MAGDALENA RIVER, COLOMBIA.

ing cheap timber of a good quality for all mining purposes available at a very low cost. Every side canyon supplies abundant water for all purposes, which can be cheaply developed by short ditch-lines, the outer shells of the 'Balsa' palm trees supplying flumes when necessary. The palms also supply the boards for floors and siding for bungalows, of which the roofs are thatched with leaves.

Labor of fair efficiency costs from 80c. to $1.20 silver, the exchange being at the rate of $2.25 or $2.50; this includes board, bringing the total cost of labor to 60 or 75c. gold per day. At present the employees are all negroes, but later it is planned to bring in white natives from Antioquia. As a rule these men are tractable, honest, and as willing to work as a tropical climate permits. They are all expert canoemen, and the freight cost from Quibdo to camp is less than it would be by big teams in the mining regions of California, Nevada, or Arizona for the same distance. The laws in this district do not permit foreigners to denounce or locate mining claims, hence it is no proper region for prospectors, for to secure holdings it is necessary to either buy or lease from native owners. They, contrary to some reports, are usually fair to deal with, leases being given on a 15 to 20% basis, which is reasonable if a proper selection is made.

So far as I have been able to judge, the titles here are just as safe and secure as a United States patent would be in America.

Foodstuffs naturally cost more here than at home, on account of duties and numerous reshipments, but on the whole the low labor cost more than counterbalances this increase. All mining machinery and supplies are allowed virtually free entry, only a nominal charge for office fees being made, as in Mexico. The climatic conditions are such that it requires from six months to a year for a Northerner to become acclimated. The nights are cool and, almost without exception, rainy, the precipitation averaging for the past six months at the rate of 300 inches per year. October, November, and December constitute the winter months; the other nine months are hot. As it requires considerable time and expense to 'get a line' on conditions here, it would prove a losing game for anyone to come into this region unless satisfied to put up with the conditions obtaining and financial backing to the extent of $20,000. With those prerequisites, if the prospector can stand the climate and knows the game he will succeed.

A. I. M. E. Meeting

The annual meeting of the American Institute of Mining Engineers was held in New York City, beginning February 17 and continuing until February 20. The sessions were held in the Engineering Societies building, 29 West 39th street, which also served as headquarters. The arrangements for the meeting, aside from the technical sessions, were made by a committee consisting of G. F. Kunz, E. Gybbon Spilsbury, L. D. Huntoon, Thomas Robins, and H. J. Seaman. The meeting was opened Monday evening by an informal smoker in the Institute rooms. On Tuesday morning the annual business meeting was held. In accordance with previous announcements, the regular order of business was suspended, and the proposed new constitution was first voted upon. This was adopted with only six dissenting votes, with the exception of the provision for creating a class of fellows, which was defeated. The amendments proposed by C. R. Corning and G. C. Stone were also carried by a substantial majority. The letter ballots for officers for the ensuing year were canvassed, as provided in the newly adopted constitution, and the following were elected: President, Charles F. Rand; past presidents; Charles Kirchhoff, James F. Kemp; vice-presidents, Karl Eilers, Waldemar Lindgren, B. B. Thayer, S. J. Jennings, T. H. Leggett, F. W. Denton; directors, W. J. Oleott, C. S. Robinson, E. L. Young, J. A. Holmes, John H. Janeway, Jr., J. W. Finch, J. W. Richards, E. P. Mathewson, L. D. Ricketts; to fill the unexpired terms of C. F. Rand and J. F. Kemp: R. W. Hunt, James Gayley.

In the afternoon, following luncheon at the Engineering Societies building, a technical session was held, and papers on mining and geology were read and discussed. In the evening F. H. Newell, Director of the U. S. Reclamation Service, gave an illustrated address on irrigation. In accordance with the program, all day Wednesday, February 19, was devoted to papers on iron and steel. Unusual efforts had been made to secure a wide variety of papers and to stimulate thoughtful discussion. The committee having it in charge have made this preliminary announcement concerning the papers available:

J. R. Finlay, 'Valuation of Iron Mines.' About 100 men who are well informed on this subject (or on phases of this subject) have been selected in advance by Messrs. Finlay, Birkinbine, and others and have been invited by the Committee to study the paper and send in advance discussions, or to discuss it in person. So much interest has been evoked by Mr. Finlay's valuation of the Lake Superior mines that an interesting debate on this subject is expected.

Albert Sauveur, 'Notes on Cast Iron.' Several men selected by Messrs. Sauveur, J. E. Johnson, Jr., and others have been invited to study this paper in advance and prepare discussion for the meeting.

Robert W. Hunt, 'Comparative Notes on Steel Rail Rolling.' Requests are also being sent out for discussions on this paper, which will no doubt attract many to attend.

H. F. Miller, Jr., 'New Design of Open-Hearth Furnace Using Producer Gas.'

Henry M. Howe, 'Why Does Lag Increase with the Temperature from which Cooling Starts?'

B. G. Klugh, 'Microstructure of Sintered Material.'

F. Louis Grammer, 'Blast-Furnace Slag Analyses for Twenty-four Hours.'

H. F. Miller, Jr., 'Methods of Preparing Open-Hearth Steel for Castings.' This paper was received at the Cleveland meeting too late to be discussed, and, as it has aroused a great deal of interest, it will be brought up for discussion at this meeting in response to requests.

In addition to these papers and discussions, the Committee will make one of the chief features of the day a symposium on the subject of sound steel ingots. The following papers dealing with this subject are on hand and will be in print for the meeting:

B. Talbot, 'The Production of Solid Steel Ingots.' with extensive discussion which has already been contributed.

P. H. Dudley, 'Piping and Segregation of Ingots of Steel and Ductility Tests for Open-Hearth Steel Rails.'

E. A. Beck, 'The Use of Anti-Piping Thermit in Casting Steel Ingots.' These three papers describe new processes for making sound ingots. In addition to them, two other processes which are now being tested commercially, but have never before been publicly announced, will be described if the experiments upon them can be brought far enough along to warrant the report, which at the present time seems probable.

Following these papers a general discussion of the subject of sound steel ingots, on behalf of both producers and consumers of steel, will be had, presented under the following topics:

1. Is the present method of getting rid of the

pipe by cropping, a safe and reliable device for making sound steel?

2. Is it desirable to increase the amount of metal arbitrarily cropped off the top of an ingot, and, if so, what would be a fair excess price to pay for cropping off 20 per cent?

3. Is it commercially practicable to make ingots without pipes or blowholes, and what additional expense of manufacture would be justified to accomplish this result?

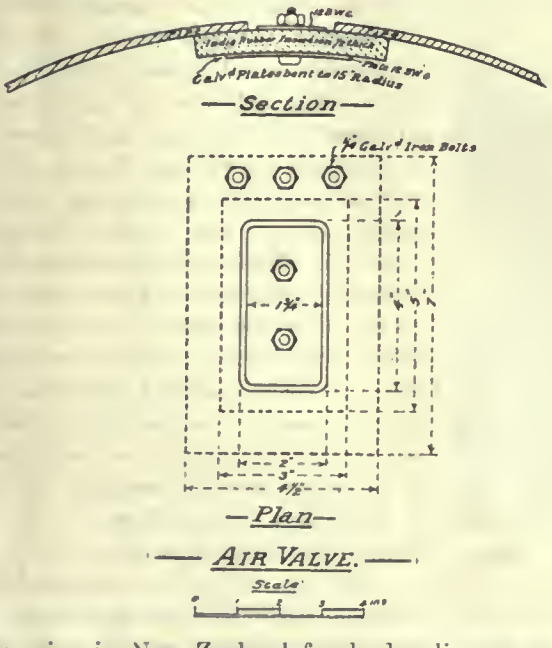
4. What process for making pipeless ingots seems the most promising of commercial success, and why?

The discussion will be opened by engineers whose names are already prominent in this connection, and a large number of engineers for railroads and other consumers, steel-makers, and metallurgists. Non-members of the Institute have been invited to attend and enter the debate in order that all sides of this question, which is probably the most important now before the steel public, may be adequately represented.

Provision was made for a technical session on Thursday, if it should prove necessary. The care shown in preparing for the meeting at Cleveland produced such admirable results that it is to be hoped that this practice will characterize all future meetings of the Institute.

Air Valve for Water Pipes

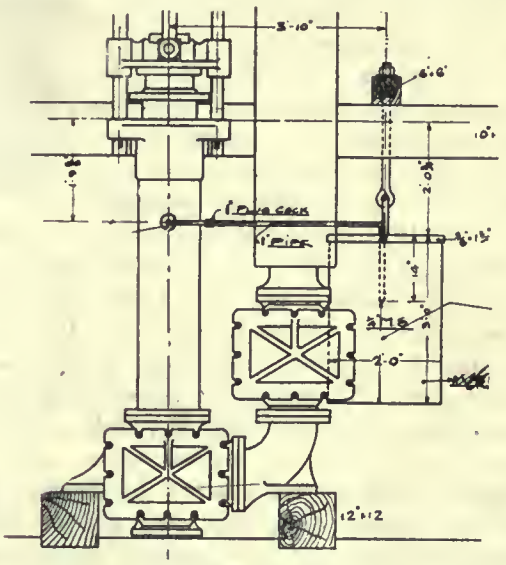
Collapse of high-pressure water pipes by creation of a vacuum through the sudden emptying of the pipe, may be avoided by fitting an air valve similar to the accompanying cut, which was used in a new



30-in. pipe in New Zealand for hydraulic purposes. It is simply a flap, hinged on one end to the inside of a pipe, just below the penstock, and is kept closed by pressure of the water; but immediately the pipe is suddenly emptied by accident or otherwise, the valve opens, and allows air to rush in. In 1898 a 30-in. steel pipe at Waikino, New Zealand, was partly destroyed by a landslide, the pipe emptied, and as there was no air valve, the whole length down the hillside collapsed, due to a vacuum in the pipe. The next pipe had a valve fitted.

Plunger Pump Regulator

Plunger pumps elevating mill pulp often give trouble through emptying the sump, and then refuse to pick up their load again, when the sump fills up. This is overcome at several mills in Kalgoorlie by means of a self-priming apparatus. The duplex Cornish pump at the Yuanmi mill, East Murchison goldfield, of Western Australia, with plungers 10 by 48 in., lifts pulp from the stamps to a diaphragm-cone, and also from the tube-mill and grinding pan. The pump is provided with a regulating bucket. The object of this gear is to constantly keep the pulp within an inch or so of the bottom of the suction pipe, which is done in the following manner: The regulating bucket, 2 by 3 ft., is filled with water. A 1-in. pipe is connected with the pump barrel, as close to the stuffing-box



PUMP WITH REGULATING BUCKET.

as possible, and is led to the regulating bucket. On the up-stroke of the plunger pulp is drawn up the pump suction pipe, and also from the regulating bucket. On the down-stroke the pulp is forced through the pump delivery column and also into the regulating bucket; only a small quantity surges to and fro between the pump-barrel and the regulating bucket. When the pump is on the point of forking, the amount of pulp necessary to prevent it from doing so is drawn from the regulating bucket, and is returned on the down-stroke. A cock may be fitted to the pipe leading from the pump-barrel to the regulating bucket, so as to adjust the quantity of pulp surging to and fro. The advantages of this balancing method are: that the pump being always nearly in fork, the sump is practically empty; no intermittent choking with sand occurs; the delivery through the rising column is constant; and the pump pit then provides the necessary storage for drainage from the stamps and grinding or other plant, when the mill is stopped for any purpose. There is, of course, a slight loss in the volumetric efficiency of the pump; but, on the other hand, a higher plunger speed can be adopted, since the use of the regulating bucket eliminates air-lock shocks. The loss of power caused by the surging of the pulp from barrel to regulating bucket is small.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Institute and Western Members

The Editor:

Sir—In view of the diverse opinions which have been held by members as to the affairs of the American Institute of Mining Engineers, and somewhat in answer to James Douglas' statement in the *Mining and Scientific Press*, January 25, 1913, I think I voice the opinion and sentiment of the majority of the members in this section when I state that at all times they have had the good of the Institute at heart, however much they may have differed as to details; that they have deplored conditions which may have reflected on the Institute itself or any of its members. But that there has ever been a thought of withdrawing, as individuals or *en masse*, from the Institute, by members in this region, is wholly without foundation, and I believe this applies to the whole Western membership.

Personally, I hail with satisfaction the apparent approaching settlement of all internal troubles, and in this sentiment I am sure I am joined by the greater number of Western members. It is my opinion that the Institute transcends in importance to the members, the individual, however great the influence may be, and anything which tends to disorganization must be frowned upon. And while Western members may reserve the right of preference and always will, they may always be found ready to promote the best interests of the Institute and to accept whatever decision the majority may arrive at. Let us all remember the past only for the value which we have had from it and let us be determined to make the influence of the Institute continue to grow wherever mining, metallurgy, and allied science is carried on.

L. K. ARMSTRONG.

Spokane, Washington, February 1.

The Benguet District

The Editor:

Sir—The articles written by Arthur W. Geiger on the above-named district for the *Mining and Scientific Press*, while interesting and in the main correct, do not throw sufficient light on the past of the district to enable readers not familiar with its history and conditions to make a just estimate of what has been done, and what the possibilities may be. His observations and impressions are evidently those of a visiting engineer, or of one new to that country. I hope, therefore, that he will pardon me if my impressions differ somewhat from his, for mine were gained during a five years' continuous residence, in charge of one of the properties to which he gives honorable mention, the Benguet Consolidated, or more properly the Minnesota mine, as all the productive work was done on that claim. When I took charge in 1905 this was merely a prospect, with 220 ft. of adit, all on the same level. During my time there it was equipped with a small stamp-mill and the first cyanide plant erected in the Islands, and was developed for a thousand feet in length by a width of nearly 100 ft. on three levels, the lowest being 15 ft. below normal water-level.

It might easily be inferred from Mr. Geiger's remarks concerning the general grade of ore in the district that ore of really good grade, and of workable width, does not exist. On this property, however, a number of shoots of ore, several hundred feet in length along the lead, and from 1 to 5 ft. in width, beginning thin at ends and being thickest at middle, assaying well above $20, were developed on two levels. Two of these were in a zone near the foot-wall, and one in a zone near the hanging wall. The ore in the former was soft and characterized where rich by a black iron sulphide which, when ground very fine, would yield its gold by amalgamation. The ore in the hanging wall side of the lead was of an entirely different character, being hard compact quartz, in fragments, and cemented by a dark bluish quartz matrix, evidently deposited from hot alkaline solution. The gold was in finely disseminated particles of bright iron sulphide, mostly in the matrix, but not limited to it. A great deal of iron sulphide carrying little of value existed in the mass of the lead matter outside of the pay-shoots, this sulphide being in distinct but not large crystals of a dull bluish color. A shipment of not particularly clean concentrate made to the Selby smelter returned over $100 in gold per ton. Samples panned from the pulp as it left the end of the plates would assay about $150 per ton, and similar samples panned from the leached charges before a table was installed would yield about $30. After table work was begun, experiments were made by fine grinding concentrate in a miniature tube-mill improvised from an old acid jar, which, with 8 to 12 hours grinding with cyanide solution of 8 lb. per ton, yielded 90 to 95% in solution. Dee W. Minier, who was assayer and engineer on the property at the time, made these experiments. It is possible that I have forgotten the exact figures and that he can give more exact ones. If I am in error, I should like him to set me aright. My impression is that KCN loss was about 4 lb. per ton. At any rate, the work proved that with fine grinding most of the gold was liberated in such form as to be amenable to cyanide, and the indicated treatment was to grind fine the concentrate at least, or better, to tube-mill the entire sand product, since this, as separated from the slime after amalgamation, would assay from $10 to $16. The sand with the concentrate removed would assay from $5 to $8 and yield not to exceed 70% extraction with three weeks leaching cycle. The slime treated separately assayed several dollars per ton higher than the sand product, so the obvious treatment was to crush in stamps, as was already being done, amalgamate the coarse gold (25 to 35%), and tube-mill the sand product, combine with slime produced in crushing, and handle the combined product in a filtration plant. Leach-

ing has no place in treating ore of this character and grade. Had the company had sufficient capital, it would have paid to have discarded the old combination plant and to have built a small but efficient all-sliming plant. In view of the facts, the loss of the old plant need not have been a serious matter—indeed, it might have been a blessing in disguise, had the owners been in a position to rebuild properly.

ANTIMOK CANYON AND THE FIRST CYANIDE PLANT IN THE PHILIPPINES.

The Bua mill, situated just below the Consolidated, was much better adapted to the ore it had to treat, for this was of entirely different character from that of the Consolidated. It came from a different vein system and consisted mainly of calcite-manganese vein material with little quartz, some sulphide, and much of the gold free on the cleavage planes of the calcite and rhodochrosite. Better results were obtained on the plates, and the sand yielded the gold up to 80% by leaching, while the slime was sufficiently low to allow of its being run to waste without serious loss. The ore, moreover, was alkaline as it came from the mine. That of the Consolidated was distinctly acid. The two ores together would have made a fine working combination, handling each separately through amalgamation, then leaching the Bua sand and combining the slime with the whole ground product from the Consolidated for agitation and filtration.

If Mr. Geiger has included these two mills in his count of seven, he should say that there *have been* seven, for these two are certainly in the 'has been' class. Yet they yielded considerable gold during their brief careers. I am not in a position to say how much was produced from Bua, but during the time I had charge of the Consolidated over $140,000 was shipped. Considerable more was produced subsequent to the loss of the cyanide plant by working up old dump stuff and low-grade surface material together with some ore from the mine. I am unable to state the amount of this production, which was all from amalgamation, and certainly did not represent over 50%, at the most, of the included gold. Since the typhoon of October 1911, which removed everything but the crusher and stamps, I understand there has been no production.

To one coming to that country now, it no doubt appears that it was a foolish procedure to place mills in such a position as that which the Benguet Con. occupied. In explanation, it should be remembered that conditions were different in 1905. The stream was running in a well defined channel, ample to carry all flood-water, and had cut to bedrock. The bank was of hard cemented gravel covered with vegetation, and offered no evidence that the water had been over it in a century. The surrounding hills, which Mr. Geiger describes as being scarred by great slides, were then covered with vegetation, and such old slides as showed were solid and grass covered. We had no difficulty in diverting the water for power purposes, nor in conveying it to the mill, gaining a head of 125 ft. in a little over 3000. Still the wheel was set 24 ft. above the normal water-level in the stream opposite the mill. The millsite was chosen because of easy water-line to it, proximity to ore supply, and topography generally suited to the class of mill being built. It served the purpose well for several years, but an unusually heavy typhoon in the fall of 1908 raised the river to such an extent that it cut under the slime-tanks. Prompt action saved them, and the following summer the channel was straightened and a protecting wall built. When the big storm of October 1909 came, accompanied in its midst by a distinct earthquake, great slides were thrown down into the stream, the flood backed up, broke these dams, and the mass of water, boulders, and trees, coming down with great velocity, made short work of everything within its reach. Indeed, it not only removed the greater part of the Consolidated mill within a few minutes, but tore away the site as

BENGUET CONSOLIDATED MILL. GRASS ROOF LATER REPLACED BY IRON.

well. After this storm the river level was fully 25 ft. above its former level for about two miles. In time this accumulation will gradually be removed by successive floods, but so far little impression has been made on it. Each year new slides occur, the country having been so badly shaken by the earthquake. It also makes it difficult to divert water from the streams, as what is water-level this year may be ten feet above or below next. It may be possible, as Mr. Geiger suggests, to develop hydro-electric power on the larger streams, notably the Agno river, but take my word for it, no one who wishes to retain a dam through a rainy season should put it in one of those streams whose drop is hundreds of feet to the mile, and which in flood times will carry down-stream boulders weighing tons, at a high velocity. No dam could withstand the shock. We never attempted to dam the Antimok (though on various and several occasions we did *damn* it, but apparently to no purpose). If I were figuring on operating there again, I should use oil-engines, unless electrical power were available by purchase.

Referring to evidences of earlier workings, we found on the foot-wall side of the lead at Antimok well preserved tunnel sets, made from the pitch-pine wood of the country, in a remarkably good state of preservation. The sets consisted of the usual four pieces, but the posts had tenons on each end, fitting mortises in both sill and cap. The height in the clear was about 3 ft. 6 in., and the width about 3 ft. Lagging had been used, though most of it was gone. The Igorrotes say that years ago Chinese worked here, and that within the memory of some of them, fragments of Chinese pottery were in evidence at the camp, where the ore was evidently ground in the many stone mortars still present. I do not believe that quicksilver was used. The gold was probably recovered by extremely fine grinding and panning, which is the method still used by the Igorrotes. The ancient workings extended along the outcrop of the foot-wall zone of ore fully 500 ft. up the slope and for a distance of 100 ft. below the outcrop, the stopes being filled, or having become filled naturally, by material from the sides. We opened up the whole extent of these workings by raises through the ore, and removed and milled the most of the filling. This assayed from $6 to $10 per ton in gold. Some remains of old timber were found in the filling, but not many. It is probable that stulls were used temporarily. The width of filling mined was from two to seven or eight feet, though of course this did not necessarily represent the original width of ore. The limitation of about 100 ft. in depth seemed not to be on account of lack of ore beyond, for the good ore was found to come right up into the bottom of the stopes, but to inability to mine further because of lack of air or some other difficulty.

Speaking of the ability of Igorrotes as packers, I once gave a contract to a young Igorrote to get 11 tons of limestone from the Comote mine to the Consolidated, a distance of 1½ miles, over one of the roughest pack-trails I have seen, for ₱10 per ton. He engaged his friends and relatives as packers (at the rate of ₱8 per ton), and they went at it, men, women, and children. They nearly worked themselves to death in the effort to get rich quick, and cleaned up the job within a few days, making four or five trips per day, with big loads. One woman brought in a load of 125 lb. and one man one of 187 lb. Our financier, who by the way had had the advantage of having been a *muchacho* to a Secretary to an American Commissioner for several years, went along with a light load, encouraging the others and doing the clerical work. While the above is not comparable with the feats of the Indian packers at the portages and in the Andes, it is, considering the size and weight of the Igorrote, not a bad record.

Prices of labor in the Benguet district must have advanced considerably of late, judging from Mr. Geiger's figures. It is possible that he includes the cost of 'chow,' which usually consists of a ration of rice and small dried fish, and costing formerly about 16c. Philippine currency. On the other hand, the price of dogs in the open market must have come down considerably, for, while I never personally purchased a dog for food purposes, I was under the impression that the price of a good *lean* dog, "on the hoof," was about ₱2.50. If the price has dropped to 50c., the Igorrote certainly has no complaint to make at the high cost of living.

Mr. Geiger falls into a quite natural error in speaking of the habit the Igorrote women have of playing what he terms a 'bow' as they walk along the trails with their loads. This is not a bow at all, but a section of bamboo with a portion cut out so as to form two long prongs like a tuning fork, and as they walk along they beat out a monotonous strain by striking this instrument on the forearm. The note varies according to the point along the prongs where it is struck. They play thus, not to ward away evil influence, but to while away the time. It is one of the few recreations the poor beasts of burden get.

I can heartily agree with Mr. Geiger in his statement that Baguio is beautifully situated. Nothing is more surprising to one going to that country with the expectation of seeing nothing but palms and tropical vegetation, to land at a modern health resort amid piney woods, with cool bracing air, and park-like surroundings. He is apt to doubt the evidences of his senses and conclude that he has wandered from his course and wound up in the Sierras of California—until he sees the people, and then he realizes that he is really in the land of the Igorrote, eater of dogs, erstwhile hunter of heads, but, withal, a right good fellow when you come to know him.

C. M. Eye.

Concheño, Mexico, January 1.

Rand mines in 1912 produced 25,506,361 tons of ore averaging $6.78 per ton. Working costs were $4.32 per ton, and the total profit was $60,854,400. Dividends paid amounted to $39,988,800. The totals to date are approximately 200,000,000 tons of ore, yielding $1,437,210,000, and $424,944,000 in dividends.

Special Correspondence

GLOBE, ARIZONA

WORK AT COPPER HILL.—SUPERIOR & BOSTON.—HOISTS AT THE INSPIRATION MINE.

At the Copper Hill shaft of the Arizona Commercial property, sinking is being continued below the 800-ft. level. Until the completion of the new concentrator of the Old Dominion in the early fall it is probable that all work in the Arizona Commercial will be confined to development. An interesting feature of the Copper Hill's shaft equipment is the cross-head now being used during sinking. The great danger of the possibility of the cross-head becoming caught in the shaft as the bucket is lowered and afterward falling upon the men in the bucket is obviated by the construction now being used. The cross-head is constructed as a platform and the men ride upon it instead of the bucket. Should it become hung up in the shaft, an improbable occurrence, because of the added weight of the men, its occupants would immediately signal to the engineer and stop the hoist. There are about 200 tons of high-grade copper ore

ARIZONA.

on the dump of the Idaho property, in the Dripping Springs district, awaiting shipment. The property is owned by J. P. Hayward and Lyman C. Woods. Assays from the property average 19% copper, $11 in gold, and 1½ oz. silver. The ore will be shipped to the El Paso smelter by way of Kelvin until the smelter at Hayden is ready to receive custom ores.

The Superior & Boston has over 75 ft. of workable ore in the raise that is now about 250 ft. above the southeast drift on the 800-ft. level. While the raise has been in ore from the beginning, it has been averaging as high as 9% copper for the last 70 ft. driven. The ore is copper glance and the average width of the shoot is about 7 ft., partly mined and partly revealed by drilling toward the hanging wall. It appears that the ore is dipping southeast from the raise, under Quo Vadis hill. This will necessitate driving in that direction on the 800 and 1000-ft. levels to explore the orebody beneath the hill. In the southeast drift on the 800-ft. level the showing is so encouraging that it is certain the 100-ft. level will be driven ahead very soon. The mine has been shipping excellent ore to the Old Dominion smelter at the rate of five carloads per week, and as soon as the raise has established connection between the 800 and 600-ft. levels the shipments can be increased to a carload per day. If the ore continues above the 600-ft. level the shipments can be still further increased to two carloads per day.

At the Iron Cap mine the shipments for January were considerably smaller than for the preceding month because of increased development on the 650-ft. level to explore the orebody farther to the east, and toward the Arizona Commercial end-line, the management having decided to drive No. 651 drift farther eastward before extending the stoping on that level. The chutes are being enlarged to a depth of 40 ft., which will allow larger shipments in future. At the Inspiration Consolidated Copper Co.'s property the installation of three 50-hp. Allis-Chalmers electric hoists is practically completed. The hoists are being placed at the Scorpion, Main West, and Incline shafts. The Incline shaft has been sunk 100 ft. below the 3450-ft. (sea-level) adit and will be sunk another 40 ft. to provide a sump. After completion of the sump a vertical 2-compartment raise will be lifted from the incline shaft at the top of the sump. The raise will be carried up to the 3450-ft. adit, where a 180-ton pocket will be cut. Waste from the pocket will be dropped through the vertical raise, and hoisted through the Incline shaft to Joe Bush adit, and thence trammed to the surface. In the incline adit, Mr. Flynn, the contractor, is placing a set of timbers daily.

PHILOMATH, OREGON

PLACER WORKING.—BIG NUGGETS.—GOLD KING.

There is still an abundance of rain and snow falling in Josephine county placer districts, and the hydraulic claims are enjoying the best season they have known for a number of years. Even the ground-sluice workings are busy; and while these employ such crude equipment as rockers, shovel conduits, and arrastres, they operate on rich ground, and give excellent returns. The Ruble placers, of Wolf Creek, are having a splendid run, operating two giants at the face and one at the grizzly. Both day and night shifts are employed. It was on this property that the Ruble grizzly, now used in placers all along the coast, had its beginning, S. C. Ruble being the inventor. It is a form of elevator used to remove tailing from ground that does not afford sufficient natural dump.

The Osgood placers, operating a battery of two giants in the rich diggings of Illinois river, near Waldo, are under the local management of John Logan. They are the property of F. H. Osgood, a prominent Seattle railroad and mining man. The mines were run a part of the season in conjunction with the old Logan & Simmons properties, but the latter have been closed down, and Mr. Logan will devote all his time to the Osgood. The Oscar creek placers, long noted for their production in big nuggets, are operating to full capacity, night and day. As with other Applegate river mines, the season has been an unusually good one, this stream remaining at a high stage for a much longer time than it generally does. The mines have already made several heavy shipments of gold to the mint, and a number of big nuggets have been uncovered. The record nugget from Oscar creek found several years ago was worth $500.

A crew of graders and brush cleaners is now at work on the right of way of the Pacific-Interior railroad, from Grant's Pass south, and contracts for the construction of the line have been let. Funds have been provided for the building and equipping the road as far as Hays Hill, and this much will be finished this year. It is now a certainty that the mines of Slate creek, Kerby, and Illinois rivers, as well as the copper mines of Waldo, will soon be favored with much-needed railway transportation. Assured of this, there is a decided activity in the development of all western and southern Josephine county mines.

The old Gold King mine, near Kerby, which attracted much attention five or six years ago, is soon to resume operations. M. Marks, who has been principal owner and general manager of the property from the beginning, spent the past two months on the property getting it in shape. While the Gold King has been idle, it was never abandoned. Mr. Marks has never lost faith in the mine, and his Seattle associates have remained with him. All are determined to

make the Gold King a paying property. J. C. Mattison states that the first shipment of machinery for the Oriole is expected soon from San Francisco. About 125 tons of equipment will come in the first lot, including a 10-stamp mill and water-power plant. The 10 stamps will be merely the first unit in the reduction plant, as the company confidently expects to increase it to 20 or 30 stamps within a year. The Oriole is now opened to a depth of 600 ft. On the lower levels, a big body of low-grade ore, assaying $9 to $10 per ton, has been uncovered, and this will be the principal milling ore.

BLACK HILLS, SOUTH DAKOTA

REPUBLIC DEVELOPMENT.—TITANIC LEASES.—FLATIRON MILL.

The Republic Mining Co. has been making some interesting ore disclosures in recent development work on its property in Blacktail gulch. The ore is a typical refractory silicious material, amenable to cyanidation. The company sank a new shaft and fortunately cut an ore-shoot in the quartzite at a depth of 100 ft. Since starting work on that level a considerable amount of work has been done in ore, exposing a liberal quantity. The company has ordered a pump and will dewater the Maggie shaft, in old workings in which milling ore is reputed to have been left from operations conducted about 12 years ago. It is probable that the company will erect a small cyanide mill the present summer.

The Titanic Mining Co., owner of 600 acres in the Carbonate district, has recently secured under bond a number of famous old mines, including the Iron Hill, Seabury-Calkins, and numerous others, giving a large area in a district that at one time produced handsomely, but which has not been worked in 25 years. The Titanic is preparing to sink a large working shaft 500 ft. west of the old Iron Hill shaft. The new shaft will be sunk to quartzite, which it is expected will be found at about 450 ft. Aside from being deeper than any previous working in the neighborhood, it will open virgin ground. Work will start soon, and as a preliminary bids have been invited for furnishing, delivered at the ground, sufficient square timber for 400 ft. of shaft. W. S. Elder, of Deadwood, is secretary. A new shaft-house is being erected at the Jungle mine, in the Custer Peak district, and everything put in readiness to commence shipping copper ore to the Galena smelter as soon as that plant is ready to receive it. Preliminary work and the making of ore contracts is being carried forward by the smelter people, and it is hoped to have the plant started at an early date.

The new mill of the Bismarck company, at Flatiron, will not be started until warmer weather, as it has been decided that since there is usually more or less trouble in starting up a new mill, there is no necessity for battling adverse weather conditions at the same time. The plant is patterned to a considerable extent after its neighbor, the Wasp No. 2, and will treat coarse crushed ore by leaching. The ore will be mined in open cuts, trammed 600 ft. to the mill, and dumped into bins of 475 tons capacity. From these bins it will be drawn to a No. 5-K Gates crusher. The product of this crusher will be carried on a 24-in. belt conveyor to two No. 3 Gates crushers, reduced to about ¾ in. and elevated to a 450-ton bin. Two sets of 36 by 15-in. Allis-Chalmers rolls and two shaking screens, set at an angle of 45° will insure a product that will pass a 3/16-in. square opening. This product will be drawn from a 475-ton bin to either of four conveyors and loaded into the leaching tanks. Of these, 5 are 28 by 9 ft. and one is 30 by 12 ft. Zinc shaving precipitation will be used. The plant is expected to have a capacity of 300 tons per day. The entire plant is driven by electricity, power being secured from the Consolidated Power & Light Company.

The annual report of the Homestake Employees' Aid Fund shows cash on hand at the end of the year, $23,338. Receipts during the year were: from employees (each man contributing $1 per month), $29,691; Homestake Mining Co., $12,000; interest, $402.20; disbursing checks uncalled for and credited back, $257. Disbursements were; death benefits, $15,200; injury benefits, $11,700.25; sick benefits, $6598; suicide benefits, $200. The balance in the treasury on December 31, 1911, was $14,686.31, so that during the year a gain of nearly $9000 was made. Of the death benefits paid only 3 were for accidents underground. The Supreme Court of the state has upheld the judgment of the lower court in the litigation between F. C. Crocker and the Cumberland Mining Co. Crocker sued for $15,000 back salary as general manager, and the company brought in counter claims, which resulted in their securing judgment against him in the sum of $5000. It is stated that the company will immediately be recognized and work resumed. The property is one of the richest in the Hill City district, and has produced high-grade free-milling ore. R. S. Jamison, president of the Imperial Mining Co., is being sued on his guarantee of the bonds of the Dakota company, of which about $72,000 are issued, and on which interest has been defaulted. Some years ago the Imperial company took over the property of the Dakota company, and a portion of the consideration was assumption by the Imperial of certain Dakota obligations. Mr. Jamison stated to have personally guaranteed the outstanding bonds of the Dakota, and is now being sued by the holders. His contention is that he is not personally responsible, but that the bonds should be paid by the Imperial company, as a corporation. In the meanwhile all development and milling is suspended, and will not be resumed until the legal questions involved shall have been adjusted.

SALT LAKE CITY, UTAH

UTAH COPPER REPORT.—OHIO MILL.—PROFITS WITHOUT WORKING.—ONTARIO ANNUAL MEETING.

Although the date for completion has several times been set ahead, it looks as though the Utah Metal Mining Co. tunnel through the Oquirrh range, from Bingham to Tooele, will be completed this spring. This will give the mines of Bingham drainage at depth and will afford facilities for deep mining and of short-cut transportation to the Tooele smelter. The tunnel company expects to gain revenue from transportation and mining privileges, the sale of water and hydro-electric power, and also to develop mineral in a great deal of its own ground. This enterprise, which will prove of great advantage to several of the important Bingham mines, has required a great deal of patience on the part of its backers. Work has been in progress now about three years, and the expenditures to January 1, 1913, were $341,393, according to the annual report. This is in addition to expenditures by previous owners. The total length of the tunnel when finished will be 11,494 ft., of which 908 ft. remained to be constructed January 11. Work on the Bingham side stopped September 21, on account of the strike, and has not yet been resumed. While four-fifths of the distance has been through solid rock, a great deal of running ground was encountered on the Tooele side, impeding progress materially, and increasing the cost. The average cost per foot is given at $16.45, exclusive of overhead charges. A flow of 800,000 gal. of water per day has been developed, which adds to the assets of the company. Several seams of ore have been cut, and these will be prospected after the main work has been finished. When this tunnel has been completed, a number of Bingham properties will be enabled to open their ground at less expense and to reduce their operating costs. E. P. Jennings has been elected president of the company.

Almost simultaneously with the report of the Utah Copper for the last quarter of 1912, showing a deficit of $82,248 after payment of dividends, comes the statement from the operating officials that the mine and mill are again reaching capacity and that a better showing may be expected from now on. It is unofficially stated that the January production of copper was not far from 7,500,000, as compared with 5,975,000 lb. in December. The February production is estimated at 8,000,000 to 8,500,000 lb., and the prediction is made by one of the operating officials that March will show a further increase, although it may be the middle of the year before the company will again reach a production of 12,000,000 lb. per month, which it approached last August. According to the official report, the cost of producing copper for the last quarter of 1912 was 14.83c. per pound, while the

selling price was computed at 15.15c. per pound. This is explained by weather conditions, low production, inexperience of employees hired during and after the strike, suspension of underground mining, consequent lower grade of ore (1.104% copper as compared with 1.41% for the previous quarter), and other reasons. The profits for the quarter are given as follows: Milling profit, $39,273.18; rents, etc., $12,741.42; Bingham & Garfield railway dividends, $175,000; Nevada Copper dividends, $875,437.50; total net profit, $1,102,452.10; dividends paid, $1,184,700; deficit, $82,248.

Ohio Copper has been milling about 2000 tons of ore per day, but this should be increased materially soon, as the second unit of the mill is nearing completion. New rolls, to take the place of the Wall rolls, are being installed, and it is expected two units will be running full time by the end of this month.

The annual meeting of the old Ontario Mining Co. of Park City calls attention to the remarkable situation of this old company, which has been able to live and make money for a number of years without working. Active mining operations ceased some time ago, so far as the company itself was concerned. But it has had a steady revenue right along, and the treasury reserve has been built up to such a point that there is talk of resuming development work in the hope of finding some new orebodies. The Ontario is one of the oldest mines in Utah, and has paid many millions of dollars in dividends from its mining operations, but in recent years its revenue has come from other sources. It owns a half-interest in a coal mine at Coalville, an interest in an electric light plant which derives power from its drainage adit, and the drainage adit itself has been a source of revenue, the Daly-Judge and Daly West mining companies paying a royalty for its use for the transportation of their ores. The Mines Operating Co. has a lease on the dumps and the filling of the stopes, which it is treating by modern metallurgical methods at a profit, and the royalties on lease will not be inconsiderable. With approximately $115,000 cash in the treasury, a steady income from royalties, and a quantity of good ore still in the mine outside of the leased ground, and with a large area of promising territory unprospected, a large number of the stockholders think the old property should be in for a renewal of its youth and activity.

JOHANNESBURG, TRANSVAAL

RETURNS FROM RHODESIA.—FUTURE OF GOLD MINING.—OTHER MINERALS.

Unsatisfactory accounts reach here regarding the condition of affairs in Rhodesia, and while in some details they may be exaggerated, the results obtained in Rhodesia, as proved by figures during the past twelve months, confirm the bad accounts and the previous doubts I have expressed about the mining future of that area. It may be that people are too prone to compare Rhodesia with the Rand, and to regard it as a new and essentially progressive mining country. But it bears no similarity to the Rand and it is by no means a new mining country, being as a matter of fact much older than the Rand. In gold mining it makes but little if any progress; disappointments are the rule in Rhodesia, while on the Rand they are few, and generally due to artificial rather than natural causes. It is true that the gold output for 1912 may show a slight increase over 1911, and may even constitute a record output, but after all these years it is but a poor record, and not by any means the progressive output year in and year out we have been accustomed to see on the Rand.

The fact is that the essential conditions for a successful gold-mining industry do not exist in Rhodesia, where the important and reliable gold producers may be counted on the fingers of one hand, and no amount of puffing either in Rhodesia or London will alter this fact. It is not intended to cast any discredit on such promising and well developed new properties as the Shamva, Cam & Motor, and other well established properties when making such a statement, but these apparent successes are more than discounted by such failures as the Jumbo, Bushtick, Hay, Viking, Buck's Reef, and many others, not forgetting the prospective premature ending of a bright but brief career in the case of the Giant Mines. It is all very well to cling to the hope that the lost orebody at the Giant mine will be picked up, because of the recognition of a basic stringer or even a leader, but this is not the first time similar orebodies have been lost in the same geological formation in South Africa and the connecting stringers and leaders again picked up in depth. But this discovery of a stringer, promising though it may appear, has never resulted so far in the discovery of workable orebodies, and the odds against success at the Giant mine are very great, despite the hopefulness displayed by the geologist called in to advise the company on the matter. These orebodies are very erratic in mode of occurrence, and once lost are difficult to recover. Judging from past results in similar instances, any success attending prospecting operations is more likely to be directly due to good fortune than geological deductions, however hopeful they may seem to be. With respect to the actual progress being made in the gold output of Rhodesia, figures show, however, that after a relapse there has been slight improvement during the past three years; the value of the output for the first eleven months of 1912 being £2,488,706, as against £2,430,869 in the previous year, and £2,368,698 in 1910. The increase during the past three years may not seem striking, but it has been continuous,

SMALL MINE IN RHODESIA.

and when the Shamva and Cam & Motor reduction plants get started and several small but promising mines join the producers it is expected that a more marked improvement will be noticeable. Still, considering the time modern gold-mining operations have been carried on in Rhodesia, the progress has been slow, and it is remarkable how few successful mines have been discovered, independent of ancient workings.

In other minerals, mining progress during the past year has not come up to expectations. It was generally considered that even if gold-mining made little progress the mining of base minerals and metals would increase by leaps and bounds. Such, however, has not been the case during the past year, for, as a matter of fact, there has been a slight set-back. As was generally predicted in these pages, the Victoria tinfields have turned out a failure, but attempts are being made to revive interest in other deposits lying east of Salisbury. Chrome iron has not made the progress anticipated, nor has coal, the development of the latter being of course impossible in a country where development makes such little progress as in Rhodesia. If ever the difficulties surrounding the copper position in Northern Rhodesia are surmounted, affairs in Southern Rhodesia may improve, but the progress anticipated in 1912 has far from materialized.

The discovery of wolfram near Klein Kharas and Nankeis in German Southwest Africa, coupled with the fact that both wolframite and scheelite are known to occur in several places in southern Rhodesia, should serve to direct attention to the possibilities of tungsten production in South Africa. The tungsten market may easily be overestimated, however.

TORONTO, CANADA

PEARL LAKE DISCOVERY.—LARGE BULLION SHIPMENT.

The most noteworthy happening in Porcupine lately was the cutting of a big vein in the Pearl Lake at the 600-ft. level, where it confirmed the expectations of the management, both as regards width and gold content. The ore is officially stated to average $30 per ton, as at the 400-ft. level. The shaft is being sunk to the 800-ft. level. A stamp-mill with a capacity of 300 tons per day will be erected immediately. The proving of the vein in depth has had a favorable effect on the market for Porcupine shares, which has been somewhat quiet with a declining tendency.

Although the leading mines claim to have their full quota of men, the persistence of the strike is retarding development work on other properties, many mine-owners deferring operations until matters are finally settled. As was to be expected, the heavy sentences given three of the strikers have accentuated the bitter feeling between the employers and the men, and the labor organizations throughout the country are making common cause with the miners. Strong remonstrances against the imprisonment of the convicted miners were made to the Canadian and Ontario governments, as a result of which the three prisoners, two of whom had been sentenced to fines of $500 and one to $50, which they were unable to pay, were set at liberty on tickets-of-leave pending the result of an appeal. These conditions do not augur favorably for the speedy return of industrial peace and stability.

The new mill of the McIntyre has been completed and is in operation. There is a large supply of ore on hand for treatment and the output is expected to be not less than $70,000 per month. A 5-stamp mill has been shipped to the Tough-Oakes claims at Kirkland lake in the Swastika district, owned by C. A. Foster, of Haileybury. A compressor is being installed and a new main working shaft will be sunk. The Hughes property in the same district has shipped 25 tons of high-grade ore. The Lucky Cross has completed its mill building and the machinery is on the way. Five stamps will be installed at first and five added later. C. E. Wettlaufer and L. E. Wettlaufer, of Buffalo, have taken a working option on the James properties, also known as the Maloof-O'Connor claims, in Shaw township.

The largest shipment of bullion that ever left Cobalt was made February 11, comprising 163 bars containing 308,997 oz. of silver, valued at $187,665. The largest consignment came from the Nipissing, being 214,206 oz., worth $132,807. It was sent to the London market. The Timiskaming has made an important discovery at depth, consisting of a vein 7 to 10 in. wide at the 575-ft. level in the diabase. The Cobalt Aladdin company, of London, which is now working the old Silver Queen, has secured a controlling interest in the Chambers-Ferland. At the latter mine a stringer that was being followed in a raise from the eastern cross-cut widened to a 4-in. vein of decomposed cobalt carrying high silver contents. The find was made immediately after passing the contact between the Keewatin and the diabase.

The annual meeting of the City of Cobalt took place on February 5. The manager's report showed that there was in sight approximately 1,269,662 oz. of ore above the 400-ft. level. The ore hoisted during the year amounted to 8675 tons at a mining cost of $4.10 per ton. The directors were authorized to raise funds for the construction of a mill. The royalty payable to the Ontario government has been reduced from 25% of the net profits to 5%. The new English owners of the Cobalt Lake have registered it in London under the name of the Cobalt Lake Silver Mining Co., Ltd., capitalized at £300,000 in £1 shares. The company has adopted the 9-hour day schedule. M. L. Foley, who with an English syndicate recently took over the Calcite Lake property in the Elk Lake district, is arranging for the installation of a 50-ton mill. Another rich vein of high-grade ore has been cut at the 200-ft. level on the Mann, Gowganda district. Machinery for the new plant is arriving at the Beaver auxiliary, formerly the Donaldson, at Elk Lake. It will have two 8-drill compressors run by a battery of boilers. The new shaft, now down 110 ft., will be continued for another 100 ft. before driving is undertaken.

LONDON

MINING AT HAMPDEN CLONCURRY.—COBALT TOWN SITE.

In the *Mining and Scientific Press* of January 4, Thomas T. Read, in his review of the progress of the metallurgy of copper, presents a diagram of the production of copper in Australia, and its metallurgical and commercial distribution. I wish more information such as this were available relating to the actual marketing of all sorts of metals. Times move rapidly even with copper, and Mr. Read's diagram is already out of date, for the Hampden Cloncurry mine started production last July with blast-furnaces and converters. The contract for the output of blister copper has been given to Brandeis Goldschmidt & Co. As the position of the Hampden Cloncurry is evidently not known in America, some notes of its history may be of interest. The company owning the Hampden and Duchess copper mines, in the Cloncurry district of North Queensland, was formed by the Baillieu group, in Melbourne, in the year 1906. More recently the Trekelano and Mascotte properties have been purchased, and three months ago negotiations for the MacGregor claims were begun. In 1909 the company was reconstructed and additional capital subscribed. Smelting was started in April 1911, and the matte was then sold to the Mount Elliott company. Attention has recently been centred on the completion of the smelting plant. This was put in commission on July 16. It contains two blast-furnaces, one measuring 84 by 42 in., and the other 168 by 42 in.; and two converters. During the run from July 16 to August 31, the smelters treated 2580 tons of Hampden ore averaging 8% copper, 2906 tons of Duchess ore averaging 18% copper, and 79 tons of purchased ore. The resulting blister and matte contained 670 tons copper, 268 oz. gold, and 7074 oz. silver. Hardly any development has been done lately owing to the stress of work connected with the completion of the smelter. As regards ore reserves, these are estimated as follows: Hampden, 88,000 tons averaging 7¾% copper; Duchess, 80,000 tons averaging 16%, and 56,000 tons averaging 5%; Trekelano, 12,000 tons averaging 14%; Mascotte, 2500 tons averaging 16 per cent.

After many years of disappointment, the Cobalt Town Site Silver Co. has achieved success and paid a handsome dividend. It is gratifying to Englishmen to find that this, the only mine at Cobalt owned in England, has become profitable. The Casey Cobalt, owning a property at New Liskeard, farther north, belongs to the same group, and recent developments have proved encouraging. The meetings of these two companies were held this week, and the speeches were unusually interesting. English investors were slow to appreciate the profitable nature of the silver deposits of Cobalt. They feared that the excessive richness of the ore betokened a shallow and a sporadic distribution of the silver. Events have proved that such timidity, although reasonable, was exaggerated, for the mines of Cobalt have prospered exceedingly and the exploitation of them has enriched many people, notably a dozen men who have become millionaires. Even after the district had passed the first stage of immaturity, it was held that the geological conditions were unfavorable to the persistence of the ore in depth, for the veins appeared to become impoverished when they were followed below the diabase and the Huronian conglomerate into the Keewatin schist. At the Casey Cobalt meeting it was asserted by Mr. Parker that rich ore had been followed in the Beaver mine down to 700 ft. through the Keewatin and into the diabase. This view is in accord with the views expressed by Willet G. Miller, the Provincial Geologist, and by others who have studied the local conditions. They have held that the veins were enriched when in the diabase or near it, so that the significant feature of the Beaver discovery is not that the ore is in the Keewatin but that the Keewatin is traversed by a deeper sill of diabase, producing conditions found favorable elsewhere in the district. However, it is gratifying to learn that such conditions are repeated in depth. While 700 ft. is not really deep, to the eye of modern mining, it is so much farther from the surface than the shallow workings of the bonanza zone as to be highly encouraging to those who propose to explore deeper.

General Mining News

ALASKA

Fairbanks

According to the *Tanana Magazine*, an interesting 'Quartz' edition of the *Fairbanks Daily Times*, little consideration has been given to the lumber question in the district. During the past three years 11 properties of fair size and several smaller ones have used 900,000 ft. of lumber in the mills and mines,. In 1910 the price was $30 per M, but at the end of 1911 this was raised to $40. To the cost of $35,000 for the above lumber was added about $25,000, owing to long wagon haul. Some rafts of logs have come from the Big Chena river, and this year all the available trees on the Chena and tributaries will be cut. They nearly all grow along the banks of streams. About 2,000,000 ft. has been cut at the Salchaket river, while on the Tanana river, below Fairbanks, there is a large quantity of good timber.

The gold output of Tanana in 1912 was $4,793,700, of which $200,000 came from quartz crushed in the various mills. A one-third interest in the lease of the Rexall property at the head of the Cleary tributary has been sold for $3500. There are four claims, and a 2-stamp mill. On the Rexall claim an adit has been driven 500 ft., and two winzes sunk on the vein. Six men are working on Lost Horse creek; the depth of bedrock varies from 16 to 50 ft. On upper Fairbanks creek there is a little gravel being hoisted to the surface during the winter. For the Mihalcik claim on Ready Bullion creek, 600 more logs are to be hauled for this year's work. Bedrock in this property is at 40 ft., and gravel will average 150 ft. in width. There is a good-sized dump on the surface, which could not be sluiced last spring owing to shortage of water. The Newsboy mine has enough ore on the 315-ft. level to keep its 5 stamps working continuously. From 35 tons, gold worth $800 was recovered. The Homestake company treated 22.5 tons of ore at the Newsboy mill, averaging $77 per ton. This ore came from a vein in an adit, about 300 ft. in, and ore has been opened for a distance of 200 ft. Enstrom Brothers, on Eva creek, have reached bedrock. The shaft is down 130 feet.

SLUICING A WINTER DUMP, FAIRBANKS.

Iditarod

All work is practically at a standstill owing to the cold weather. The minimum temperature recorded is 52° below zero, while 40° below has been common.

Juneau

During December the Alaska Mexican mill worked 29.76 days, and crushed 18,343 tons of ore, which yielded $41,151 from free gold, and 405 tons of concentrate. Operating expenses were $24,005, and construction $7313, and the profit was $9421. Development covered 299 ft., and the stock of broken ore decreased 3352 tons. In 1912 the 120-stamp mill crushed 233,659 tons averaging $2.87 per ton.

The Alaska United mills worked 29.51 and 29.70 days, respectively, crushing a total of 35,467 tons, which yielded $81,627 from free gold, and 900 tons of concentrate. Operating expenses were $50,337, and construction $8300, leaving a profit of $22,173. Development in the Ready Bullion claim covered 370 ft., and in the 700-Ft. Claim 68, the stock of broken ore decreasing 11,854 and 506 tons, respectively. In 1912 the two 120-stamp mills crushed 450,147 tons averaging $2.60 per ton.

At the Alaska Gold property ore has been cut in the Sheep Creek adit, two miles from where a considerable amount has been opened. At the present rate of progress this main haulage-level should be under the main workings about June 1914. At the Perseverance mine 200 men are employed developing ore. One 3000-hp. hydro-electric station is in operation. This is the Salmon creek plant, which will develop 6000 hp. when finished. The second station of 3000 hp. is also well under way. Between the mine and millsite there is a difference in elevation of over 2000 ft. The destruction of the old Perseverance mill has hindered treatment studies, but experiments are being made in another small mill. In the summer work will be pushed on the big mill; the site is now being cleared.

Valdez

The Alaska Water, Light & Telephone Co. will construct an electric lighting plant to cost $30,000. It will consist of a 500-hp. Pelton-Francis turbine, driven by water coming through a 30-in. wood-stave pipe from Solomon basin, and a modern generator and other accessories.

ARIZONA

Cochise County

In the Hoatson shaft of the Calumet & Arizona a body of sulphide ore about 35 ft. wide, worth 6% copper, has been opened. There is good reason to believe that this company will acquire the Saginaw property. Shipments of lead-silver ore from the Shattuck mine to El Paso have returned $20 per ton.

Maricopa County

The Monarch mill at Wickenburg is in full operation, the pipe-line delivering plenty of water. The resumption of work at this property means a good deal to the town.

Pima County

The Twin Buttes mine is employing 30 men, and ore is sent regularly to the Pioneer smelter. The Empire Zinc Co., which took over the old San Xavier claims, has 25 men at work. High-grade carbonate of zinc ore is being hoisted, and will be sent to Canon City, Colorado. The Olive Mines Co. is erecting a concentrator. Silver-lead ore is being opened at 260-ft. depth in one claim. Considerable work is being done in the Helvetia district.

Yavapai County

In the Copper Basin district a syndicate has driven an adit 320 ft., intersecting four veins. A shaft has been sunk over 60 ft., and a cross-cut from this has passed through 11 ft. of silver-lead ore worth $57 per ton. The Jerome Oil Co. has received a supply of casing, and will resume drilling. The oil stratum is expected at about 400 ft. The Breed group of mines, near Senator, which was taken over last year by the New Mexico Lead & Copper Co., is opening well. The Effie shaft is down 40 ft., and has cut 4 ft. of heavy copper pyrite and galena ore. This ore disintegrates quickly on exposure to the air.

Yuma County

(Special Correspondence.)—Black Hills people have organized the Arizona Mining Co., taking over a large acreage of copper property in the Hacquavar mountains, south of Wenden. The board of directors comprises Seth Bullock, president; T. G. Grier, vice-president; Chambers Kellar, secretary; R. H. Driscoll, treasurer, and H. Nevin, of Yuma. Present development is showing good orebodies carrying copper and gold. It is proposed to ship to the Swansea smelter, which can be reached in about 32 miles, 12 of which would be a wagon or motor-truck haul, and the rest by rail. Patenting of about 15 claims is to be pushed at once.

Wenden, February 14.

CALIFORNIA

Butte County

The California Diamond Drill & Engineering Co. has begun work at Magnolia, in sinking a series of holes to a depth of 500 ft. This work is being done for a syndicate of San Francisco people. The Hupp mine has been forced to suspend work temporarily on account of the large quantity of water coming in. The Blue Hog has also been shut down. About 20 men were employed at both mines. Good ore has been cut in the McClung-Kincaid mine at Berry creek.

Calaveras County

The concentrator at the Calaveras mine, Copperopolis, is making a saving of 80% of the metal content of the ore. Five cars of ore, 227 tons in all, were shipped, averaging from 9.15 to 10.92% copper, net returns being $4570.

Modoc County

(Special Correspondence.) — Development in the High Grade district has been seriously handicapped of late by the snowstorms and cold weather, but several companies continue to conduct work in a small way. The Modoc Mines Co. has two shifts steadily employed, and the shaft is nearing the 200-ft. level. In the latter workings a 6-ft. vein has been intersected by the west drift. Some of the quartz is said to assay $50 per ton. Lessees are also busy on Modoc ground. The Sunset-Hummer company is preparing to make an early shipment of high-grade ore, and about 100 tons are available. The main vein is stated to be 8 ft. wide. The shipping grade averages over $50 per ton. The Lucky Dutchman lease on the Sunshine is planning to send the 60-ft. shaft deeper and extend a crosscut to tap the vein outcropping on the surface. The lease is controlled by the Spearmint Mining Co., composed of Colorado people. Several rumors concerning the plans of the Ft. Bidwell Mines Co. are in circulation. A contract has been let for driving 200 ft. of drifts from the Sugar Pine adit, and it is reported this adit is to be extended to the Mountain View claim. The management is further said to be considering employing the adit for transportation of ore to the mill in winter, the operation of the aerial tramway being attended with difficulty because of the severe snowstorms. The Sunshine-High Grade is working in a small way. Several companies are preparing for extensive operations with the advent of spring, and it is believed that summer will record vigorous work at most of the larger properties.

Ft. Bidwell, February 13.

Nevada County

About 30,000 tons of tailing from the Pennsylvania mill has accumulated on the Larkin property, southeast of Grass Valley, and it is proposed by H. Rhyne and P. Eastman to treat this dump. The Pennsylvania Mining Co. is now treating its current tailing. Men are at work on Deer creek, about 300 yd. below the Broad street bridge, and are working gravel in a sluice-box about 40 ft. long.

Placer County

The King Gold mine, three miles east of Roseville, has been incorporated for $100,000. It contains ore averaging $15 per ton; also black sand in a channel 50 ft. deep and 100 ft. wide, which is stated to be worth $4 per ton in platinum.

Plumas County

Six men have started at the Pettinger mine, near Taylorsville, and an adit will be driven 500 ft. during the summer. This mine is owned privately, and A. L. Beardsley is in charge.

Shasta County

Six miles west of Redding the Shasta King company is developing its mine, and making shipments of silver ore to the Selby and Kennett smelters. A drag-line excavator is to be used to handle gravel in the Russell tract, near Igo. Machinery ordered will cost $15,000. The property, operated by the Thompson-Porter interests under bond, comprises 500 acres, and if profitable it is probable that the Bryant ranch of 1300 acres will be acquired. The new 5-stamp mill at the Moonlight mine, near Ingot, started on February 13. It is driven with power supplied by the Northern California Power Company.

Sierra County

It is reported that the Tightner mine at Alleghany is producing rich ore, and sinking will be done on the ore-shoot. The water-power for the Fruitvale mine, on the Middle Yuba river, was frozen up in January. A raise is being driven on a shoot about 100 ft. from the face of the adit, which is in 700 ft. A cross-cut went through 40 ft. of mineralized ore. All the miners of the Tippecanoe section of Pike City district have stopped work for the winter, except Hartman & Son, who will develop the Gilt Edge lode.

The adit in the Herkimer property, south of Bunker Hill, is in hard lava, but it breaks well, and 100 ft. is being driven per month. Work is to be resumed at Brandy City, as water has been got there again. About 50 ft. of the Gold Bluff North Fork ditch broke away above Sweetwater, and a flume will be built in its place. Development in the Sierra del Oro, or Ironsides adit, has opened the ore-shoot 125 ft. below the bottom of the shaft. The ore carries free gold and arsenical pyrite.

Tuolumne County

(Special Correspondence.)—The Josephine mine, situated between the Shawmut and Jumper, on the Mother Lode, was bonded this week to W. P. Jones, representing Eastern capitalists, who states that machinery has been purchased and that the sinking of a new shaft to a depth of 300 ft. will begin at once. Mr. Jones will be superintendent. Upward of $100,000 was taken out of the property in early days. Charles Gillis and associates have taken out gold to the amount of nearly $3000 from the Old Wilson mine on Jackass hill, near Tuttletown, during the past few days, and the prospects for more are reported as being good. The property has yielded aproximately $160,000 to date. The property of the Horse Shoe Bend Mining Co. was sold at sheriff's sale this week to George Morrice, judgment creditor, for $15,000. The Gold Crater mine, at Jupiter, has also been sold to satisfy a judgment. It was bid in by George Mundorf, a Sonora merchant, for $4336. The New Providence Mining Co. will begin milling ore next week. For more than two years the company has done nothing else than develop the property, and a large supply of ore is on hand.

Sonora, February 8.

COLORADO

Clear Creek County

The Terrible and Dunderberg mines have been consolidated, and will be worked under one management. They were recently examined by Boston people. The Terrible shaft will be pumped out in the spring and sunk further. The Golden Glory adit, above Empire station, is in 1509 ft. It cuts the Jo Reynolds-American Sisters system of veins. Two cars of lead ore per week is being sent to the Salida smelter from the Santiago mine at East Argentine. In 1912 the Capital mines output was $49,103 more than in 1911, and it is expected the total will be $500,000 for the current year. Swanson & Co., in a lease below the adit-level of the Bellevue-Hudson, are mining ore from a vein 8 to 24 in. wide, carrying 50% lead and over 400 oz. silver per ton. Shipments are being made from the Josephine, Tobin, and Hummer & Herber leases.

Ouray County

The Mountain Top cross-cut was driven 377 ft. in January, there remaining 1442 ft. to be driven to cut the vein. This is said to be a record for cross-cutting in unaltered andesitic breccia of the San Juan. The rock drills well, but breaks badly. The total cost was $14.76 per foot driven.

Pueblo County

Besides having steel works of 500,000-ton annual capacity, the Colorado Fuel & Iron Co. has three iron mines in Colorado, Wyoming, and New Mexico, 25 coal mines, and 2 railroads. During 1912 the works produced 485,743 tons of finished products worth $15,140,523, the net earnings being $2,766,775. The chief market of this company is in

the Central and Western states, where it does not come into keen competition with large Eastern concerns of a similar nature.

TELLER COUNTY (CRIPPLE CREEK)

It is proposed to alter the capitalization of the Golden Cycle Mining Co. from 1,500,000 shares of $1 each to 300,000 of $5 each. In the Eclipse lease of the El Oro Mining & Milling Co., at a depth of 75 ft., 15 ft. of ore worth $20 per ton has been opened. During 1912 the Elkton Consolidated M. & M. Co. made a profit of $215,000, of which $150,000 was paid in dividends.

IDAHO

IDAHO COUNTY

The Little Butte mine, 6 miles from Elk City, is opened by an adit 1000 ft. long, and a high-grade ore-shoot was cut at 200 ft., while at 600 ft. a winze opened 4 ft. of good ore, which is being sent to the Washoe smelter at Anaconda. A one-stamp mill on the property concentrates the second-class ore. The Mother Lode claim, 1½ miles from Elk City, has a vein 8 ft. wide, and the custom mill is kept busy on this ore.

SHOSHONE COUNTY

The Burke ore-train, which leaves Wallace at 6 p.m. over the O.-W. R. & N. Co.'s line, to haul ore from mines at Burke and Mace to the various mills, got beyond control on February 8, and after rushing down a 4% grade, the engine and three ore-cars jumped into the gulch, 200 ft. below. Nobody was badly hurt, the train crew having jumped into deep snow.

The Stewart Mining Co. is employing 250 men at the mine near Kellogg and the Mammoth mill at Wallace. Net monthly earnings are $60,000. An adit will be driven 200 ft. into the North Bunker Hill property near Wardner, to cut the orebody found in the upper workings of the Caledonia. Machine-drills will be used, the contract price being $5 per foot.

The Federal Mining & Smelting Co. has been experimenting for some time on treatment of the zinc ores of its mines, the loss in past years being heavy from these ores. At the Green Hill-Cleveland mill, formerly the Standard, at Mace, the flotation process is being tried with success.

MICHIGAN

HOUGHTON COUNTY

Copper production of the Lake Superior mines in January was as follows: Ahmeek, 1,273,610 lb.; Allouez, 603,210; Baltic, 1,502,000; Calumet & Hecla, 5,095,262; Centennial, 243,295; Champion, 2,440,000; Franklin, 366,000; Isle Royale, 633,853; Osceola, 1,674,465; Superior, 274,050; Tamarack, 631,765; Trimountain, 1,004,000; and Wolverine, 964,000 pounds.

IRON COUNTY

The Hollister Mining Co., Crystal Falls, will install a 625-kva. Curtis turbo-generator in its power-plant. In the installation are included a 50-kw. generator, 150-hp. motor, Tirrill regulator, three 20-kva. transformers and switchboard, also two 4-ton electric mining locomotives. All the apparatus has been ordered from the General Electric Co. The Cleveland Cliffs Iron Co., Ishpeming, will install in the Lloyd mine at Morris a 100-kw. motor-generator set and three 6-ton electric mining locomotives in the Ishpeming mines. The orders for this apparatus have been placed with the General Electric Company.

MINNESOTA

ST. LOUIS COUNTY

The Pittsburg Iron Ore Co., Mountain Iron, will equip its mines for driving the machinery by electric power with 12 new motors ranging from 15 to 50 hp., supplied by the General Electric Company.

MONTANA

MADISON COUNTY

(Special Correspondence.)—There is talk of resumption at the mines of the Green-Campbell Mining Co. near Silverstar.

Silverstar, February 12.

PARK COUNTY

(Special Correspondence.)—The troubles of the Yellowstone Portland Cement Co. seem to have been adjusted, and it is reported that the plant will be completed and in operation this summer. The company, a $6,000,000 corporation, has already spent a large amount in preparing the ground for operation. The limestone will be obtained from a huge deposit of travertine, precipitated by ancient hot springs. This deposit is pure white calcium carbonate, from which a white cement can be made.

Livingston, February 12.

RAVALLI COUNTY

(Special Correspondence.)—The Montana Mines Co. cut rich ore in its property near Florence, on the east side of the Bitter Root valley. The ore assays well in gold and is free milling.

Florence, February 12.

SILVERBOW COUNTY

(Special Correspondence.)—A fire has made its appearance in the West Colusa mine of the Anaconda Copper Mining Co., and before it is completely subdued promises to do considerable damage. Just how it originated is unknown, as the mine was not being worked, having been closed down to equip the engine for operation by compressed air. The belief of B. H. Dunshee is that the fire was caused by spontaneous combustion in some of the abandoned workings on the 500-ft. level. The Mountain View mine has ventilation connections with the West Colusa, with the result that the smoke and gases entered that property to such an extent that about 50 men were overcome, but they were quickly taken to the surface and no serious results followed. When it was found that the fire was likely to prove serious, all the men in the Mountain View were sent to the surface, and work probably will not be resumed in that property for some weeks. The mine employs 650 miners. The extent of the fire will not be exactly determined for some days, and it is quite probable that it has reached the 600-ft. level. The West Colusa is the most heavily timbered mine in the district, and for this reason it is going to be hard to control the flames. A large force of men under the direction of Jack O'Neill is engaged in fighting the flames, and the Anaconda officials are confident that they will be able to confine the fire at a point not lower than the 600-ft. level.

Butte, February 14.

Butte & Superior will produce 5,000,000 lb. of zinc concentrate in January, while March is expected to have an increase of 50%. About 550 tons of ore is being treated daily in one unit of the mill, and extraction is reported at 80%. The total capacity of the mill will be 1200 tons per day.

NEVADA

ESMERALDA COUNTY

The St. Ives shaft of the Goldfield Merger Mines Co. is down below the 1450-ft. level, the country varying considerably in hardness. At the Sandstorm-Kendall, additional pumping machinery has been installed. At the 1400-ft. level of the Grizzly Bear mine of the Goldfield Consolidated Mines Co., a strong flow of water has retarded work. In the Combination mine a cross-cut is being driven at a depth of 250 ft., to cut the orebody opened recently on the 130-ft. level.

A shipment of good coal has been received at Goldfield from the Nevada Coal & Fuel Co. property at Coaldale. A flat coal seam has been opened for 500 ft. on its dip, making a vertical depth of 100 to 150 ft. Near the bottom the seam was disturbed by a fault, but was picked up 30 ft. lower.

HUMBOLDT COUNTY

On February 11 the Charleston Hill National Mining Syndicate, defendants in the recent suit at National, transferred to the National Mines Co. the West Virginia No. 1 and Charleston No. 1 claims, known locally as the 'Mammoth' properties. The terms are not known, but this means a final settlement of the case. The National Mines Co. has finished the station in No. 5 adit.

After driving a 1500-ft. adit, N. P. R. Hatch has cut

4 ft. of ore in his lease on the Mayflower National property. High-grade silver ore is being sacked from a lease on the Cheefoo lode by Walker Brothers. The Kennedy-MacDonald Mining Co. is driving an adit to cut a vein already opened in its Indian Valley adit.

LYON COUNTY

The Nevada-Douglas mines produced 1,114,691 lb. of copper in January, from 22,279 tons of ore. The Ludwig mine averaged 4.7% and Douglas Hill 3.6% of copper. The Mason Valley smelter received 26,000 tons of ore during January. Matte production was 2328 tons and copper 1,658,000 pounds.

NYE COUNTY

The Tonopah Mining Co. has installed spraying apparatus in its mines to keep down the dust made in drilling. It only requires from 5 to 10 gal. per shift., does not interfere with operations of the miners, and costs about $5 each. In January the mill treated 14,720 tons of ore yielding bullion worth $197,700, and 110 tons of concentrate worth $41,850. The net profit was $130,143. The Belmont treated 12,517 tons yielding 304,734 oz. of bullion, the profit being $150,485. The mines at Tonopah, during the week of February 15, produced 11,297 tons of ore valued at $237,110, the yield for the current year being 75,238 tons and $1,573,530. The Jim Butler yielded 1684 tons in January and a profit of $20,612.

STOREY COUNTY

At the Virginia City School of Mines, according to the biennial report recently issued, there are 38 students receiving instruction, including the 16 members. At the Comstock, it is proposed to reopen the old connecting drift on the Ophir and Con. Virginia 2500-ft. level, to connect with the 2500-ft. station of the C. & C. pumping shaft. Pumps will be installed in the old Ophir-Mexican winze to lower the water below the 2500-ft. level. No. 1 hydraulic elevator in C. & C. shaft is to be removed; and the centrifugal pump moved to the centre compartment. During the week ended February 15, 1575 tons of ore was hoisted from the Mexican, worth $46,302. The mill treated 522 tons worth $32.95 per ton. On the 1600-ft. level of the Ophir the northeast drift was extended 35 ft. from 600 ft. north of the C. & C. connection in the north lateral Sutro tunnel, and shows porphyry, clay, and quartz of fair value.

NEW MEXICO

GRANT COUNTY

The Guggenheim Exploration Co. has taken an option on the Cleveland group of five claims in the Pinos Altos district. The property contains zinc ore. The annual report of G. H. Utter shows that he shipped 3,100,000 lb. of concentrate in 1912.

SANTA FE COUNTY

(Special Correspondence.)—The Denver mine-rescue car

MINE RESCUE CAR.

of the Bureau of Mines is making the following tour. On February 9 it arrived at Berwind, Las Animas county, and remained there 6 days; on February 16 the car went to the Broadhead mine, at Aguilar, in the same county, stopping there 6 days; then will remain at Frederick, Weld county, from February 23 to March 1. The car then goes south to the Albuquerque & Cerillos Coal Co.'s mines near Madrid, Santa Fe county, New Mexico, and will stop there 6 days; next going to the Carthage Fuel Co.'s mines, near Carthage, Socorro county; and after 6 days will go to Gallup, McKinley county, and remain 20 days at the mines of the Diamond Coal Co. and Victor-American Fuel Company.

Pittsburg, Pennsylvania, February 10.

TENNESSEE

POLK COUNTY

During the year ended December 31 last, the Tennessee Copper Co. produced 13,252,634 lb. of copper, and 195,000 tons of sulphuric acid. The profit from these products, custom ore, and miscellaneous revenue was $1,200,000.

TEXAS

REEVES COUNTY

According to information from Pecos, a rush which is not justified by present development has set in for that district, and many claims have been staked.

UTAH

JUAB COUNTY

During January 900 ft. of development was done in the Chief Consolidated mine, and 8000 tons of ore and waste was hoisted. The main shaft is down 1800 ft., and water-level should be reached in 30 days. The Gold Chain shipped 600 tons of ore in January, and has paid a dividend of 3c. per share, totaling $30,000. In the Iron Blossom a drift is being driven in a westerly direction from the 1900-ft. level toward a vein which was cut on the 1700-ft. level. The May Day is shipping one car of ore per day.

SALT LAKE COUNTY

The Utah Copper Co. treated 930,595 tons of ore during the last quarter of 1912, 95% being mined by steam-shovels and 5% from underground. Copper production was 12,906,582 lb., the year's toal being 96,175,090. The average grade of ore during the quarter was 1.104% copper, and cost 14.83c. per lb. Owing to the strike, operation was largely affected. The profit was $1,102,452, and dividends were $1,184,700, leaving a deficit of $82,248. All power for the Arthur plant is supplied by the Utah Power & Light Co., also one-quarter of that for the Magna plant, a corresponding portion of the Magna steam power-plant having been stopped.

At the beginning of the current year the Utah Copper Co. employed 1547 men, as against 1322 in November. The January tonnage of ore is estimated to be 450,000 tons, the average daily tonnage up to January 20 was 14,000 tons. The Arthur and Magna plants are handling 8000 and 10,000 tons per day, respectively.

The Utah Metal Mining Co. states that the tunnel from the Tooele side of West mountain is in 8616 ft., an advance of 2072 ft. during 1912; and from the Bingham side on September 21 was 1970 ft., an advance of 1585 ft.; the total to date being 10,586 ft., leaving 908 ft. to be driven. In 1912, $98,787 was spent, and to date $341,393, the average cost in 1912 being $16.45 per foot. The tunnel makes 800,000 gal. of water per day.

SUMMIT COUNTY

During the past year the Tintic Central Mining Co. confined work to the 920-ft. evel. At 200 ft. from the shaft a large body of quartz was cut, which gave assays as high as 61 oz. of silver per ton. Development covered 1226 ft. Cash on hand January 1, 1913, was $498.

WASHINGTON

FERRY COUNTY

Ore shipments over the Spokane & B. C. railway for the two weeks ended February 7 were 705 tons, of which 493 were from the Ben Hur mine. The Hope Mining Co., after considerable idleness, has resumed work, and

made a shipment of 40 tons. The Washington Water Power Co. has finished sampling the Surprise, Republic, Ben Hur, and San Poil mines. The Ben Hur Leasing Co. has produced ore worth $44,000 in 11 weeks. A 14-drill air-compressor has been delivered at the mine, also a new boiler. The Fan Lake Mining Co. has been incorporated at Spokane with a capital of $1,500,000.

STEVENS COUNTY

From 80-ft. depth of the new shaft in the Standard Chewelah mine, copper glance ore has been cut, worth $50 per ton. When the new machinery is installed the main shaft will be pumped out, and a cross-cut driven to cut the new ore at 200-ft. depth. Ore in the June-Echo is improving in value.

On the 520-ft. level of the Copper King, at Chewelah, high-grade copper ore has been opened, and shipments will be started in a few weeks.

WYOMING

ALBANY COUNTY

In his biennial report, C. E. Jamison, State Geologist, states that he will make an examination of Centennial, in this county. To investigate the oil and mineral resources of other districts, and prepare geological maps, will take two years and cost $15,000.

CANADA

BRITISH COLUMBIA

(Special Correspondence.)—Spokane interests are opening a good silver-lead district at the head of the Tulameen river. There are several promising claims near the government wagon-road between Leadville and Tulameen City, the latter being a government townsite 20 miles below the former place, on the stage-road between Princeton and Merritt. The Great Northern Railroad Co. has 3 steam-shovels working on its main line up Otter creek to Tulameen. The Canadian Pacific Railroad Co. has applied for a charter to build a branch line to Leadville. About 5 miles from Tulameen there are quantities of peridotite said to contain platinum. Bear Creek is 12 miles away, and will probably develop into a good copper centre.

MAP OF BRITISH COLUMBIA.

Leadville, February 14.

From the first year's development and shipment of 670 tons of ore from the Utica Mines, Ltd., near Kelso, $67,000 gross and $54,155 net was received. A dam has been constructed giving a head of 300 ft., from which 150 to 200 hp. can be obtained. In the War Eagle mine, between the 1200 and 1500-ft. levels, a silver-lead orebody 30 ft. wide has been opened, which is said to be the best yet discovered in British Columbia.

SONORA

In January the Cananea smelter produced 9,000,000 lb. of copper. Shipments through the port of Agua Prieta from mines in the northeastern part of the state were 14,031 tons, valued at ₱2,383,600.

In 1912 the Cananea Consolidated Copper Co., known locally as the 'Four C.,' produced 54,000,000 lb. of copper, while this year's output is estimated at 90,000,000 lb. The present cost of treating a ton of ore is about $2.50. After three months idleness, the Calumet & Sonora mine is in operation. Up to September 30, 1912, the past year's production was 1161 tons of copper concentrate, which contained 2.3 oz. of silver and 11.41% of zinc. Zinc concentrate totaled 1834 tons, averaging 45.70% of zinc. Lead concentrate amounted to 747 tons, containing 63.55% of lead, 31.29 oz. of silver, and 0.94% of copper. These products were smelted at Cananea, Oklahoma, and El Paso, respectively. The net earnings were $98,513. The shaft is down to 525 ft., and on the 300-ft. level a good deal of ore has been broken. W. H. Weed is consulting engineer, and W. H. Tangye, superintendent. The Democrata Mining Co. blew in its 250-ton furnace in December, and during 1912 produced 1,500,000 lb. of copper, but in 1913 will probably yield 18,000,000 lb. The Mexican Metals Co. has been working all the past year, and is now treating 100 tons of ore per day. El Pilar mine, of the Arnold Mining Co., 35 miles northwest of Cananea, will build a 50-ton concentrator, while the Arizona-Sonora company may erect a 50-stamp mill. In the Moctezuma district the Moctezuma Copper Co., at Nacozari, made about 600,000 tons of concentrate, which was smelted at Douglas.

Obituary

GEORGE WILLIAM MAYNARD, a distinguished metallurgist who is best known for his work in introducing the Thomas basic steel process in United States practice, died in New York on February 12. He was born in Brooklyn, June 12, 1839, and studied at Göttingen, Columbia, Royal School of Mines, and Clausthal. After a brief experience as a mine manager in Ireland, he went to Colorado. He served as professor of mining and metallurgy in Renssalaer Polytechnic Institute from 1868 to 1872. For the succeeding six years he served as consulting engineer to steel works in England and copper smelters in Russia, and in 1880 established himself as consulting engineer in New York, where he took a prominent part in the development of the metallurgical industry. He was one of the original members of the American Institute of Mining Engineers and was prominent in a number of other scientific societies, both at home and abroad.

MAX BOEHMER, who died at Denver, Friday, February 14, was one of the best known and best liked of the coterie of engineers that has long made Denver a centre for mining men. Born in Luxemburg in 1847 in an influential family, he received his education at the Polytechnic Institute at Hanover, graduating as a mining engineer in 1869. Shortly thereafter he came to the United States and, serving first with the engineering corps of the U. S. Army in the Mississippi river, to Leadville in 1879. Here he met D. H. Moffat, with whom he was intimately associated for many years. At various times he was connected with most of the large mining companies in Colorado and with many in Idaho, Nevada, Utah, and elsewhere. Two weeks ago, while sampling an incline in the Bunker Hill & Sullivan workings he, as he thought, strained his shoulder, but neither he nor the physician consulted in Denver considered the matter serious. His death, resulting apparently from heart trouble, was entirely unexpected. Mr. Boehmer leaves a widow and two daughters, one the wife of George Argall, and a son, Max Boehmer, Jr., who is a student in the School of Mines. He was a genial likeable man and an able conscientious engineer who stuck close to his work and he leaves a clear record and honorable name.

Market Reports

LOCAL METAL PRICES

San Francisco, February 20.

Antimony	12—12¾c	Quicksilver (flask)	40
Electrolytic Copper	18—18¼c	Tin	53¾—54c
Pig Lead	4 60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, February 20.—Copper prices are declining; large sales have now steadied market. Lead remains unchanged and spelter is still weak. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Feb. 13	14.87	4.33	6.05	61⅞
" 14	14 81	4 33	6 03	61⅞
" 15	14.81	4.33	6.00	62⅛
" 16	Sunday.	No market.		
" 17	14.56	4.33	6 00	62
" 18	14.45	4.33	6.00	62
" 19	11.45	4.33	6.00	62

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	February 20.
Camp Bird Ltd	$ 4⅜
El Oro	4⅛
Esperanza	6⅛
Oroville Dredging	1¾
Santa Gertrudis	6⅜
Tomboy	6⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. February 20.		Closing Prices. February 20.
Adventure	$ 3¼	Mohawk	$ 47½
Allouez	33½	North Butte	21⅝
Calumet & Arizona	60½	Old Dominion	45⅝
Calumet & Hecla	445	Osceola	88
Centennial	14	Quincy	66½
Copper Range	43½	Shannon	10⅝
East Butte	11⅛	Superior & Boston	3½
Franklin	6	Tamarack	26
Granby	58½	U. S. Smelting	38½
Greene Cananea, ctf	7⅜	Utah Con	9
Isle-Royale	21½	Victoria	1½
La Salle	3⅜	Winona	2½
Mass Copper	4½	Wolverine	65

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 20.

Atlanta	$ .16	Midway	$ .51
Belmont	7.00	Montana-Tonopah	1.52
Big Four	.87	Nevada Hills	1.20
Buckhorn	.95	North Star	.21
Con. Virginia	.22	Ophir	.23
Crown Point	.20	Pittsburg Silver Peak	.60
Florence	.40	Round Mountain	.33
Goldfield Con	2.27	Sierra Nevada	.12
Halifax	1.10	Tonopah Extension	1.80
Jim Butler	.71	Tonopah Merger	.79
Jumbo Extension	.31	Tonopah of Nevada	6.00
MacNamara	.20	Union	.12
Manhattan Consolidated	.08	West End	1.30
Mexican	.75	Yellow Jacket	.25

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. February 20.		Closing Prices. February 20.
Alaska Mexican	$12	McKinley-Darragh	$ 2
Alaska Treadwell	42⅜	Miami Copper	22⅜
Alaska United	23	Mines Co. of America	2¼
Amalgamated Copper	68	Nevada Con	16¾
A. S. & R. Co	69	Nipissing	8⅜
Braden Copper	8½	Ohio Copper	⅝
B. C. Copper Co	3⅞	Ray Con	17
Chino	37¾	Tenn. Copper	35½
First National	1⅞	Tonopah Belmont	7½
Giroux	2½	Tonopah Ex	1⅝
Goldfield Con	2⅜	Tonopah Mining	5⅞
Greene-Cananea	7⅛	Trinity	4½
Hollinger	15½	Tuolumne Copper	2⅜
Inspiration	15⅜	Utah Copper	50¾
Kerr Lake	3¾	West End	1¼
La Rose	3	Yukon Gold	3
Mason Valley	8		

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

F. L. Sizer is up from Arizona.

H. B. Lamb is in San Francisco.

Gelasio Caetani is in New York.

Frank Reber is here from National.

Edward de Villa is in San Francisco.

P. W. Hull is visiting San Francisco.

J. J. Multer is at Calistoga, California.

James Douglas has returned to New York.

O. B. Perry was in San Francisco this week.

Philip R. Stanhope has returned to Denver.

Thomas T. Read will leave today for Arizona.

James H. Hyde was in San Francisco recently.

A. D. Foote has been in San Francisco this week.

L. D. Ricketts has returned from a trip to the East.

O. H. Hershey passed through San Francisco last Saturday.

Charles Farnham and R. G. French are here from Grass Valley.

Sidney J. Jennings and Frederick Lyon were at Gold Road recently.

M. R. B. Gordon is now in charge at the Cobalt Lake mine, Ontario.

Lionel Lindsay expects to leave early in March for a visit to Japan.

Edgar Rickard arrived in New York Sunday and will visit California.

P. N. Moore attended the A. I. M. E. meeting in New York this week.

F. J. Basedow is up from Australia to visit American mining districts.

E. P. Jennings is now president of the Utah Metal Mining Company.

Karl Eilers is at Salt Lake City and is expected in San Francisco early in March.

R. B. Lamb has been appointed consulting engineer of the Peterson Lake mine, Cobalt.

O. B. Hart is now with the Andrada Mines Co., Macequece, Portuguese East Africa.

J. B. Tyrrell has returned to Toronto, after having spent two months in London, England.

Theodore B. Comstock is president of the California Farm & Home Builders at Los Angeles.

Leon J. Pepperberg has returned from professional work in the Santa Clara Valley oilfields.

George C. Stone has been elected treasurer of the American Institute of Mining Engineers.

L. L. Ferguson is now consulting engineer for the Triangle Mining & Development Company.

Howland Bancroft has been in the hospital at Denver for an appendicitis operation. He is recovering nicely.

At the weekly luncheon of the Engineers' Club of San Francisco next Tuesday at the Palace Hotel at 12:30, plans will be consummated for permanent quarters.

Norman C. Stines has left London for St. Petersburg, going by way of Paris and Berlin, having been appointed mining engineer to the Syssert Estate, in the Urals.

Louis Coderre, Secretary of State for the Dominion of Canada, now has charge of the Canadian Geological Survey and Bureau of Mines, which have been transferred from the Department of the Interior.

C. M. Eye expects to return to California soon, having resigned as manager for the Concheño Mining Co. in the Rayon district, Chihuahua. His temporary address is Box 571, Ocean Park, Los Angeles county.

Among those attending the recent conference called by the Director of the U. S. Bureau of Mines to consider problems relating to gas and oil wells in coalfields were: E. J. Taylor, W. C. Neill, F. W. De Wolf, Richard R. Hice, R. Dawson Hall, A. P. Cameron, A. C. Beeson, B. H. Canon, George W. Schluederberg, A. J. Moorshead, E. B. Moore, John W. Boileau, George S. Rice, O. P. Hood, H. M. Wilson, and Irving C. Allen.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

FATALITY rate in British Columbia mines is 5.24 per 1000 employed.

SALT is produced in the province of Szechuan, China, amounting to 300,000 tons per year, while the output of the districts tributary to the T'o river is 600,000 tons.

LAUNDERS at the Junction North mine are made of ⅛-in. steel plate in three sizes, 4 by 6, 5 by 8, and 7 by 12 in., parabolic in section, and in nearly every case the flow to different machines is made interchangeable.

WILFLEY tables at the Junction North mine, Broken Hill, are fitted with riffles ending in a special curve at the delivery end, the idea being to separate the fine lead from rhodonite gangue. Each table requires about 1 hp., and treats ¾ ton per hour.

CEMENT-GUNS were not invented by an engineer, a cement worker, or even a contractor or builder, but by C. F. Akeley, a taxidermist of Chicago. His idea for the use of the cement-gun was to rapidly and economically build up forms over which the skins of the larger mammals such as elephants and hippopotami might be placed.

ONE of the markets available for Alaska coal, were the coalfields of the territory developed, would be to supply coke to the smelters and foundries on Puget Sound and at Portland, San Francisco, Los Angeles, and the cities on the Pacific coast. Most of the coke now consumed on the Coast is imported from Germany, England, Australia, and China, or is brought from the Eastern states.

DATA for use in figuring requirements for gas-engine practice are as follows: One gallon of fuel oil contains 130,000 B.t.u.; 1 cu. ft. of water gas, for high heat work, contains 260 B.t.u.; 1 cu. ft. of mixed gas, for low heat work, contains 130 B.t.u.; 1 cu. ft. of producer gas, for gas-engine work, contains 95 B.t.u. An efficient gas-engine requires 10,000 B.t.u. per brake horse-power. One long ton of good bituminous coal will produce 40,000 cu. ft. of 260-B.t.u. water gas, or 120,000 cu. ft. of 95-B.t.u. producer gas.

MANGANESE exports from Bombay during the seven months ended October 1912 amounted to 272,795 long tons, of a value of $1,430,539. The shipments to the United States were 70,800 tons, worth $344,831. There was little change from the previous year in amount shipped. The manganese deposits of Central Uruguay will soon have an outlet through a 75-mile branch of the Central Uruguay railway, which is to be constructed from Tacurambo to Cerro Paraguay. The Government is to construct the branch and lease it to the Central railway at $1200 per mile per year.

GAS METERS require testing before use, and in Massachusetts, New York, California, and Maryland all of the meters used must be tested, sealed, and stamped by state officials. Special rules have been adopted in each. In Wisconsin and Nevada the companies are required to test all meters once in three years, and in New Jersey once in six years. The state inspectors test any meter upon formal complaint, but make no other routine meter tests. Certain local meter regulations are still in force in New Jersey, pending the decision of state authorities who are now investigating this matter.

AUTOMOBILE show at Chicago has set aside February 10 to 15 exclusively for the exhibition of commercial vehicles, and business men will be able to inspect them without being annoyed by people attracted by passenger vehicles. There are 77 exhibitors of complete wagons and trucks, of which 33 are specializing in those of 750 to 3000-lb. capacity. Delivery wagons of from 500 to 1000-lb. capacity, in both gasoline and electric types, are shown by 15 firms, prices ranging from $500 to $1800, and $700 to $2500. Seventeen firms have light trucks of 1500-lb. capacity, costing $750 to $2100; 25 show 2240-lb. trucks from $1100 to $2870 for the chassis without body, and 27 have 4480 to 5600-lb. trucks from $1800 to $3100. There will also be exhibits of 6720, 7840, 11,200, 12,320-lb. trucks, either electric or gasoline, with prices from $3100 to $5090. There are also exhibits of 15,680 and 22,400-lb. trucks. In all, there are 95 models of trucks from 500 to 5600 lb., and 72 models of 6720 to 22,400-lb. capacity.

WATER for mining purposes may be acquired on public lands, but certain precautions are to be noted. By locating, rights similar if not equal to those given by a patent are acquired; consequently, where riparian rights are recognized, a located or patented claim has a riparian right to use the water flowing through its ground. This right is not as conclusive as might be wished for, and consequently an appropriation should always be made. Where it is sought to divert the water off the claim having riparian rights, an appropriation must be made. In those states where riparian rights are not recognized, an appropriation must be made. In general, little reliance should be placed upon the riparian rights of a mining claim. Where an unappropriated flowing spring or well is upon a claim, under riparian rights, the claim-owner also owns the water; but where appropriation only is recognized, an appropriation of the flow at the point it leaves the ground of the claim-owner may be made by a stranger. What effect such an appropriation may have on the claim or land-owner's use of the water flowing from the spring or well is not clear; the safe course is to make an appropriation of the water naturally arising on one's own ground. Flowing water that develops naturally or is developed artificially after patent is obtained from the government, is private property and cannot be appropriated. Such water may come from the driving of wells, opening up new springs, driving tunnels, or from ponds arising naturally. The surplus of such water as it leaves the private land may be used and appropriated, but no real right is obtained, for the land-owner may cut off or divert the flow at his pleasure.

SLOW-BURNING or mill construction is simply a special class of timber work. Such a building will have heavy brick walls with the interior columns, beams, and floors of massive timbers so disposed as to present the least possible opportunity for the spread of fire. The columns are made of single timbers, usually square, capped with a corbel or short beam which forms a seat for the column of the next floor above, and supports the cross beams which carry the floor. This corbel may be replaced by a steel or cast-iron cap which is more reliable when the loads are great. The cross-beams are also heavy single timbers, and on these are laid 2 by 4-in. or 2 by 6-in. pieces, set on edge and spiked together so as to form a floor 4 or 6 in. thick, as the case may be. A hardwood wearing floor 1 in. thick is usually laid on this. Note the absence of all joists and any thin projecting woodwork which might easily catch fire. In case a fire should start, the thick floors would tend to confine it to one story, and the heavy beams and columns would burn slowly, thus giving the fire department a chance to put it out before it destroyed the whole building. This construction is only effective, however, when used intelligently, for unless all the many rules for preventing the spread of fire are carefully observed, the result may be disastrous. The roof of such a building may be constructed like the floor, or, if the span between the rafters is not too great, matched sheeting may be used. This is covered with a felt and gravel roofing material or some one of a score of special roofings which will resist the attack of fire. The cost of long timber of large cross-section practically limits the length of beams to somewhere between 12 and 16 ft. This means that in a wide building there will have to be many columns, which take up room and interfere with the arrangement of machinery.

Company Reports

MT. MORGAN GOLD MINING CO., LTD.

The work of this great Queensland concern for the half-year ended November 30, 1912, may be stated as follows:

Ore reserves, high grade, tons	1,433,000
Ore reserves, medium grade, tons	1,997,000
Development, feet	451
Ore mined from—	
Mt. Morgan mine, 450 to 1050-ft. levels, tons	116,277
Many Peaks mine, tons	53,064
Average of Mt. Morgan ore, copper, per cent	3.27
Average of Many Peaks ore, copper, per cent	1.64
Smelter work:	
Ore and other products treated, tons	172,423
Limestone used, tons	34,363
Coke used, tons	20,702
Copper production, tons	5,004
Gold contents, ounces	62,553
Revenue from all sources	$3,075,360
Profit	1,215,000
Dividends paid	480,000

At the mine, development on the 1050-ft. level is encouraging, and diamond-drilling will be started at an early date. In the Many Peaks pyritic orebody, development covered 569 ft. The ratio of this ore to Mt. Morgan silicious ore has decreased from 1.22 to 1, to 0.557 to 1. A new smelting plant to cost $720,000, entirely independent of the present plant, is being erected, having been designed by B. Magnus, general manager, and R. Sticht, of Mt. Lyell. A new power-plant is to be erected, and other necessary works. The reservoirs contain enough water for 15 months.

PORTLAND GOLD MINING COMPANY

The nineteenth annual meeting of the above company, operating mines at Victor and mills at Colorado Springs, Colorado, was held at Cheyenne, Wyoming, on February 3, and the following notes are from the report of the president, F. G. Peck.

The business of the company during 1912 has been satisfactory. The Colorado Springs mill has been reconstructed, the Victor mill enlarged, the No. 2 three-compartment shaft sunk a further 100 ft., a working station cut, and an important orebody opened on this level. Above the amount necessary to pay dividends, the earnings were $85,510. A considerable portion of surplus earnings during the past few years has been devoted to the increase of capacity, and reduction of costs of the mills, and development of the mine, rather than to building up a cash reserve. The Portland mine, like others, has a tonnage of low-grade ore much greater than that of the higher grades. After an expenditure of $500,000 in experimenting, and construction of the Victor mill, the plant is treating 500 tons of ore per day, worth $3.15 per ton, which gives a profit of $1.17 per ton. Its capacity has been increased from 12,285 tons in December 1911 to 14,791 tons in December of the past year, by adding 12 concentrating-tables; 4 Pachuca tanks, 1 Dorr thickener, and 2 classifiers. During 1912 this mill treated 173,361 tons, worth $547,424, upon which a net profit of $203,413 was made. The profits earned by this mill for 1911 and 1912 were 90% of the total cost.

At the beginning of 1912 the chlorination plant at Colorado Springs was being reconstructed into a cyanide plant to treat the high-grade ores, and about the middle of November the work was finished. After a good deal of investigation, 2 Merrill filter-presses were installed, each with 200-ton daily capacity, and they have proved a success.

At the mine, No. 16 level is extremely promising, and a large lode has been opened there. Early in the year No. 15 level, which had been under water since July 1909, was cleaned out, and No. 2 shaft was sunk to open No. 16 level. A cross-cut was driven 145 ft. to the first lode in September, which has been driven on 325 ft., the width varying between 5 and 25 ft. For stoping, 235 ft. has been prepared. The shoot on this level is much wider and longer than on the level above. No. 2 shaft will be sunk to No. 17 level in March 1913. The Roosevelt drainage tunnel has lowered the water 207 ft., and a further depth of 600 ft. will be drained. Regarding the driving of a fourth tunnel, as proposed by Cripple Creek mine-owners, the Portland company is not prepared to help for the present.

The following details are given in the report:

Ore treated at both mills, tons	217,923
Ore treated since April 1894, tons	1,536,185
Value of 1912 output	$ 1,413,766
Value of total production	34,361,897
Cost of mining and milling in 1912	1,091,020
Net profit	322,745
Dividends paid	240,000
Dividends paid to date	9,157,080
Cash and assets, January 1, 1913	338,787
Development in 1912, feet	7,680
Development to date, feet	244,743

Recent Publications

MINERALS AND MINING IN NEW ZEALAND, 1911. Annual Report of the Department of Mines. P. 155, ill, maps, plans. Wellington, New Zealand, 1912.

SALT CREEK OILFIELD, NATRONA COUNTY, WYOMING. By C. E. Jamison. Bulletin 4, Series B. P. 75; ill, maps. State Geol. Survey. Cheyenne, 1912.

PRELIMINARY REVIEW AND ESTIMATE OF MINERAL PRODUCTION, 1912. By Wm. Fleet Robertson. Bulletin No. 1, 1913, British Columbia Bureau of Mines. P. 29. Victoria, B. C., 1913.

CALIFORNIA MINERS' ASSOCIATION ANNUAL, 1912. Proceedings of the Sixteenth Annual Convention held at Native Sons' Hall, San Francisco, December 1912. P. 280; Index. San Francisco, 1913.

PRODUCTION OF COPPER, GOLD, LEAD, NICKEL, SILVER, ZINC, AND OTHER METALS IN CANADA, 1911. By Cosmo T. Cartwright. No. 199. P. 85. Canada Department of Mines, Mines Branch. Ottawa, 1913.

PHOSPHATES IN IDAHO AND MONTANA. By A. R. Schultz, R. W. Richards, and J. T. Pardee. Advance chapter from Bulletin 530, 'Contributions to Economic Geology, 1911, Part I.' Bulletin 530-H. P. 27; maps. U. S. Geol Survey. Washington, 1912.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE WESTERN STATES AND ALASKA IN 1911. MINE PRODUCTION. By A. H. Brooks, C. N. Gerry, V. C. Heikes, C. W. Henderson, H. D. McCaskey, and C. G. Yale. P. 791. Advance chapter from 'Mineral Resources of the United States, 1911.' U. S. Geol. Survey. Washington, 1912.

MINERAL RESOURCES OF THE UNITED STATES, 1911. PART II, NON-METALS. Chapters by E. W. Parker, D. T. Day, B. Hill, C. A. Davis, E. F. Burchard, J. Middleton, A. T. Coons, W. C. Phalen, F. L. Hess, H. S. Gale, F. B. Van Horn, F. B. Laney, J. S. Diller, D. B. Sterrett, E. S. Bastin, G. C. Matson, and J. S. Diller. P. 1224, maps, Index. U. S. Geol. Survey, Washington, 1912.

The Rivers and Lakes Commission of Illinois has published the following reports, Chicago, December 1912:

THE ILLINOIS WATERWAY. Bulletin 10. P. 26; ill.

THE ILLINOIS WATERWAY. By Isham Randolph. Bulletin 13. P. 21.

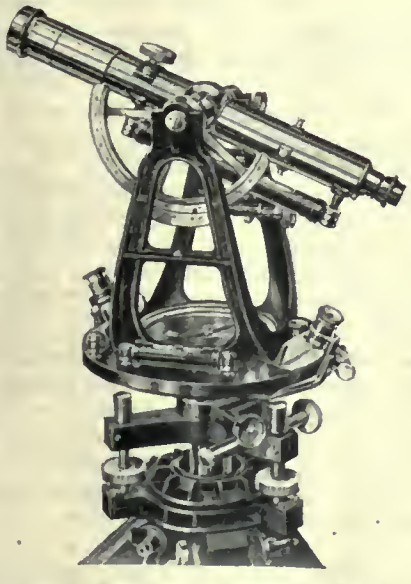
ANNUAL REPORT OF THE RIVERS AND LAKES COMMISSION OF ILLINOIS. P. 31.

EUROPEAN HARBOR DEVELOPMENT. By Robert R. McCormick. Bulletin 11. P. 9.

COMMON SENSE APPLIED TO THE INLAND WATERWAY PROBLEM. By Robert R. McCormick. Bulletin 12. P. 7.

A New Theodolite

A new precision theodolite of improved design, claimed to be especially adapted for triangulation and for city work, and when provided with the necessary attachments, equally suited for mine surveying and for use as a tunnel transit, has just been placed upon the market by Wm. Ainsworth & Sons, of Denver, Colorado.



AINSWORTH, TYPE 'A 3W', PRECISION THEODOLITE.

This instrument has 6¼-in. limb with verniers at 30° with telescope, reading to 10 sec., adjustable reading microscopes, 5-in. vertical arc with vernier reading to 30 sec., 12-in. 25-power erecting telescope, with stadia and solar wires and 3½-in. compass, with variation circle. All graduations excepting compass circle on solid silver.

The improved self-contained 3-screw leveling head has no detachable parts liable to become lost or misplaced, has ample adjustment for taking up wear at every point, and is provided with shifting centre to facilitate setting up.

The finish of the telescope, standard, plates, clamps, tangents, and leveling head is a durable black, protected by a heavy coat of weatherproof lacquer; tangent, clamp, and leveling screws are finished bright and lacquered. The weight of the instrument, complete as shown, is 15 lb., and with heavy split-leg tripod, 25 lb. The instrument can also be furnished with improved non-cramping 4-screw leveling head, edge graduation on vertical circle, any type of solar attachment, interchangeable auxiliary telescope, etc.

Fusible Signal Plugs for Air-Compressing Machinery

Modern methods and equipment both call for treatment which a few years ago would have been thought a needless expense. A recognition of the necessity for making machinery automatic so as to reduce the cost of operation and for eliminating the human factor so far as possible (the cost of attendance) has called for the incorporation of devices safeguarding against abnormal operating conditions. In the air-compressor, for instance, which has reached a high stage of automatism, various contributory causes might produce unduly high temperatures, which should be vigilantly guarded against, and which, so far as the human element is concerned, would not be apparent on the outside. High temperature in air-compressing machinery and its appurtenances such as pipe-lines or air-receivers, may produce various undesirable conditions, such as increased friction and unequal expansion of the working parts, requiring more power to drive and heavy leakage losses, so that the general efficiency of the plant is lowered.

It is essential that lubricating oils be employed in a compressor cylinder to reduce friction and prevent cutting and wear, but it is also a fact that if such oils are subjected to high enough pressure they will catch fire and burn. As interruption of proper cooling, sticking of valves, etc., will tend to induce such temperature, it is imperative that proper precautions be taken. Products of combustion are foul gases, while incomplete combustion results in a carbonic monoxide (CO) gas. One of the most undesirable conditions which might arise is the contamination of compressed air with these hurtful gases. Especially is this true in connection with the use of air in closed workings, such as mines, tunnels, and caissons, where exhaust from drills and other pneumatic machinery is depended on for the supply of fresh air. Instances are on record where explosions in discharge pipes and receivers have been traced to excessive temperature, and while the safety of such apparatus is unquestionable under proper supervision, safety devices looking to the prevention of such danger are entitled to serious consideration from users of compressed air.

Devices of a thermostatic nature have at times been manufactured for this duty, but as they usually involve other complicating apparatus, such as batteries, bells, and wiring, they prove an added burden upon the operating engineer. The Hodges fusible signal plug, which is being placed on the market by the Ingersoll-Rand Co., is intended as an assurance (by giving warning in a positive and unmistakable manner of a rise in temperature to a point which has been previously determined upon as the limit of safety) against the development of excessive strains, or other unnatural conditions. The device as a whole is shown in Fig. 1 and consists of a body formed for readily screwing into a hole tapped for ¼-in. pipe thread in the wall

FIG. 1.

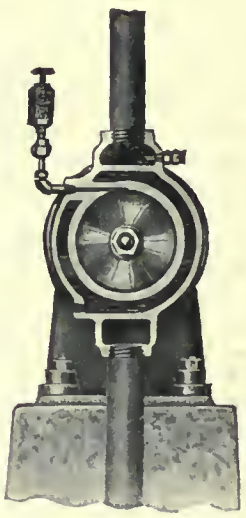


FIG. 2.

of the apparatus to be protected, an ornamental cap, and a removable stem containing the safety element.

The whole device presents a neat appearance when in place, and, as there are no movable parts, no attention is required by the operating engineer. The material used is mostly brass and copper, and is therefore unaffected by atmospheric conditions. Fig. 2 shows the device in place in the discharge space of a single-stage compressor. With this device in place, a rise of temperature to a point for which the safety element is set melts it and opens a minute passage through the stem to the head, allowing a small amount of air to pass, producing a distinctive whistle that cannot be overlooked by anyone in the vicinity; and this will persist until such time as measures have been taken to reduce the primary cause of the threatened trouble. It is then but a moment's work to replace the plug with a new one, and the machine is again properly protected against a similar recurring danger. The removable stem containing the safety element is easily replaced, and a few of these carried in stock will provide protection to a plant of considerable size.

Users of compressed-air machinery taking cognizance of

the simplicity of this device and its insurance against damage can readily understand that it forms a very desirable addition to compressed-air equipment and should be found at every point of possible danger throughout the plant. The manufacturers supply these signal plugs in two types with a 350° and 500° blowing point, respectively. The 350° plug is suitable for use in the discharge pipe of a single-stage compressor working at 40 lb. gauge pressure, in the discharge side of a two-stage compressor working at 100 lb. gauge pressure, or in the discharge side of a three or four-stage compressor delivering air at 1000 lb. gauge pressure. The 500° plug is for use in the discharge pipe of a single-stage compressor working at 100 lb. gauge pressure.

Commercial Paragraphs

C. E. Heald has succeeded A. Van der Naillen, Jr., as manager of Heald's Engineering School, San Francisco.

The Ridge Roasting Furnace & Engineering Co., with offices at 62 London Wall, has been organized to acquire the patents in roasting, calcining, and drying furnaces of H. M. Ridge.

The Taylor-Wharton Iron & Steel Co. announces that it has moved its Western sales office from 203 Mills building, San Francisco, California, to 504 Newhouse building, Salt Lake City, Utah.

W. E. Hardy, formerly manager of the Diamond mechanical branch at New York City, has succeeded I. R. Bailey as sales manager of the mechanical rubber goods department of the Diamond Rubber Company.

The Washington Iron Works, Seattle, Washington, is installing a three-ton Girod electric furnace in its new foundry, together with complete steel foundry equipment for the manufacture of high-grade steel castings. This will be the first electric steel-casting plant on the Pacific Coast.

At the recent annual stockholders meeting of the Riblet Tramway Co., of Spokane, Washington, the following officers were elected: B. C. Riblet, president; R. N. Riblet, vice-president; W. S. Riblet, treasurer; John Clark, secretary. R. S. Riblet and W. S. Riblet were formerly in the tramway department of A. Leschen & Son's Rope Co. W. S. Riblet will have charge of the British Columbia business, with offices at Nelson.

The Hess Flume Co., 2166-76 Fifteenth street, Denver, Colorado, announces the purchase of the Maginnis flume patents, covering both the Maginnis standard flume and the Maginnis smooth interior flume, together with the business, stock, and good-will of P. Maginnis, of Kimball, Nebraska. The Hess company will continue the manufacture of both the Maginnis flume and the Hess flume at both its Denver and Canton, Ohio, factories.

The Union Construction Co., San Francisco, manufacturer of placer gold and tin dredges, has completed arrangements with Fraser & Chalmers, Ltd., of London, England, whereby the latter will act as the representative for the construction of dredges outside of the United States and Alaska. The Union Construction Co.'s corps of engineers has had experience in not only the designing but the operating of dredges, and will act as consulting engineers in this work for Fraser & Chalmers.

The H. W. Johns-Manville Co., New York, has recently put on the market 'J-M High Temperature Cement No. 31,' which it is said can be used practically whenever working temperatures range between 1500 and 3100°F. This new material is a dry powder mixture composed of asbestos and other materials of secret preparation. It is mixed with water to the proper consistence (say about 18 to 20 lb. of water to 100 lb. of powder) for working like mortar or tamping around molds. When used for setting up firebrick for boilers and furnaces, lining and roofing furnaces of various kinds, or molded into door jambs, lining fire-doors, repairing side-walls of furnaces, making stay-nut caps, etc., it has considerable mechanical strength. When air dried it will withstand a crushing strain of 883.5 lb. per square inch. It vitrifies at the comparatively low temperature of 1418°F., and has a high melting point (3182°F.). Being semi-acid in character, it can be used with chrome bricks, silica bricks, or fire-clay bricks. It is claimed that experiments conducted with this cement show that it can be successfully used in building doors of angle-iron framework without backing, or for making one-piece linings for gas or oil-burning crucible furnaces.

The Western Electric Co., New York, reports that its sales for 1912 will be between 71 and 72 millions, which is slightly more than in 1906, the previous largest year in the company's business. The increase has been in American sales outside of the Bell system, which have increased about 100% over 1906, and in European sales, which were the largest in the company's history. The results have been accomplished by an energetic selling campaign in the face of increased and increasing competition. The company is now selling to upward of 30,000 customers in the United States alone. The board of directors has established two additional vice-presidents in the company's organization, and has appointed to these newly created positions Gerard Swope, general sales manager, and A. L. Salt, general purchasing agent.

The Traylor Engineering & Manufacturing Co. has recently closed an order with the Granby Consolidated Mining, Smelting & Power Co. for its entire smelting equipment for a new 3000-ton copper-smelting and converting plant to be erected on its Hidden Creek properties at Anyox, British Columbia. This consists of three complete blast-furnaces, 360 in. long by 50 in. wide at the tuyere zone; three Great Falls type 12-ft. converters; molding machines for both low-grade matte and copper; complete sampling mill and accessories; large initial crushing plant for the mines; complete furnace charging-car system. It is claimed that this is one of the largest individual machinery contracts placed in a number of years. This machinery is expected to be completed and shipped some time in April or the middle of May, and it is reported that the Granby company expects to have the plant running in September or October of this year.

The Dodge Manufacturing Co., Mishawaka, Indiana, announces that the Dodge 'Standard' iron split-pulleys are now being made without set-screws and with the bushings split ready to put on the shaft. Many tests under actual working conditions have demonstrated that the pulley is held fast to the shaft with absolute security by compression alone. The hub bolts are large in diameter, and the clamping power therefore is much greater with these pulleys than any other type. This makes set-screws unnecessary, and as they are an element of danger, projecting as they do from the hub, they have been, in the interest of safety and efficiency, eliminated. All bushings for 'Standard' split iron pulleys will be split, clearance for clamping being provided, and the halves of each bushing wired together, bearing a tag showing the shaft size. Also in the interest of safety, all regular made-to-order Dodge solid iron pulleys and iron-centre wood-rim pulleys, rope sheaves, etc., are being fitted with headless set-screws which are concealed below the surface of the hub.

Catalogues Received

Allis-Chalmers Co., Milwaukee, Wisconsin. Bulletin No. 1631, 'Hydraulic Turbines.' 32 pages. Illustrated. 8 by 10 inches.

Chicago Pneumatic Tool Co., Chicago, Illinois. Bulletin No. 34-F, 'Class G Compressors.' 28 pages. Illustrated. 6 by 9 inches.

Leo-Courtenay Co., Inc., 90 West St., New York. Bulletin H, 'Turbine Pumping Machinery.' 30 pages. Illustrated. 6 by 9 inches.

Power and Mining Machinery Co., Milwaukee, Wisconsin. Bulletin No. 106, 'Loomis-Pettibone Gas Generating System.' 16 pages. Illustrated. 7 by 10 inches.

Chrome Steel Works, Chrome, New Jersey. Booklet describing the manufacture of 'Adamantine' chrome steel shells and tires. 23 pages. Illustrated. 4 by 8 inches.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

NEW districts yield new names at times. The *Rochester Miner* reports a college girl visitor as being "greatly pleased with the formation, particularly these corruptive rocks."

CANADIAN mining engineers will enjoy next week another of the annual gatherings that have made the Canadian Mining Institute notable for good fellowship as well as technical interest. The program announced for the meeting at Ottawa, March 5, 6, and 7, promises an unusually good meeting.

WHETHER use of the parcel post for the sending of gold bricks constitutes an offense sufficient to justify a fraud order is being seriously debated in our office. We reserve till another number the telling of the tale, but announce now in deep sorrow that we have been 'gold-bricked' by friends.

GEOLOGISTS in Canada are offering an extremely attractive program of excursions in connection with the meeting of the International Geological Congress at Toronto, August 7 to 14. Opportunity will be afforded visitors to see the country from Louisburg to Dawson under most favorable circumstances. The Canadians have established an enviable reputation as hosts, and visiting geologists may feel sure that their time will be well spent. While the excursions are, properly enough, offered only to accredited geologists, the Congress itself is open to all.

AMONG papers read at the New York meeting of the American Institute of Mining Engineers was one by Messrs. Chase Palmer and Edson S. Bastin, of the United States Geological Survey, that is of special interest to students of ore genesis. Messrs. Palmer and Bastin have been studying the materials that precipitate gold and silver from solutions, and they find that the metallic sulphides have large power in this direction. Chalcocite proves to be especially efficient, and this affords a ready explanation for the large amount of silver commonly found in veins rich in chalcocite, as at Butte.

COLORADO has maintained a tradition that every decade would witness the finding of a new and important district within that state, a tradition well sustained by several decades. Since Cripple Creek came into being, however, this cherished tradition has seemed likely to go the way of that maintained by the man who went to church regularly—on Easter, but had missed the last two. Discovery of rich silver ore in Eagle county, as announced in our news columns, has especial interest in that it possibly heralds the coming of the longed for new district. Friends assure us that the find is genuine and important.

PANAMA-PACIFIC EXPOSITION affairs seem to make good progress so far as money and buildings go, but we are less certain as to exhibits, at least in mining. So far as public record goes the directors have made no progress in the matter of choice of a commissioner of mines and mining. No one seems to know why. Gentlemen of the Board, the miners are anxious and willing to help, but must know to whom to report. Why not act?

PARTITION walls have always two sides, and it makes a deal of difference whether you gaze at the smooth white finish of the side toward the company office or the rough unfinished side where the plaster has oozed through between the lath, that faces the men's quarters. There are managers who see right through lath and plaster and deep into the hearts of men, and such gifted ones find success easy, for mining, as every other human activity, deals with men as well as materials. Too many managers understand mathematics but have never mastered the intricacies of the human equation. Such men need a guide if they would see not, 'how the other half lives,' but what they think and feel. To such, the paper on mine administration that we print this week will be especially helpful. The author is a genuine miner, one who has worked underground from boyhood and who is working now in the stopes. The point of view that he takes is that of the miner, illuminated with knowledge that has come from experience, travel, and study. The touch of exaggeration is balanced by the play of humor, and the whole portrays excellently the miner's cheerful toleration of a certain type of mine superintendent, a type, by the way, that we hope to see become extinct.

Agitating With Solution

Agitation of slime has received a good deal of attention, and there are a number of methods in use which have been described from time to time: but the system of continuous agitation with barren cyanide solution, as described on another page of this issue by Mr. C. F. Spaulding is new, economical, and does the work of agitating, washing, and decanting in one operation. The process has been tried at Parral, in Mexico, and is now to be used in a 100-ton plant in Oregon. Mechanical and compressed-air agitation is fairly expensive, and the solution agitation takes only one-third of the power required by the former methods. Any existing plant, in which Pachuca vats are used, can be converted for the new system at low cost. Instead of air being used to circulate the slime, solution may be pumped into the transfer pipe, the pulp diluted, its specific gravity lowered, and it then rises in the pipe as in an air-lift. By means of a small vat fitted in the agitator, the slime is made to settle, and the clear solution is decanted off, while the thickened pulp is again elevated by barren solution. This going on continuously, the barren solution replaces the metal-bearing solution as soon as it settles. When the final wash is low in value, the charge is complete. The decanted solution flows to a clarifying vat or filter-press of some kind, and is then precipitated, each agitator having a complete set of clarifiers and zinc-boxes. Unless the ore being treated contains a large amount of colloidal matter, a clarifying vat should suffice. The process is simple, and labor costs should be reduced considerably. Where applicable it affords a means of avoiding the use of vacuum or pressure filters. Mr. Spaulding has not patented his idea, which is somewhat refreshing. We hope that his article may lead to discussion and that the process may find extended application. As has been stated before, the chief weak point in all decantation processes is the quantity of solution which must be discharged with the pulp. Where this can be kept low in value and in cyanide the losses may be kept down to where the process is economical. It is a matter requiring careful study in each case.

Possible Competition in Nickel

Nickel was for many years a drug on the market. Careful work and expanding industry have led to its adoption for new uses until it is now in fair demand. In the form of monel metal it finds especially wide use, and the world's production has doubled in the last decade. Of the present smelting capacity, approximately one-half is in the United States and Canada, and the other half is divided among Germany, England, and France. The world's chief producer is the International Nickel Company, having mines at Sudbury in Ontario. The Mond Nickel Company owns mines adjoining and is now building an enlarged smelter at Coniston. The chief opponent of the International, though, is Le Société de Nickel, with mines in New Caledonia and refineries in France. This company is controlled by the Rothschilds and for some years there has been an amicable arrangement between the companies for division of territory and trade. With the growth of the latter the dominant position has come to be worth fighting for and there are signs suggesting that a fight is impending. Canadian papers have announced that Mr. F. S. Pearson, acting for the owners, has sold to the Rothschilds the nickel properties developed by Messrs. M. K. O'Brien and J. R. Booth. These properties are on what is known as the north range at Sudbury and the best known is the Murray mine. While the ore is lower in grade than in the Creighton and other mines on the south range, it is workable, and systematic diamond-drill work is said to have proved four million tons. It has been known for some time that the New Caledonian mines were failing and that the French interests found competition with the International difficult; presumably the purchase of the Booth-O'Brien properties is to give the French refiners an assured source of cheap ore. Incidentally the American Smelting & Refining Company has been studying the Sudbury district for about a year and is reported to have made an offer for the properties just sold. That concern is rapidly adding to its lines of production and thus broadening the basis of its business. If, however, the old compact between the International Nickel Company and Le Société de Nickel has expired and a contest impends, the nickel business is no field for an innocent bystander.

Gold Production

By George F. Becker

*Historical study of the relative values of the precious metals and of their purchasing power has convinced me that chemical or metallurgical invention almost completely controls the relative values of gold and silver, legislation exercising only an evanescent influence; while the purchasing power is as a rule and under stable economic conditions only about the average cost of extraction. In less alluring industries there is usually a net profit, but much gold and silver is produced at a loss endured in the hope of better developments; and vast amounts of money are spent in almost fruitless search for profitable ores. It is probable, however, that in the Transvaal at the present time there is a net profit on the gold production, because of the regularity of the wonderful Witwatersrand deposit.

The average rewards of mental and physical efforts in fundamental industries for any considerable period of time must be nearly the same, for otherwise the most remunerative occupation would attract an inordinate proportion of workers. Among these rewards, however, must be counted pleasurable excitement and comfort as each of us is aware when choosing a field of activity. Here the personal equation comes in; the adventurous life and gambling chances of a gold miner appeal almost irresistably to men of a certain temperament, while unwashed crowds and cheap shows fascinate the predordained inhabitant of the slums.

Hence improvement in the technique of gold extraction, attended for the moment by increased profit, must soon be followed by increased wages and prices in other occupations in order that the balance of industry may be preserved. We cannot eat gold.

I look for a decided increase in the production of gold in the Russian Empire within a few years through the introduction there of modern methods and machinery. On the Rand, too, as I understand it, the policy is to press production to the utmost, and this will doubtless result in a considerably greater production for a few years. The world's production may rise within five years to something like five hundred million dollars annually.

Ten years from now the Rand deposits now explored should have passed their greatest productivity, and perhaps the Siberian fields already known will have reached a maximum output. All analogy indicates that South America and Africa must contain unexplored goldfields of importance, and progress in discovery is as likely to exceed as to fall short of the exhaustion of known auriferous areas.

Chemical invention will not cease, but the cyanide process is so inexpensive that it is difficult to conceive of an undiscovered method of extraction which would be a very great economic improvement upon it. Nevertheless, the average expense of gold extraction will diminish. There is a strong tendency at present to reduce costs by systematic improvements in mining and milling; by the study of economy in small things the aggregate of which is great. The effect will be to render ores of lower grade available, and of these there are known to be vast quantities. Higher wages will be offset by the increased use of machinery.

I know of no more permanent standard of value than ordinary cattle in an agricultural region. The ox is good to work, can transport himself to market, his flesh, hide, horns, hoofs, and bones are marketable; he represents a fairly definite quantity of available potentialized energy accumulated by the elementary ancient and unimprovable process of digestion; he and his sister never go out of fashion and they make no factitious demands upon their master. In ancient Egypt, 90c. in gold would buy an ox, and the fortune of a Croesus had a purchasing power thirty or forty times as great as the same number of talents would possess at the present day.

Apart from abolishing the artificial enhancement of prices through a protective tariff, the plain way to a reduction of the cost of living is to follow the example of the gold industry; to improve, intensify, and systematize the process of production.

*From *The Annalist.*

Potash in Nevada

Some significant results have been obtained from the potash explorations of the U. S. Geological Survey in Columbus marsh, on or near the line between Esmeralda and Mineral counties, Nevada. Coaldale is a railroad station at the southeast corner of the marsh, and the Tonopah & Goldfield railroad skirts the eastern margin of the marsh itself. Columbus marsh is a broad mud plain with a rough hummy surface. Little salt shows on the mud except about the margins of the plain, where some borax-producing plants were situated in the earlier days of the borax industry. A small area about the margin of the marsh was located for borax a good many years ago, and a part has been patented. Columbus marsh itself comprises an area of about 35 or 40 square miles, roughly elliptical in outline, being about 9 miles in longest dimension from north to south and 6 miles or more in width. Shore terraces at heights of 70 to 75 ft. above the flat testify to the presence in this basin of a prehistoric lake.

During 1911 the explorations of the Survey geologists with hand-drilling apparatus were carried into Columbus marsh and six holes were sunk to depths ranging from 32 to 50 ft. The drilling was done by Charles E. Watson under the direction of Hoyt S. Gale. It appears from analyses made in the laboratory of the Survey at Washington that the average content of a 20-ft. section of the core obtained between the depths of 18 and 38 ft. consists of 20.59% potash in the water-soluble portion of the sample. These samples averaged 5.96% water-soluble salts in the dried mud and sand as received at the laboratory. Such muds, therefore, contain nearly 6% of soluble salts, of which essentially one-third (32.57%) is potash if the salt is figured as the chloride. It should be emphasized, however, that all these mud samples were brought up through saline waters, also derived from corresponding strata, through the rotated casing used in drilling the well.

FIG. 1.

FIG. 2.

FIG. 3.

Erection of MacNamara Head-Frame

By HERBERT HAAS

As a supplement to M. W. von Bernewitz' article in your issue of January 25, on the mill designed and built by me for the MacNamara Mining Co., the following description of the erection of the new head-frame may interest your readers.

In order to supply the mill with a larger tonnage than had been previously mined, and to carry on more extensive development on the 800 and 700-ft. levels, the hoisting from all of which had to be done through a single 4 by 4-ft. compartment, it became imperative to increase the hoisting speed as well as the load. This would have taxed the old head-frame beyond its safe carrying capacity. Inspection further developed that the sills and portions of the old structure had rotted, and that all of the frame members were badly twisted and had checked from continued exposure to the elements, the frame being nearly ten years old. The hoisting capacity of the winding engine, which was a slow speed, double reel, geared 10 by 16 in. double-cylinder steam engine, had to be increased. This was done by electrifying the hoist, the speed being increased by adopting a proper gear ratio and suitable motor, at the same time that the net hoisting capacity was raised, by the use of a heavy counterweight. The connecting rods and eccentries with reversing links were disconnected, and one of the crank discs was provided with a cast-iron cut-gear ring, which was bolted to the disc. The steel pinion, keyed to the armature shaft of an 80-hp. Westinghouse variable speed type W. S. induction motor, engaged the spur-gear ring, two speed reductions being used with the electric drive.

Use of Counterweight

To reduce 'peaks' during starting, acceleration, and toward the end of a trip when the hoisting speed would be the highest, as well as to reduce the power required for hoisting and the size of the motor, a counterweight of 4000 lb., which is considerably greater than the weight of the empty skip, was placed in the manway compartment, a narrow space of which was portioned off for the counterweights and guides. The skip was designed as a 35-cu. ft. self-dumping vertical car, holding about 3000 lb. of ore. The changed hoist was designed for an average hoisting speed of 800 ft. per minute, and a maximum of 1000 ft. The head-frame had therefore to carry rapidly changing loads upward of 11,000 lb., which was beyond the capacity of the old structure. A new head-frame, considerably higher, was therefore designed, to accommodate the dumping cradle for the skip; and ore and waste-rock bins were built into the frame structure, into which the skip dumps automatically.

A Photographic Record

The accompanying photographs illustrate the method used for erecting the frame into place. In designing it, it was intended from the start to use the old frame and steam-hoist to raise the new frame in place. This was so proportioned that it would go over the old frame; the concrete foundations for the new frame sills were placed along the outside of the old sills, and the new front posts outside of the old ones. The entire head-frame was first carefully framed, then joined, fitted, bolted, and marked; and then disconnected again. Fig. 1 shows the old head-frame. Fig. 2 shows the front posts and bridge tree, sheave platform timbers, and knee bracing, all framed and bolted, supported on false work. For this, use was made of the two lowest post bents of the future ore-bin for the mill. To support the end of the structure, two 4 by 8-in. props were put underneath, in the manner clearly shown in the photograph. Fig. 3 shows everything in readiness for hoisting the front portion of the frame in place. A 1-in. manila line was tied to each post at the top below the cap, and a third and fourth line were tied respectively a little farther down. The first two, or back lines, were used to hold the frame from going over too far and beyond its vertical position when being hoisted in place, the left and right line to prevent a shifting of the frame laterally. The foot of the posts rested on the new sills, which were permanently bolted to the concrete foundations. One corner of the post tenon was directly over the mortise in the cap, which was cut into the sill to receive the foot of the post. The other short side of the tenons had been rounded off slightly at the edge, so that

they would enter the mortises when the posts were being hoisted into position. Back of the mortised caps, timbers were placed horizontally on top of the sills, and a piece of steel plate was wedged between the foot of the new posts and the butt of the horizontal timbers, which absorbed the resulting pressure exerted during the beginning of the raising of the posts. The steel plate was well oiled, to decrease friction while the posts were being fulcrumed into the vertical position.

Arrangement of Rigging

The new frame is 73 ft. from top of sill to top of cap. It was figured that the most favorable point at which to attach the rope slings with which the frame was pulled into position would be about 45 ft. above the foot of the posts. A 1½-in. manila rope sling was tied around each post, and a 2-in. manila sling was fastened to the smaller slings. The shackle of the flat wire hoisting rope was secured to the large sling. Of this, as much as was available was fed out, in order to divide the pull equally between the two frame legs and secure the most favorable direction of pulling force. This sling, forming an acute triangle under tension, can be seen in Fig. 4. and Fig. 5. Timbers 6 by 8 inches in size were bolted to the back of the old frame posts, one near the cap and a second one farther down, the ends of which projected beyond the sides of the old frame posts and served to arrest the posts of the new frame. A notch, the width of the sheave wheel, was cut out of the old cap, so that the hoisting rope would get free after passing through tangency to the sheave. In Fig. 2 a carpenter can be seen cutting this notch. The weakened bridge-tree of the frame was reinforced with braces which allowed the rope to pass unobstructed.

Calculation of Stresses

The entire evolution through the different stages of the raising of the frame was first drawn out on paper, and the stresses the frame, chiefly the posts, would have to withstand, were figured. The weight of the structure to be raised was estimated to amount to 7000 lb., but because of the flat position of the frame, and the consequent unfavorable direction of the rope pull at the start of the lift, the resultant pull was figured to be nearly twice the weight of the frame, which pull decreased with a shifting in the direction of the applied force as the frame was being lifted into position.

It was first tried to raise the frame with the steam hoist singly, but this proved of insufficient power. The second, or 'running over,' rope was therefore passed over the other sheave (the regular hoisting sheave), the cage was attached to it and loaded with about five tons of scrap iron and sacks of cement. About 45 ft. below the collar of the shaft a few sets were placed across the wall plates, the distance being so figured that the cage would land on this staging shortly before the new frame would be in its final vertical position.

Method of Work

When everything was in readiness, three men were stationed at each mooring or guy post, and the signal was given to the hoisting engineer. He opened the throttle full, the frame began to vibrate and then swing around its toes and rise rapidly into position. When it was at an angle of about 75°, the engineer stopped hoisting; the men holding the rear guy-ropes not being able to feed them out fast enough, the lines became taut. A few seconds later the front legs were leaning against the ends of the timbers bolted to the old frame, to which they were securely lashed. In Fig. 4 can be seen a small cloud of dust, caused by the falling of the 4 by 8-in. props temporarily suporting the end of the new structure, which props fell when the frame was raised. Fig. 5 shows the frame in position.

Time Occupied

The work of building the staging, placing the frame on it, joining, bracing, and bolting, and then raising it, was all done in one day, October 16, 1911. Fig. 6 shows the progress of erection the next day. Fig. 7 shows the erection and placing into its splice the last third of the back leg, on October 18, 1911. With the exception of the diagonal braces, all this work was done in three days, which shows good work and excellent framing.

Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Mine Administration and Mine Bosses

By A Miner

A layman upon perusing the columns of the current mining literature would probably gain the impression that those who occupy the executive positions at a mine are a superior class of knights and courtiers, all possessed of marvelous intelligence and stupendous ability. Such phrases as "winning the precious metal from the bowels of the earth" and "the mining engineer matching his ability with the forces of nature and the 'everlasting rocks'" have a magnificent sound. One might picture the valiant superintendent, always a mining engineer, seated in his office, knowledge and ability personified, information oozing from every pore, every problem mastered, and every feature indicative of a master of the situation. The foreman, another mining engineer, but with less experience, enters for his daily orders, and receiving them in a few curt decisive words departs to transmit them to the shift-boss, an intelligent fellow, who is awaiting them at the shaft. The shift-boss, in turn receiving the orders, steps upon the deck of the awaiting cage, signals the engineer with a majestic motion of the hand, and is promptly lowered into the depths where he proceeds, according to instructions, to send forth enormous quantities of pay-ore. Truly the administrative organization of a mine presents an imposing appearance—on paper.

To the miner who has spent a matter of twenty years in the mines, working from the iron mines of New York to Cananea, and from the phosphate mines of Florida to the Klondike, this organization presents a different appearance. Long experience has familiarized him with the different officials until, when he strolls into a strange camp in search of a job, no inquiries are necessary. He has met so many of each that he can always recognize them without any description.

The Shift Boss

Probably of all species of mine official the easiest identified is the shift-boss—he always wears a No. 14 shoe and his hair grows clear down to his eyebrows. However, the shift-boss is not chosen for the position on account of his looks. His chief characteristic is his vocal ability. He always speaks two languages, both of which are thoroughly understood by the miner; one of them is a growl, the other, a grunt. When he makes his first trip of the day through the mine you—if you are a miner—always get a growl. On his last trip, if you have done about as much as two men ought to do, you get a grunt. If you have done any less than this you draw another growl. I have worked for about three hundred shift-bosses, and they are all alike. If any were different they would be promptly 'canned' by the foreman.

The foreman can be distinguished by his dress as well as by his language. He always apes the superintendent in dress and is always swearing at the shift-boss. That's what a shift-boss is for in the foreman's estimation—that, and to be made the goat for all blunders. The foreman gets his job in a peculiar manner. The superintendent, being a mining engineer, always wants to learn a little mining when he gets out of the School of Mines, so his father, a stockholder, gets him a job in the mine where he is put to work with Pete, the miner. Pete earns his living as a miner because, as a rule, he knows no other way. He does not consider working in the mines in the light of a vacation, and he knows that in most mines two men are supposed to do two men's work. Consequently, when he draws a mining engineer for a partner, he realizes that he has his choice of two methods of procedure. He may either do two men's work or quit. Usually the condition of his finances makes it more diplomatic to pursue the former course, and he resigns himself to fate. When, after about three weeks, his partner, through his father's influence, gets a position as superintendent, Pete is rewarded by being taken along as foreman. And be it said to his credit, Pete has built up a reputation for many a superintendent.

The Superintendent

The superintendent can be recognized in many ways; so many, in fact, that it would be useless to attempt to enumerate. His dress would indicate that mining camp life is one perpetual masquerade ball, and he acts like the shift-boss looks. He is selected for the position because he is the nearest relative of the president or some stockholder who has given indication of an infinite capacity for interfering with his own business. Then, too, being a mining engineer, he has a headful of intellectual chop suey accumulated at the School of Mines where he thinks he received his education.

His first move on 'assuming the superintendency' is to change all of the methods previously used at the mine to conform to the methods of the mine where he received his three weeks 'practical experience.' This usually lasts for about a month, by which time Pete is able to persuade him that the methods used in a 14-ft. vertical vein of copper ore are not applicable to a 3-ft. vein of gold ore dipping 45°. As it is undignified for a superintendent to recede from a position once taken, he never changes his methods. He simply 'modifies' them, but in most cases the modification is of such extent that he gets right back to the methods originally used. He seldom tries to apply any of the methods he learned at the School of Mines, because, with three weeks' practical experience, even a mine superintendent will learn enough to not try to apply those methods to actual mining.

Importing Men

Another favorite 'stunt' of the new superintendent is the importation of men from that wonderful mine where he discovered Pete and where he learned all about mining in three weeks. In all of his experience those are the best miners he has ever met; so

he promptly sends back for a dozen or so. It never occurs to him that a miner in the 14-ft. vein where 3-in. piston machines are used, may not be equally at home with a single-jack in a flat vein of gold quartz, nor does he consider the fact that the best miners will not leave Leadville or Butte or the Coeur d'Alene, where the accommodations are good, to work for the same wages in a 'bunk-house camp.' He thinks, because he has never been in such a place before, that the miner is equally ignorant. So when the new crew arrives he has Pete 'fire' enough of the home talent to make room for the imported men, and later discovers that those he fired are better suited to his conditions than the imported stock. He frequently learns, too, that the whole community is sore on him for 'canning' the men who were considered by the previous management to be able miners.

Changing Methods

A change of methods is frequently advisable, but is best made by a miner who has had experience in both methods and not because the methods to which the change is made has been used advantageously in an entirely different kind of deposit. The importation of men in large numbers from any camp is very seldom a success. These two mistakes have been made by every young School of Mines superintendent who has had charge of a mine in the last forty years, and they are being made just as often today as they ever were. It is really astonishing how much damage can be done by three weeks 'practical experience.' It often requires years to overcome the evil effects of it.

Another favorite stunt is for the young superintendent to take charge of the mine itself. After fifteen or twenty years he learns that the proper one to direct the actual operations of a mine is a miner, but he seldom learns it in less time. So he 'takes personal charge' of the mine, retaining, however, the faithful Pete in order that he may put in his reports such expressions as "my foreman, acting under *my* orders," did so and so. "My foreman shall be immediately instructed to," "my foreman made a mistake and caved the stope." In the reports 'I' gets the credit for everything correctly done, and 'my foreman' makes all the 'bulls.' That's part of a foreman's duty.

Personally Managed Mines

If there ever was a mine personally managed by a superintendent and made to pay it was a very rich one. I do not believe it was ever done, but if it was, I know from what I have seen them do to ordinary mines that it took a rich one to stand it and pay dividends. I have worked for forty or fifty mine superintendents and have yet to see one who is capable of taking 'personal charge' of a mine. As a matter of fact they usually only think they are in charge. In 90% of the cases Pete is actually directing the work, and Pete must be a pretty able miner to make a mine pay when handicapped by one of the 24-carat boss-heads that is so frequently inflicted upon him.

Somehow, it never seems to occur to the 'super' that there is anything for him to do except interfere with the operation of the mine. He seems never to think that he might look into conditions around the bunk-house or boarding house. He thinks when he has provided a kennel in which a miner can spread his blankets (for which the miner usually pays $1 or $2 per month), and a boarding house compared with which a Salvation Army soup-house resembles a Waldorf-Astoria, he has done his duty. He can always find time to drop down into the mine and ball things up, but he never has time to visit the kitchen. That is about the only place around the works where he cannot make things any worse, so he never goes there. Of course, he will not live on the common dollar-a-day grub that he feeds the miner—he has a private table. It looks as though some superintendent would learn that if he does not wish to eat at the same table with the miner, he would better hire a cook of his own than to have a private dining room in the miners' boarding house. Dissatisfaction over the boarding house is a common complaint in any case, but it is less common when the bosses eat at the same table with the miners or take their meals in some other place than the company boarding house. Probably the private table is no better than the other, but the miner does not know it and will not believe it. He is 'from Missouri' when it comes to 'grub'.

It seems, too, that it would occur to some superintendent that a boarding house could be run by some one except a Chinaman, but it rarely does. They all seem to think that the proper food for a miner is 'grub' that can only be masticated by a rock-crusher and digested by an ostrich and that it is much more palatable to him when served by a greasy Chinaman, dressed in overalls and with his shirt-tails out, than if served by clean white women.

The Superintendent's Geology

However, the 'super' has no time to devote to such things. His presence is demanded in the mine where he can get in someone's way. Besides, the miner could not properly extract the ore from the stopes unless it was explained to him how it got in there, so the 'super' must be on the job with the explanation; much of the geology inflicted upon poor Pete and the other miners would scandalize the dear old professor back at the School of Mines. The one feature of the 'super' that appeals strongly to the miner is the fact that no one can stick him on any geological question. His long suit is talking geology to someone who knows nothing about it, and it is really inspiring to hear him discuss 'metasomatic interchange' and 'pneumato-hydrogenic processes' when he has a shoveler for an audience. It is in such cases that he shows himself at his best and he always likes to be questioned on geology and the formation of ore deposits. Some miners, learning this, always have a leading question ready for him when he comes around and during the peroration that follows they enjoy a restful half-hour on a powder box. The 'super' will always stand for your loafing if you will stand for his geology.

The only time one of these 'personally managed' mines is free from the interference of the 'super' is when he has made some mistake that everyone, in-

cluding himself, recognizes. Then he goes down to the office and meditates upon 'lateral infiltration' or reads a book on 'industrial efficieney' for a couple of days while Pete straightens up the mess. I have seen one spend a half-day with five or six men trying to get a 24-ft. pipe into a place the greatest dimension of which did not exceed 18 ft. and, after shouting at and quarreling with the miners until they were all on the verge of quitting, go away and not bother the mine for a week. It may not be believed, but it is a fact, that such men as this draw pay as superintendents of mines. Another characteristic of this kind of superintendent is his mania on the subject of efficieney of labor. How can a man expect to get efficieney out of labor when he insists upon hiring all men himself and when he does not know enough about labor to distinguish between a Japanese dishwasher and a Swede lumber-jack? That inefficieney exists in most mining camps cannot be denied, but usually 95% of it is in the superintendent's office, and it is there that reform might well begin.

Is mining languishing? Undoubtedly—and no wonder. If it were not the greatest of all industries, the scientific mismanagement with which it has been afflicted would long ago have put it in a class with the profession of smuggling Chinamen across the Mexican border.

Litigation Over the Federal Mining & Smelting Company

News despatches from New York have much to say about a suit against the Guggenheims that has been filed in the Supreme Court of New York by minority stockholders of the Federal Mining & Smelting Co., asking for annulment of an alleged unfair contract under which the ores of the corporation are now being shipped to the smelters of the A. S. & R. Co., on a basis much below the present price of lead. The complaint demands an accounting for the difference between the price received for the company's lead since 1909 and the price that could have been obtained in the open market. An injunction is also sought to restrain the Federal company from acquiring more properties, as they must, according to the stringent provisions of the present contract, be operated under its alleged unfair conditions.

Bearing of Litigation

The action is important in its bearing upon the lead industry. The Coeur d'Alene district of Idaho, in which are all the mines of the Federal company, produces about 27% of the total domestic lead supply of the United States and about 48% of the desilverized output. The Federal company accounts for 43% of the Coeur d'Alene output and no less than 12% of domestic lead derived from all sources. Minority interests have also declared their intention of taking the matter before the Ways and Means Committee of the House of Representatives on the ground that arguments presented to that body are predicated upon the definite statement that the smelters pay full New York prices for lead in the ores of the Coeur d'Alenes, while it is charged the Federal contract, which covers a large percentage of the output, provides for settlement at between 50c. and $1 per 100 lb. below that figure. It is argued that since the producer derives no benefit from at least that proportion of the present tariff, there is no good reason to maintain protection at the present levels. Application for permission to appear before the committee has already been made, and United States Senator Simon Guggenheim has asked for opportunity to counteract the evidence by further briefs from producers.

The action involves men of prominence in the financial world. About the time the contract complained of was entered into, in 1905, the Federal directorate included John D. Rockefeller, Jr., George J. Gould, Frederick T. Gates, George W. Young, Peter B. Bradley, and several other financiers of importance.

History of Federal

Since the Federal officials have refused to permit minority interests to inspect records of transactions at that time, and the directors of 1905 will therefore be subpoenaed. Upon the day the contract was signed, the old directors resigned and were succeeded by alleged 'dummies' in the employ of the smelting company. Evidence of the old directors is asked to determine whether they aided the latter to enter into an unfair contract running 21 years, after selling control to the Guggenheims, or whether the contract was entered into upon the authority of the alleged 'dummies.'

Federal was promoted in 1903 by Charles Sweeney, one of the most forceful and interesting of Western mining men, to take over the holdings of the Empire State Idaho Mining Co., which for some years previously had successfully operated properties at Wardner, Burke, and Mace, in the Coeur d'Alenes. Foreseeing that the association of such a commanding financier as John D. Rockefeller would aid in the exploitation of the new company and open wide the public purse, Mr. Sweeney approached the Standard Oil interests with the proposal that they turn over the old Everett smelter and Monte Cristo mines to the new company and take the price agreed upon in stock. The smelter was antiquated at the time and the Monte Cristo mines had failed to respond to expenditure of large sums of money, so the Rockefeller interests accepted Sweeney's proposition and the property was duly turned over early in 1903. At the same time the Rockefeller interests took control of the company's directorate. Subsequently the Guggenheims sought a contract for treatment of the company's ores and, as consideration for a favorable agreement, are said to have paid $600,000 for the old smelter at Everett and the Monte Cristo mines. The former was soon abandoned and the latter sold to a company organized in New York by Sam Silverman. After a few months of desultory work the properties were finally abandoned.

Sale of Mine

Under the direction of Standard interests, production from the Federal mines was maintained for two years at high pressure and, finally, in 1905, the Guggenheims secured control by purchasing something over 9000 shares of common stock from the Standard Oil at a reported consideration of $120 per share, although the common stock was originally dealt out as a bonus with the 7% cumulative preferred. The quotations on common immediately commenced sensational flights, and in 1906 reached a high level of $199 on the New York Stock Exchange, while the preferred ran up to $112.50. At the present time, with production maintained at former rates, the quotations stand at $15 and $39, respectively, representing a loss in value of no less than $19,800,000 since 1906, upon the issued capital of $12,000,000 preferred and $6,000,000 common stock. The control of common stock, which carries all voting and administrative power, is vested in the American Smelters Securities Co., which, in turn, is owned, in so far as voting power is concerned, by the American Smelting & Refining Company.

Terms of Contract

In October 1905, when the first contract, entered into in 1903, had still four years to run, another was prepared to take effect upon the expiration of the first contract and continuing in effect for a period of 21 years thereafter, or until September 1, 1930. It is this contract that is being attacked by the minority interests upon the grounds that it was fraudulent and not in the best interests of the producing company. The question as to whether it was concurred in by the representatives of Standard Oil as a part consideration for purchase of control by the Guggenheims or whether their own 'dummy' directors forced it through at the smelter's dictation after the personnel of the directorate had been changed, is one that will lead to interesting testimony. The contract runs for 21 years from 1909, and calls for settlement for lead at 90% of the lead in the ore at 90% of the New York quotation so long as that quotation remains at $4.10 per hundred pounds or less. If the quotation be above $4.10, then the smelting company and the producer divide the difference. Other contracts in the same district provide for settlement at flat New York prices. Since 1905 lead has been below $4.10 in 9 months and above that figure in 75 months, with an average for the whole period of $4.67. At the time the second contract was made in 1905 lead stood at $4.85, and the agreement therefore entailed a loss to the Federal of 80c. per hundred pounds of lead, or $6.17 on every ton of an average tenor of 42 per cent.

Alleged Excess Profits

The minority interests charge that the sum of $662,000 was lost to the company in this way during the fiscal year ended August 31, 1912, alone, and that the additional loss in the four months of 1912 since the report was issued has amounted to $271,000. It is also alleged that if the present contract be allowed to stand, the smelting company, during the entire life of the contract, will collect no less than $12,600.000 in excess of prices paid by the same concern to rival producers in the same district, besides the sum of $19,947,312 in regular treatment charges at $8 per ton. These figures are based upon production, tenor, and average prices of 1912. The minority also contends that if Federal enjoyed a contract as favorable as those granted to other producers, the company could earn good dividends upon common stock and maintain the 7% dividends on preferred—a rate that was reduced to 6% last year. No dividends have been paid on common stock since the second contract went into effect in 1909, although as high as 17% was previously paid in one year. To these various charges Edgar Newhouse for the A. S. & R., has made the general statement that at the time the contract was made the mining company was as anxious for it as the smelting company, and that it was considered a fair bargain in the interest of both concerns.

Vanadium in the West

*Late in the nineties a dull green sandstone in the steep walls near Placerville, Colorado, was found to be vanadiferous, and although its percentage of vanadium is low, the deposits have become of commercial value owing to the increasing use of the metal and to the large quantities of vanadiferous sandstone available. The known vanadium deposits of the Placerville region extend through a distance of a little more than 9 miles south and east from Brown, a Rio Grande Southern Railroad station on Leopard creek, 4 miles above Placerville, to a point on Bear creek 3 miles south of Newmire. The deposits occur on both sides of Leopard creek, extending with short interruptions to the valley of the river; thence they follow the river irregularly to a point north of Sawpit. Some deposits occur on the east side of Fall creek, extending for a distance of about a mile above the mouth, and others are found on the south side of San Miguel river for a mile or more above Fall creek. In thickness the deposits range from 1 or 2 in. to over 30 ft. From present developments probably only a few thousand tons of ore carrying over 3% of vanadium can be profitably mined, but there are many thousands of tons of vanadium-bearing sandstone which will show between 1 and 2% of metallic vanadium and much more running between 0.5 and 1%. Sufficient ore has been mined in this area, and to a less extent in the carnotite fields 40 or 50 miles to the west, to cause the price to be reduced in the last three or four years from $5 per pound of metallic vanadium in ferrovanadium to $2.50 or less.

The Utah deposits are on the east side of the San Rafael swell, at a place marked on some maps as Tidwell, about 15 miles south and west of Greenriver. These deposits are now being worked.

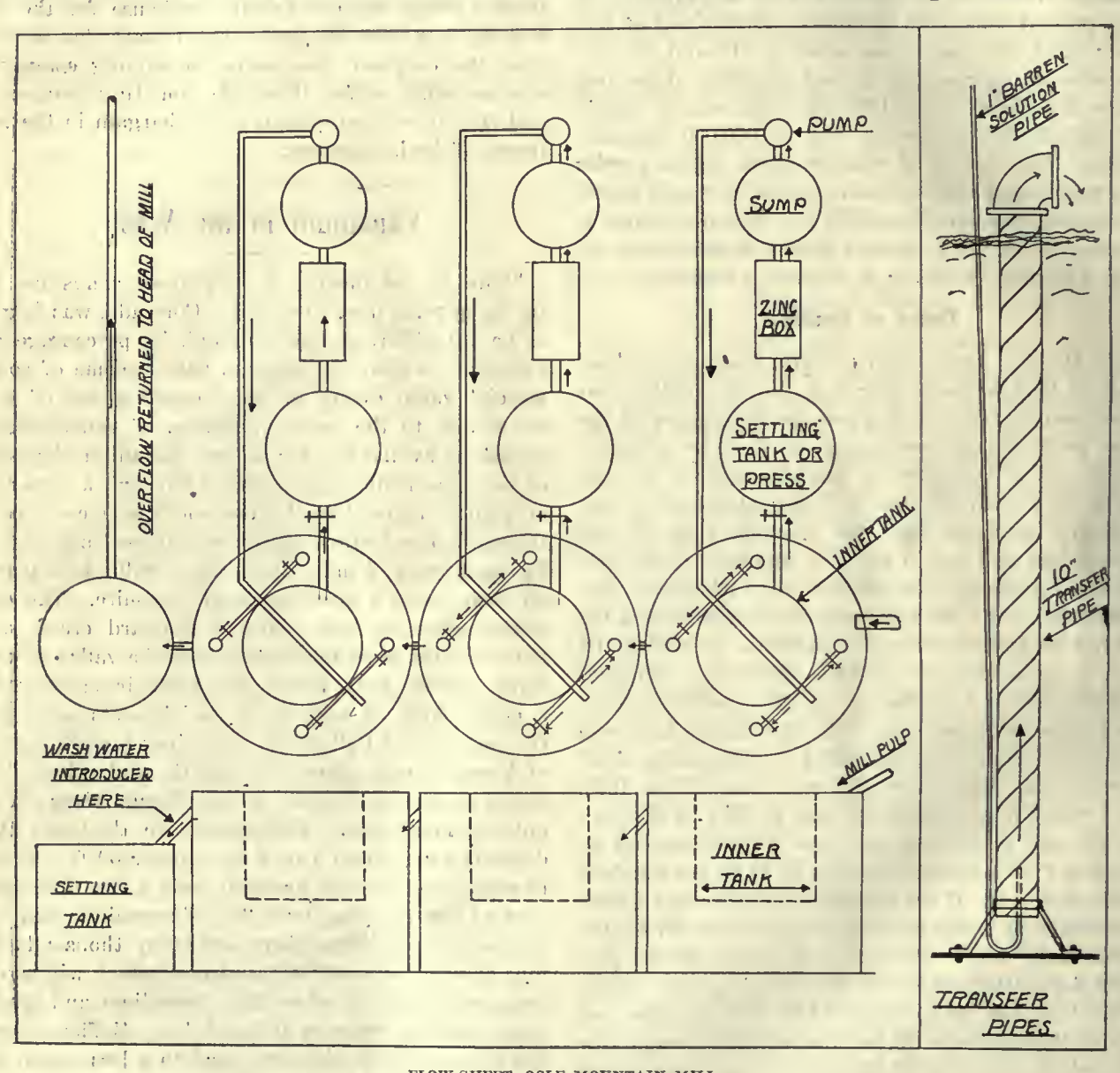
The Sierra de los Caballos lies along the east side of the Rio Grande in New Mexico, and reaches a maximum height of 10,000 ft. at Timber Hill, south of the vanadium deposits. The vanadium-bearing mineral at this place is vanadinite, a lead vanadate.

*From Bulletin 530-K, U. S. Geol. Survey.

Continuous Agitation of Slime With Barren Cyanide Solution

By C. F. Spaulding

The Ogle Mountain Mining Co., of Oregon City, Oregon, will build a mill this coming summer in which the slime will be agitated by circulating barren cyanide solution instead of air. This mill has been designed from data worked up at the 350-ton cyanide plant of the Veta Colorado at Parral, Mexico, where the plan worked admirably, reducing the tailing 12 to 15 gm. silver per ton and also cutting the time for agitation from 72 to 48 hr. I believe that the better extraction and shortening of the time was due to the displacement of the pregnant solution surrounding each particle of silver by more active barren solution during each passage through the transfer pipe.



FLOW-SHEET, OGLE MOUNTAIN MILL.

In the figure is shown the flow-sheet of the cyanide plant of the Ogle Mountain Mining Co.'s mill which will be from 100 to 125-ton capacity. The agitating-vats are three in number, 20 ft. in diameter, 20 ft. deep, and have flat bottoms. They contain an inner suspended bottomless vat, 10 by 10 ft., in which the slime settles. This inner settling-vat is fitted with baffle-plates to stop the swirling motion of the pulp as it rises from the outer vat.

The agitating will be done through four 10-in. transfer pipes made of spiral riveted pipe and fitted with L's on top, these to be four to six inches above the level of the pulp surface and to point normal to radius of vat. The discharge of the pulp through these L's give a circular swirling movement to the pulp, keeping the bottom of the vat fairly well scoured, and preventing rapid settling of the slime. These transfer pipes will be evenly spaced and 2 ft. from the side of the agitating-vat. The solution, as it settles in the inner clarifying vat, is decanted off through a 4-in. horizontal pipe, passing to a clarifying vat or press, thence through zinc-boxes or zinc precipitation-presses and to a sump from which it is pumped back to the agitating-vat in which it is used for agitation. A centrifugal pump is best for this work as the pressures are low, not over 15 to 20 lb. For the Oregon mill, handling 100 to 125 tons per day, tests show that a 2-in. centrifugal pump

at each tank, consuming not over 5 hp., will displace the pregnant solution in the vat with barren solution every 6 hr.; equivalent to four complete displacements or washes each 24 hr. Each agitating vat is connected with an independent set of inner settling-vat, a clarifying-vat or press, a zinc-box, sump, and pump. Each unit, being complete in itself, will keep the solution from the different vats from mixing. The mill pulp entering vat No. 1 displaces an equal amount, which goes to vat No. 2, and on through the system. The overflow from the last vat goes to a settling-vat. The settled tailing is discharged and the overflow is pumped back to the head of the mill, where it is brought up to strength and again enters the system. The make-up water for the mill can well be added to the overflow launder from the last vat where it will act as a wash water.

The decanting pipe is proportioned in size to the tonnage in the vat and the time in which it is desired to replace the pregnant solution with barren solution. In the Oregon mill the decanting pipes are to be of 4 in., and the agitating pipes 1 in. diameter.

Agitating in Barren Solution

Agitating with barren cyanide solution has many advantages over air-agitation. For one thing, it is much cheaper. The zinc-box for each tank can be arranged so there is not over 12 to 15 ft. drop between the pulp-level in the tank and the solution in the sump. This will give a small head to pump against and should not take over 2½ to 5 hp. To agitate with air takes 10 to 15 hp. to each vat. The cost of piping and zinc-boxes in each case is about the same. The cost of the settling and clarifying-vats and pumps is small. This is more than offset by the cost of the filter-press for the tailing which is done away with. In the second place, the system permits easy manipulation. There is only one valve to regulate for each tank. This is placed somewhere in the decanting pipe. The plant will run for days without adjusting this valve. The valves in the four agitating-pipes are not touched after adjustment. The plant is automatic in action and needs little attention. It costs less to operate for labor, power, supplies, and repairs, than a plant agitating with air and including filter-pressing. One man on a shift should be able to attend to a plant up to 300 tons in size. A third important factor is the increased extraction. The recovery will be materially increased and the time of agitation shortened; due, I think, to the operator being able to carry a more dilute solution and to the displacement of the pregnant solution with barren solution. At the Veta Colorado it was necessary to carry a thick pulp, not over 2 to 1 dilution, because a more dilute solution foamed badly. The best extraction was with a pulp 3 to 1 or thinner. With barren cyanide solution this might be as thin as desired without any foaming. The system also saves the cost of an expensive air-compressor and receiver. The agitating pipe is much simpler, being merely turned up at the bottom and using no valves, rubber sleeves, or complicated devices to stop the flow of pulp into the pipe whenever the air goes off. There is no danger of this happening when using cyanide solution for agitation, since the pipe is always full of solution and the pulp cannot back up in it and clog it.

Absence of Foaming

This passage of the pulp through the transfer pipes is due to two things. The barren solution acts as a jet or hydraulic elevator forcing the circulation, diluting the pulp in the transfer column, it makes the latter lighter than that in the vat. This difference in specific gravity also helps the circulation. It results in a particularly satisfactory agitation, with no fuss, foaming, or troubles of any kind. The flow-sheet illustrated includes clarifying-vats or presses. In some cases where the slime contains a large amount of colloidal matter and it is necessary to crowd the passage of pulp, these may be necessary. Usually, however, with sufficient decanting capacity these will not be needed, though it might be well to put them in, to provide extra capacity for decanting. If the clarifying vat or press is used the inner (settling) vat can be made smaller in proportion and the decanting may be crowded, the clarifying device taking care of any colloidal matter which passes over.

Mr. McKinnery, of Ward, Colorado, who has a plant somewhat on these lines, except that he agitates mechanically and keeps the decanted solution passing through the system of tanks against the flow of pulp, finds that the settling is practically perfect. His extraction on heavy sulphide ore is good. By the time the pulp reaches the last vat and is ready to be discharged, the dissolved gold remaining is so small in amount that it does not pay to use a filter-press. Tests show that in the Oregon plant the dissolved gold in the tailing when ready to be discharged will not be over 8½c. per ton. This can be thrown away cheaper than a filter-press can be put in and operated.

Modifying Existing Plants

An existing plant using Pachucas for agitation can easily and cheaply be modified to use barren cyanide solution for agitation, and it would probably cut out the cost of filter-pressing. In making such a change, build the inner vat 8 to 10 ft. diam., 10 to 15 ft. deep, and construct it from 1-in. lumber, corrugated iron, or any handy material. It does not have to be especially strong or heavy. Leave the transfer pipe in the centre as usual, cutting into the air-pipe a connection from the barren-solution pump, or, better, putting in a separate pipe for the barren solution. Do the settling outside the inner vat instead of inside it as shown in the flow-sheet. That was the system used at the Veta Colorado mill during the summer of 1911. So far as I know, the process of agitating with barren cyanide solution is not patented and has never been used by anyone except myself. I do not intend to patent the process.

Schools of mines in New Zealand have been organized for 27 years, during which time the Government has appropriated for the work nearly $250,000.

Pig iron production of the United States in January was 2,795,331 tons, which is ahead of all other records.

Dressing Western Zinc Ores

By Frank A. Bird

Twenty years ago, except in a few isolated cases, shipments of zinc ore or concentrate from Western states were unknown. No crude ores of sufficient richness had been developed in commercial quantities or where any were known to exist, they were below the then generally accepted limit of grade. Where low-grade ores of zinc, lead, iron, or copper sulphide occurred together, the whole effort was to bring the zinc content as far under the limit imposed by the lead smelter as possible. At first the zinc was allowed to run to waste as tailing; later attempts were made to save this in ponds or to make a low-grade zinc-iron middling which could be piled to await future treatment. Occasionally some zinc smelter risked the freight charges to secure a car of this middling, but always reported negative results. A change has come through the gradual improvement in milling, a better understanding as to the method of treatment at the zinc smelters, and the increasing scarcity of Middle West ores. These factors, helped by a protective tariff, have led to development of Western tonnage, until today zinc ores are commonly mined through the West. Much still remains that the Western shipper should consider if he would better his product and increase his profits. It is surprising how many ores that could be improved are being shipped after imperfect treatment.

Close Dressing Necessary

Unlike lead or copper smelting, where one can speak of a daily capacity of hundreds of tons, zinc metallurgy is one of small weights. The individual retort seldom holds more than 75 lb. of ore. The average furnace, containing slightly more than 300 retorts, must be hand cleaned and recharged every 24 hours. It can be seen how necessary is the production of high-grade ores. With each betterment in grade, resulting in the lowering of undesirable impurities, a larger output and a higher grade of spelter becomes possible. The retorts have a longer life, thus lessening working expenses, and a better price can be offered for the ore.

As in lead or copper metallurgy, zinc ores can also be divided into two general classes: carbonates and sulphides. The 'carbonates' usually contain silicate, and in cases, as that of ore from the Scranton mine in Utah, consist of an almost pure silicate containing some carbonate. 'Carbonate' ores vary in metal content from just above 20% to occasionally over 40%. All usually contain high moisture. As the zinc furnace first drives off all moisture and carbon dioxide, making an artificial oxide, in which form all zinc ores must be brought before reduction occurs, it would be to the shippers' advantage to calcine all carbonate ores. Besides the saving in freight charges on moisture, a reduction in weight of from 20 to 25% occurs, together with an increase in zinc content of 50%. These changes may be represented by the constant factor 1.5409, although this theoretical increase is seldom realized in practice. Silicates, with conditions favorable, should also be calcined, although the theoretical loss in weight, aside from contained moisture, is only 7.5% (water of crystallization). The increase in zinc is represented by the factor 1.0808. In their raw state the hardness of these ores makes them difficult both to prepare for treatment and to distill. They necessitate a higher furnace temperature. Calcining softens them and therefore makes them easier to prepare. It allows the furnace carbon to commence the work of reduction at a lower temperature. This direct benefit should result in a higher price. Looked at from a Western standpoint, calcining is really a fire concentration.

While the zinc smelters will buy ores containing less than 30% zinc, such ores are not desirable and the price offered is not in any way proportional to that paid for 40% ore, which is the basis content for all Western ores, whether carbonate or sulphide. Because of fuel expense, it may not always be possible to treat Western ores before shipment, but with an assured tonnage the following rules are generally applicable: (1) In the case of ores above 30%, at least dry to dust limit and calcine if possible; (2) with ores from 20 to 30%, calcine and raise to a desirable class. For ores below 20%, which are waste today, mix with carbon (run of mine slack coal), blow-up in furnace with light blast, driving off zinc as an oxide, collect this in a bag-house, compress, and sack for shipment. Such treatment would result in a high-grade and desirable smelting product. It is also possible to make an article having a good commercial demand as pigment or filler for rubber.

In a few special cases wet concentration is feasible. The plan adopted by the Yellow Pine in southern Nevada could be used. This includes hand sorting of crude ore on belt, picking out rich lead ores, lime, and other gangue rock, concentration for a lead product, and saving as a commercial zinc product the remainder, which under ordinary circumstances would be tailing. The slime is settled in ponds which also go to the zinc smelter, but separate from the coarse. With the high freight on this ore, $8 per ton, an improvement over present practice would be to oxidize everything or at least dry to 2% moisture.

Calcining Ore

The following designs for calcining furnaces are of a simple and easily built furnace.

The simplest form of furnace resembles a lime kiln, as in Fig. 1. In this $a=7$ ft. 3 in.; $b=17$ ft. 6 in.; greatest bulge at $b=9$ ft. 8 in.; $c=5$ ft. 6 in.: cone $d=3$ ft. 6 in.; $e\,e$ are draw holes; $f\,f$ arches, there can be either two or four draw holes and arches. The furnace should have a refractory fire brick lining. It is filled with alternate layers of 6 in. each, of lump ore and fuel. Drawing every 4

hours, it has a capacity of 25 tons in 24 hours. The fuel required varies between 3 and 6% of the weight of the ore, according to its purity. While this furnace can be made the cheapest in operation, cost and capacity considered, the objections to it are the mixing of all ashes with the ore and the fact that from 15 to 20% only of fine ore is allowable.

A shaft furnace, externally fired, is shown in Fig. 2. In this a=5 ft. to 5 ft. 9 in.; b=1 ft. 8 in. to 2 ft.; a to b (inside height) = 8 to 16 ft.; c is feed

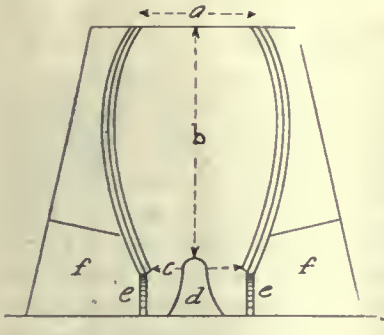


FIG. 1.

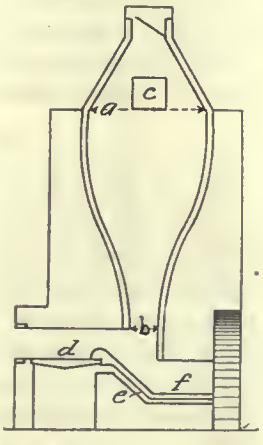


FIG. 2.

door; d fire box. The ash pit being kept closed, air for combustion is heated while passing through flue e under f where the calcined ore is drawn. Doors for d and f are also kept closed. The fireman is provided with hood, stack, and fire-regulating damper. In such a furnace with one fireplace, 5 to 8 tons of ore can be calcined in 24 hours. Coal consumption amounts to 8 to 9% of weight of ore. With two fireplaces 10 tons can be calcined with about same fuel consumption.

A fixed reverberatory furnace, hand worked and grate fired, should be built 40 to 43 ft. long, with a double hearth and single fireplace. The breadth should not exceed 8 ft. Working doors should be placed on both sides 6 ft. apart. The height of arch at the outside should be 1 ft. 4 in. to 2 ft. Incline the floor somewhat toward the flue bridge. With gas-firing the length can be extended to 46 ft. The capacity of such a furnace is 3 to 10 tons in 24 hours, with a fuel consumption equal to between 10 and 15% of weight of ore. A reverberatory furnace with movable chambers may have a length of 42 ft., a diameter of 3 ft. 3 in. inside, and should be lined with refractory brick. Such furnaces revolve 16 times per hour, turning on 8 sets of rollers. Ore requires 6 hours treatment. The fire grate has an area of 10 sq. ft., the fire bridge being tubular and projecting into the furnace. The capacity is 12 tons in 24 hours, and the fuel consumption, 12½% the weight of raw ore. Reverberatory furnaces allow working up all fine ore and crushing the coarse ore to a finer size, thus facilitating treatment. With slight variation these furnaces may be built so as to allow the use of producer gas from either coal or oil. This would usually be more economical. Various other forms of furnaces could be utilized in treatment of ores of this character; most of the large reverberatory furnaces with mechanical stirrers used in oxidizing sulphides may be used with slight modifications. They would give a maximum of output, from three to four times greater than in sulphide roasting, with low working costs.

Preparing Sulphide Ore

Sulphide ores permit similar criticism as to shipments as do the carbonates, although now the Western shippers are more familiar with them, having first made a lead product which the lead smelter penalized for its zinc content, they have learned how to limit the zinc. Today acceptable zinc concentrates are being widely made.

Considerable crude zinc ore is being shipped. Some of this contains excessive moisture and objectionable lead, iron, and copper sulphides. Many of these with treatment would yield valuable by-products. Detrimental silica, lime, and barium sulphate also occur. These should be dressed out. The silica forms silicates with the iron and other bases at comparatively low temperatures which soon run through ('butcher') the retorts. The lime, besides facilitating the formation of slags at low temperatures, forms calcium sulphate while the ore is being roasted. Afterward, when retorting, each part of sulphur combines with two parts of zinc, making zinc sulphide, which cannot be distilled. The sulphur in the barium sulphate acts similarly.

Summary

1. Crude ores should at least be dried and all large lumps crushed. Zinc smelters are notoriously deficient in sampling facilities and the true proportion of large pieces which should go into the sample are often ignored.

2. Ore should be treated by concentration, as coarse as possible, for removal of gangue. Make a clean lead product, if any lead be present, and a middling of zinc-iron or zinc-iron-copper which can be further separated by tube flotation (requiring a large unit), magnetic separation, requiring a slight roast, electrostatic separation, only requiring drying and sizing. At times it would be advisable to use wet concentration following one of the above treatments.

3. In the case of concentrates, clean them further by one of the above methods making marketable products for the lead or copper smelter. Close classification is necessary in every case. The Richards-Janney classifier is one of the many admirable ones. Dry all products to avoid excessive freight charges.

While today the zinc smelters will pay for lead, copper, silver, and gold contained in zinc ores, the deductions are greater than in the case of lead-copper ores and the prices offered are lower. In a majority of cases these metals are below their requirements and are a total loss to both ore producer and smelter; proper concentration would avoid this and benefit the producer.

Coalfields have been discovered in the Belgian Congo, according to a recent report. A despatch from Belgium states that drill-holes over a large area disclose a seam 6 or 7 ft. thick, of a quality satisfactory for steaming.

Copper in York County, Pennsylvania

By M. L. Jandorf

Occurrences of copper in Triassic rocks have been observed in many parts of the world. Some of these can be profitably worked; others are disseminated streaks, sparsely scattered throughout the rocks, and of no economic value. Deposits of this type have been worked in England, Germany, and in the United States, in the states of New Mexico, Idaho, and New Jersey.

During the autumn of 1909, my attention was called to an occurrence of copper ore in Triassic sandstone, along the Bull road, about 5 miles northwest of York, Pennsylvania. The prospect may easily be found in the lower right-hand corner of the New Cumberland quadrangle, between parallels 40°00′ and 40°1′, and meridians 76°45′ and 76°49′. At this point the Bull road is the dividing line between Conewago and Dover townships and passes through a cut exposing about 15 ft. of Triassic sandstone. It may be mentioned here that copper was first discovered in these sandstones as early as 1837. While prospecting was carried on in both townships, an adit was driven into the ridge of Triassic rock in Conewago township, at a point approximately 100 ft. north of Fox run, a tributary of the Little Conewago creek.

The Triassic sandstones at this point form a low-lying ridge, striking northwest and southeast and dipping toward the northeast, through which the Bull road passes, exposing part of the series of copper-bearing strata. The ground-water level of the prospect lies close to the surface, owing to the proximity of Fox run, and the porosity of the sandstone is of such a nature that at a few feet below the surface the rocks are highly saturated.

Disseminated in Sandstone

This deposit of copper ore occurs as a dissemination of a certain horizon of the Triassic sandstones (Newark series), characterized by fossil plant remains, such as Calamites and Equisetaceae. No veins have been observed, the ore occurring in a finely disseminated condition throughout the sandstone, thus necessitating the mining and treatment of all the copper-bearing material.

The sedimentary rocks present consist of gray, green, and red sandstones, the copper minerals being disseminated in the former, which is usually fine-grained in texture. Microscopically, the copper-bearing sandstone consists of grains of silica (quartz) and a mica (probably muscovite) cemented by kaolin and calcite, together with more or less carbonaceous matter derived from fossilized organic remains, the living types of which were abundant prior to and during Triassic times. These sandstones, like certain Triassic sandstones in England which are characterized by the occurrence of copper, contain little grains of a grayish-green mineral, which may be glauconite. These grains have rounded shapes, and are thought to be casts of foraminifera. The sandstone in which the copper ores occur may be termed a calcareous-micaceous sandstone.

Deposits of this type are generally found at considerable distance from igneous rocks, and while no such rocks were found in the immediate vicinity of the prospect, yet in the fields and along the road, about five-eighths of a mile to the north, many boulders of Triassic diabase were observed.

Primary Ore

The primary ore in most deposits of this nature is generally chalcocite, with subordinate amounts of bornite, chalcopyrite, and pyrite. Secondary ores, or those resulting from surficial alteration, are native copper, cuprite, melaconite or tenorite, azurite, malachite, and chrysocolla. Gangue minerals are rarely present. A characteristic feature of this type of deposit is the occurrence of plant remains, replaced by ore. In the deposit under discussion, the primary ore is seemingly chalcocite, so finely disseminated as to be almost invisible to the unaided eye. The secondary ores are native copper, cuprite, melaconite or tenorite (?), azurite, malachite, and chrysocolla, which appear to be more abundant in that they may be readily distinguished by the unaided eye. No chalcopyrite, bornite, or pyrite have been seen in these sandstones.

Chalcocite or cuprous sulphide (Cu_2O), containing about 80% copper, occurs in finely disseminated grains throughout the sandstone; replacing fossil plant remains; and as disseminations in carbonaceous shale. Native copper occurs as grains forming small nuclei, surrounded by cuprite and chrysocollo.

Cuprite or cuprous oxide (Cu_2O), containing, when pure, 89% copper, is read in color and occurs as minute stains upon the carbonaceous shale, as small segregations surrounding nuclei of native copper, and between the laminae of the mica present in the sandstone. Melaconite or tenorite (?), the black oxide (CuO), occurs indiscriminately scattered throughout the sandstone. Malachite ($CuCO_3.Cu(OH)_2$) the green carbonate of copper, containing, when pure, 58% of copper, occurs as radiating groups, in the form of minute spherical concretions, and as stains between the laminae of the mica. Azurite ($2CuCO_3.Cu(OH)_2$), the blue carbonate of copper, containing, when pure, 50% of copper, occurs in minute monoclinic crystals filling fractures in the sandstone and as stains between the mica laminae. Chrysocolla (CuH_4SiO_5), containing, when pure, 36% copper, is the blue-green silicate, occurring in thin seams associated with cuprite and native copper. This mineral surrounds the cuprite, which in turn surrounds the native copper.

Coal (lignite) occurs as the remains of plant life, existing during Triassic times; in some instances it is replaced by chalcocite and malachite. Pyrolusite (MnO_2) occurs in the form of dendritic stains. It is the black dioxide of manganese.

Effect of Diabase

Whether or not the Triassic diabase near this prospect bears any relation to the origin of the ores is a matter of conjecture. Waldemar Lindgren (*Economic Geology*, Vol. VI, September 1911, pp. 568-582) believes the origin of such types of ore deposits to be epigenetic and to represent concentrations of small quantities of the metal, originally disseminated in the rock. The fact that the copper ores herein described occur in a certain horizon coincides with the belief that the ores are epigenetic, that is, formed during the time in which the ore-bearing horizon was laid down. If this is not the case, why is there an entire absence of copper in the overlying and underlying rocks?

The replacement of certain carbonaceous matter by secondary chalcocite may have been due to oxidation and leaching out of the primary sulphide by hot or cold percolating descending waters, the solutions thus formed having been reduced by the carbon of the coal, thereby precipitating the chalcocite. Kaolin and calcite, which are always present in these sandstones, likewise acted as precipitants.

The following reactions may have taken place in the formation of the ores:

$$2CuSO_4 + 2H_2Ca(CO_3)_2 = CuCO_3.Cu(OH)_2 \text{ (malachite)} + 3CO_2 + 2CaSO_4 + H_2O.$$

$$3CuSO_4 + 3H_2Ca(CO_3)_2 = 2CuCO_3.Cu(OH)_2 \text{ (azurite)} + 3CaSO_4 + 4CO_2 + 2H_2O.$$

$$CuSO_4 + H_2Ca(CO_3)_2 + H_4SiO_4 = CuH_4SiO_5 \text{ (chrysocolla)} + H_2O + 2CO_2.$$

Furthermore, part of the carbonaceous matter present undoubtedly reduced the copper-bearing solutions with the formation of native copper as:

$$2CuSO_4 + 2H_2Ca(CO_3)_2 = CuCO_3.Cu(OH)_2 \text{ (malachite)} + 3CO_2 + 2CaSO_4 + H_2O.$$

$$CuCO_3.Cu(OH)_2 + C = 2Cu \text{ (native copper)} + 2CO_2 + H_2O.$$

The following reactions may have taken place in the formation of chalcocite and native copper:

$$4CuSO_4 + 4C + H_2O = Cu_2S \text{ (chalcocite)} + CuCO_3.Cu(OH)_2 \text{ (malachite)} + 3CO_2 + 3SO_2.$$

$$Cu_2S + 4O = CuSO_4 + Cu \text{ (native copper)}.$$

$$2CuSO_4 + 2C = 2Cu \text{ (native copper)} + 2SO_2 + 2CO_2.$$

Institute Papers

At the New York meeting of the American Institute of Mining Engineers there was a preponderance of papers relating to iron and steel, a natural result of the activity of the Iron and Steel Committee of the Institute. A small but important lot of papers dealt with general mining, metallurgy, and economic geology. The complete list of papers presented, so far as they were available in preliminary edition, is printed below.

The Geographical Distribution of Mining Development in the United States. By Edward W. Parker.

The London Mine, Mosquito Mining District, Park County, Colorado. By Charles J. Moore.

The Rôle of Certain Metallic Minerals in Precipitating Silver and Gold. By Chase Palmer and Edson S. Bastin.

The Elk City Mining District, Idaho County, Idaho. By Arthur L. Flagg.

School Laboratory Work; Sampling of an Ore Containing Coarse Gold. By Charles E. Locke.

The Hardinge Conical Mill. By H. W. Hardinge.

Electric Power Installation at El Tigre, Sonora, Mexico. By James W. Malcolmson.

A Problem in Mining, together with Some Data on Tunnel Driving. By F. M. Simonds and E. Z. Burns.

Valuation of Iron Mines. By James R. Finlay.

Notes on Cast Iron. By Albert Sauveur.

Blast-furnace Slag Analyses for Twenty-four Hours. By F. L. Grammer.

The Use of Anti-Piping Thermit in Casting Steel Ingots. By E. A. Beck.

Comparative Notes on Steel Rail Rolling. By Robert W. Hunt.

The Microstructure of Sintered Iron-Bearing Materials. By B. G. Klugh.

New Design of Open-Hearth Steel Furnace Using Producer Gas. By Herbert F. Miller.

Methods of Preparing Basic Open-Hearth Steel for Castings. By H. F. Miller, Jr.

Why Does Lag Increase with the Temperature from which Cooling Starts? By Henry M. Howe.

Piping and Segregation of Ingots of Steel and Ductility Tests for Open-Hearth Steel Rails. By P. H. Dudley.

The Production of Solid Steel Ingots. By Benjamin Talbot.

The Production of Solid Steel Ingots. By John E. Stead.

Commercial Production of Sound Steel Ingots. By Emil Gathmann.

Fire-Clay Deposits of Canada. By Heinrich Ries.

Goldfield Consolidated Report

During the month of December 1912 the total production of the Goldfield Consolidated Mines Co., according to the report of J. F. Thorn, superintendent, was 27,903 tons, containing $457,952, or an average of $16.41 per ton, of which 27,651 tons was milled, with an average extraction of 94.28%, and 252 tons was shipped, of an average value of $24.04 per ton, the net recovery from all ore being $15.48 per ton. The net realization was $270,562, or $6.96 per ton. During the month 3297 ft. of development work was performed. The total cost of mining, development, transportation, milling, office, and general expense was $5.72 per ton, distributed as follows:

Mining (including stoping and development)	$3.07
Transportation	0.07
Milling	2.12
Marketing	0.06
General expenses	0.45
Bullion tax	0.07
Marketing ore	0.01
Total cost of operation	$5.85
Miscellaneous earnings	0.13
Net cost per ton	$5.72

The new orebody on the second level of the Combination has been developed to a considerable extent during the month. Development of the 1400-ft. level has been rather slow, owing to a large flow of water met early in the month, necessitating the installation of additional pumps. The work of prospecting the latite quartz mass for the downward extension of the 1300 orebodies is going forward steadily, and there is every reason to believe that within a short time commercial ore will be found on this level.

Spring-Tension Anchor Bolts

By Henry A. Kuns

The spring-tension type of construction utilized in the Original M. & M. Co.'s 1000-lb. ten-stamp mill was devised to avoid breakage of the anchor bolts in the concrete block by the vibration from the mill while in operation, and also to permit maintaining a uniform tension on the rods. The accompanying illustration clearly shows the construction.

Two coiled springs, one nesting in the other, are used. These are centred on an angle washer, weighing about 75 lb., which is placed ahead of the concrete work making up the monolithic block. The rods are centred in 2½-in. boiler tubing and cut to run from the angle washer to the finished top of the mortar block, which is level. After the mortars were set on ¼-in. rubber sheets and the sole-plates for the battery posts were in place on the solid concrete, the rods were run to place and the springs all placed on the lower ends. The springs were then screwed up to a tension of about 17,000 lb. to each rod of 1¾-in. diam. Since the operation of the mill no breakage or loosening of the rods has occurred.

Fig. 1. The figure shows the position of the angle socket washers and spring in place on the front side of concrete block. The same construction is at the rear. The bolts are withdrawn clear of the mortars from the top in case of breakage. The timber bolted on the block is for the support of the plate floor and leaves plenty of head room for men to work and walk around mill foundation for inspection. The block weighs 95 tons and carries a 10-stamp mill weighing 45,000 lb. The longer bolts shown are holding down bolts to the sole plates for the battery posts.

Fig. 2. This second view is of the power-house, in which is generated 380 hp. in two 30-ft. head turbines. A 30-in. turbine drives a 100-kw., 3-phase, 60-cycle, 440-volt generator, and is designed to drive an additional generator. A 20-in. wheel drives an Ingersoll two-stage compressor. The current drives the mill shop, and the electric underground hoist, and inside lighting of the camp. The distant peak is just north of the famous Hite mine, Mariposa county. The N. V. railroad tracks are also shown. The station is called Clearinghouse and is six miles from El Portal The Merced river furnishes water for power.

The springs are designed to stand a pressure of 3500 lb. each before closing. It is not possible to secure this, as it would require three or four men to bring the nuts to a solid bearing. The springs keep a steady tension on the rods, even if the sheet rubber should thin down due to weight of mortar, tension of anchor bolts, and pounding of stamps. My idea in this construction was to eliminate breakage of anchor bolts, the constant labor of going over the bolts and tightening them up, and the consequent poor working of the mill caused by mortars getting out of proper line.

Should any anchor bolt fail, it can be withdrawn in a few minutes and a new one inserted, as the bolts are accessible at both ends. The mill is of the back-frame type of construction and is driven by a special mill motor placed at the rear of the mill and so mounted that the main belt (the only one used in the mill drive) is tightened by moving the motor on its base. While this plan is objected to by many for a large mill, it is not so bad as it may seem.

The cam-shaft pulley is 84 in. diam. and this permits considerable space between the top belt and the finger platform. The belt is guarded to prevent accident to the millmen. By this arrangement, light, so desirable over the plates in front of the mill, is unobstructed, cost of material and labor is much reduced, and the counter-shafting is eliminated, with its consequent loss of power. Time will, of course, determine whether or not the anchor bolts will yield, but so far no evidence has been shown of any weakness of the plan. I believe that it will be an improvement in mill construction.

The deepest borehole in the world is near Cynchow, Silesia. This reached a depth of 7350 ft., nearly three years being required to complete the work, as the hole was completed from a depth of 1800 ft. by means of the diamond-drill. The total cost was $75,000, and 700 carats of diamonds were consumed. It was expected that the coal seam sought for would be reached at 4500 ft., and it was therefore necessary to ream out the hole down to that depth in order to continue drilling. The temperature of the rock at 1500 ft. was 78°F., and at 7280 ft. was 182° Fahrenheit.

Damage done to vegetation by smoke and smelter fume has been extensively studied in Saxony, and the Ministry of Finance has announced another competition for prizes in this field, supplementary to the competition of 1908. Devices to produce a soot-free combustion are excepted, but any other work, including literary contributions tending toward the solution of the problem of smoke damage, is eligible for competition.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

The Sorting of Ore

The Editor:

Sir—As nearly all mines commence by shipping sorted ore, it is well to remember that right here a property can be made or marred. In Mexico, where there are no labor laws to bother (and, by the way, neither strikes nor 'hobos'), a bunch of boys do better than men on the light work: they cost less, booze, dances, and cigarettes don't trouble them, they are not so apt to 'high-grade', and are quicker to learn: also they may be searched, if necessary, without the aid of a shot-gun.

One man to do the breaking and two or three boys as helpers, is about right usually; a small man will generally sort more ore than a big one, for the reason that there is less lost motion and he is closer to his work. Often a man shoveling into a wheel-barrow and a boy on each side of the barrow picking out ore or waste, affords the quickest way to clean a lot of dirty ore. Spalling hammers wear badly, especially on a flinty ore. Make the men take the handles out once a week and put them in the other way—anyone having seen the Cornish square stamp at work will see the idea. When the ore is 'mucky,' or even dusty, rig a grizzly and clean it with a jet of wet steam, or a spray of water from a hand-pump. Often ore may be sorted twice as fast by wetting it and the old prospector who assays a rock by licking it and then scratching it with his knife, obeys two golden rules. Sunday work is unnecessary, but a small premium for a full week's work helps. Breaking in a new ore-sorter costs money, as his discards must be piled up and gone over by a boy who knows the ore. The men's hands must be cared for. They ought to wash them noon and night and grease them. Soap, warm water, and basins ought to be supplied and axle grease with a little flower of sulphur mixed in it costs little, and will keep the hands in good condition.

The sides of a sorting house ought to be built of panels, so that they can be stacked away in summer. There should be windows in each panel with wire screens inside. Everything inside, roof and all, should be whitewashed to give a good light. A stove is necessary in winter, as cold fingers are poor tools. Have track wherever needed. I find that inside one strap is as good as two. Two spikes only for each tie prevents splitting. Place one pair outside the rail to keep the track from spreading and on the next tie, one pair inside. For changing track, the inside spikes only are pulled. In drifts, break the joints midway; this makes a better track, and only one half railpiece is needed at the end. Change this from one side to the other, putting in one full length rail in its place. This keeps the track close to the face with one-half the work. The common frog and tongue do for switches. A long tongue, 8 ft. or so, is the whole secret; one can cut out 10 in. of the lower part of the rail, round up and double down the upper part, making this serve as a pin, and bringing the tongue close up to the point of the frog.

If possible, keep mill ore and waste widely separated. This should be done from the start; keep a tally of cars every day, and an assay once a week of mill dump. Stating the week's tonnage is not much work and gives valuable data later. Above everything, the man in charge of the sorting, the mine foreman, and the assayer, must be firm friends and must all pull together. Often the foreman can arrange to strip ore in the mine and bring it out clean, saving much work, and the assay returns ought to be out the day after they are received; otherwise they are often valueless.

To find the tonnage in a mine dump, when it is not known whether the ground underneath is a hill or depression, is difficult. The best way is to measure all workings from which the dump came, and allow two tons for each foot of 4 by 6 drift, with other workings in proportion. This gives a conservative but close result. When sampling a dump, it is safer to first determine where the sorting was done, and then carefully keep away from that part.

Nacozari, January 25. AN OLD ORE SORTER.

Persistence of Ore in Depth

The Editor:

Sir—In the *Mining and Scientific Press* of December 21 last, Stephen J. Lett contributed interestingly to the discussion of 'Persistence of Ore in Depth.' In this Mr. Lett referred to a contribution by myself, appearing in your issue of October 12, 1912, entitled 'Possibilities of the Mother Lode in Depth,' and says the details given by me "prove conclusively that, in many instances, the mines of the Mother Lode improve in depth, but the statement that 'proper geologic conditions seem to be more important than all other considerations,' is disappointing, for he leaves us completely in the dark as to what those proper geologic conditions may be."

In the first place, I agree with George E. Collins that "prospectors do not usually sink on barren veins to find out what is below. Ordinarily prudent people, as a rule, only sink on veins which show at the surface evidence of productiveness." Mr. Lett calls attention to the fact that there have been noted exceptions to this, and again cites me as authority for the statement that shafts have been sunk to depths ranging from 200 to 1000 ft. before payable ore was found. I wish to make plain, in this connection, that this seemingly foolish prospecting was done on the line of the Mother Lode, where there were rich mines already developed in the vicinity, both north and south of them, and that these undertakings were not, perhaps, as desperate as they seemed to be, as has been proved by the profitable results of the subsequent operations.

In saying that "proper geologic conditions seem to be more important than all other considerations," I, perhaps, made an unfortunate choice of a term in using the word 'geologic.' Possibly the word 'physical' would have been better, or a combination of these two words, by saying 'geo-physical.' All

who have had an opportunity to study the Mother Lode throughout its length are familiar with the several formations in which this great system of fissures occurs. The principal rocks are: clay-slate; ancient greenstones (meta-andesite), which are found massive, schistose, or slaty, depending upon the amount of pressure and shearing to which they have been subjected; serpentine, or more rarely gabbro; in some localities large or small masses of ferro-dolomite; and in a few instances intrusions of basic or acid rocks, the former being usually diabase, the latter aplite, or its felsitic equivalent. Pay-shoots are known to occur wholly in the blue-black clay-slate, as at the Keystone mine, at Amador City. These rocks contain fossils which have shown them to belong to the Jurassic. More rarely the veins occur in the clay-slates of the Calaveras formation (Paleozoic), as at the Jumper mine in Tuolumne county; in the greenstones (massive, schistose, or slaty, as the case may be), as at the Utica group at Angels, Calaveras county; at contact of these two kinds of rock, the slates and the greenstones, a noted example being the Eureka Consolidated at Sutter Creek; in the ferro-dolomite, as at the Melones; and at the contact of slate with serpentine or some other kind of rock. In fact, the combinations which actually exist in the way of contacts of various rocks are numerous, and in some places the geological conditions are very complex and a puzzle to the geologist as well as the miner. Occasionally veins at contact are persistent for several hundred feet, but generally the contact may be considered as incidental, the fissures cutting diagonally in both strike and dip through the stratified formations, though at a low angle. All of the formations are extremely irregular in the dimensions of their mass, pinching or swelling, coming to a sudden ending without apparent cause, and otherwise presenting complex and erratic conditions most difficult to understand.

From a consideration of the above it at once becomes evident that if a certain kind of geological condition, or association of particular rocks were all that is necessary to insure ore, engineers would have a right to expect a continuous fissure with pay-rock along the entire distance throughout which the favorable rock, or combination of favorable rocks, might extend. Experience proves that nothing of the kind occurs. It is also known that rocks of the same age and of identical physical appearance with those which form the walls of veins that have produced hundreds of millions of dollars, are to be found extending for miles along the Lode where no ore-shoots have been known to occur, nor is there any evidence that they might be found by prospecting. The natural inference, then, is, that the first thing to do is to find a good strong fissure, is it not? Apparently not, for in the case of the South Spring Hill mine, in Amador county, a shaft was sunk at the contact (slate foot, greenstone hanging), where there was not even a gouge seam to guide the miners. This shaft was continued to a depth approximating 500 ft. without ore, but at that depth the formation which had been standing steeply, flattened somewhat and quartz began to make its appearance, and soon after, at a little greater depth, ore was found. This mine produced over $1,500,000 with a poor beginning, and at a place where, in all probability, Mr. Collins would not even advise a prospect hole. In this instance the principal geo-physical condition appears to have been a change from a steep to a flatter dip of the formation, or of the vein. As a rule, along the Mother Lode, veins which have proved to be strong, persistent, and profitable, do not stand at angles approaching the vertical. The normal dip is about 60° below the horizon, though varying from 35 to 65, and more rarely as high as 70°. Regions of excessive disturbance do not usually produce large and profitable mines, at least not on the Mother Lode. In such regions ore-shoots may, and do, occur, but they are short and the value is nearly always 'spotted.' Such a region can generally be recognized at the surface by the occurrence of numerous gullies, and more or less pronounced depressions. I can recall to mind no mine that has been largely profitable, or even one which was profitable at all, where this surface condition obtains. Often, and I may say nearly always, when the end of a profitable shoot of ore is being approached in mining, a distinct change in the physical appearance of the vein is observable. The fissure begins to turn toward foot or hanging, or the vein straightens up; the quartz bodies begin to pinch and swell, and sometimes only gouge fills the fissure, the quartz disappearing entirely. In other instances, and I recall several such, the quartz continues, but it becomes dry and harsh in appearance, and with this change from what the miners call a 'lively' to a 'dead' quartz, the value of the ore also drops or disappears entirely.

It is the physical appearance of the vein that must guide the miner. Water is usually considered a favorable indication, and so it often is, but water alone is not to be depended upon, for water will issue from a barren fissure, or along the course of a dike, as readily as from the richest vein. Several years ago a well known mine superintendent on the Mother Lode was showing a friend, who was also a stockholder, through the mine of which he was in charge. Passing through a cross-cut they came to a vein about a foot wide in which gold could be seen liberally sprinkled through the quartz. The visitor gazed upon this evidence of wealth with natural satisfaction, and congratulated the superintendent, and incidentally himself. He was astonished when told by the superintendent that it did not amount to anything and would not continue twenty feet. He was right, for it entirely disappeared in a little over half that distance. This vein was a short shoot of dry-looking quartz, occurring in a twisted and irregular formation, and the wise superintendent had learned by experience to distrust veins of that description. A few weeks later the same stockholder made another tour of inspection of the mine with the superintendent, and found the rich vein gone and the working place deserted, but a few feet farther along this cross-cut another vein had been cut a day or two previously. No quartz was in sight, except a few small threads of it

mixed with a little calcite. The fissure was filled with bright glossy foliated slate and a soft putty-like gouge. The whole face was damp, and a little water trickled away on the floor of the drift. The entire face reflected the light of the candles from a thousand little crystals of sulphides. "Now," said the superintendent, "here is the true business —this will make a valuable shoot of ore, if I am not greatly mistaken." It is interesting to know that again this man's judgment was confirmed by subsequent results, for this shoot produced several hundred thousand dollars.

W. H. Storms.

Berkeley, California, February 15.

Methods of Teaching Assaying

The Editor:

Sir—In your issue of February 8, D. C. Livingston presents an interesting discussion of methods of teaching assaying and invites comment thereon. Ten or fifteen years ago the teaching of assaying was in a truly pitiable plight. The faulty organization which still hampers the work of many mining schools generally placed this course under the supervision of the chemistry department, and the helpless student was in many cases under the tutelage of men who had never seen the working laboratory of a mine, mill, or smelter, and who labored under the impression that experience in the complete analysis of complex silicates was the practice best adapted to qualify a mining engineer for work in the chemical phases of his profession. This emphasis upon theory was in part a reaction against the pressure from students who desired to learn to do assaying by intuitive methods similar to those by which a Southern 'mammy' does her cooking, but was in large part due to a lack of perception by the teachers of the real needs of the student and of the methods by which they may best be met. Fortunately those days are now permanently passed.

Mr. Livingston's argument as to the necessity for the student spending a whole day in the laboratory in order to accomplish really effective work interests me, since I so strongly urged the same point upon the president of the University of Wyoming, ten years ago, as to secure the necessary change in the schedule of hours. The long period has the disadvantage that the student performs a relatively large amount of work with little opportunity for study and classroom conference, but where the number of students per instructor is not too great, conferences can be held in the laboratory, where they are most effective and useful. And the earnest student finds many brief opportunities for study, while waiting for operations to complete themselves, that can profitably be utilized.

The matter of never allowing the student to mark his crucibles is one of which the importance may easily be overestimated, in my opinion. Crucibles are not marked in a laboratory where a large number of determinations of a similar character are made, because the slight saving of labor thus effected is obtained without material inconvenience, since all the crucibles are placed in the muffle at once and similarly withdrawn. But where the student is carrying on determinations of different character, which require longer or shorter periods and differing degrees of heat, it is not practicable to conduct his work in such a wholesale fashion, and the use of a distinguishing mark is a great convenience, in the early stages of his work at least. The essential thing is to get the student to understand what he is doing, and why, and unless he does understand, it is immaterial whether he makes ten or fifty determinations per day. In concentrating attention upon the commercial details of work too early in the course, there is grave danger of diverting the student's mind from the consideration of the fundamental chemical criteria which must be the basis of right practice. I remember with amusement the superintendent of a mining property in Colorado who vehemently assured me that as a mining school my *Alma Mater* was a failure, adducing as proof the fact that several of its recent graduates whom he had employed had proved incapable of handling 30 or 40 unmarked determinations daily without getting them mixed. Whether or not they evidenced any understanding of their work was apparently a minor affair.

It is highly desirable that the student should upon graduation be able to do one or more things well enough so that he can 'hold a job' on the manly basis of adequate service rendered for compensation received, and assaying is one of the subjects best adapted to semi-vocational teaching methods. But the student who has devoted four years of precious time, and money that in many cases can ill be spared, in an attempt to make an engineer of himself, only to find, after a few years experience, that the short-sighted instructors to whom he entrusted his future have converted him into a high-grade workman, certainly has grounds for a suit for educational malpractice. Shift-bosses and foremen are essential elements in the success of mining operations, but college training and the curriculum of a technical school ought not to be laid out on the hypothesis that any considerable number of its graduates will find their permanent level as shift-bosses and foremen, or even as assayers and surveyors. As a matter of fact, only a comparatively few of the entering class of any technical school were ever intended by nature to become real engineers. The rest cannot be made to score a success, no matter what treatment they get, and the rational method is to give the best possible training to the best men. It is better for a school to turn out a dozen first-rate men in a lifetime than an army of mediocrities. Just what constitutes the best possible training 'is another story,' and no two persons are likely to agree absolutely in its recital.

Thomas T. Read.

San Francisco, February 8.

Flotation Patents

The Editor:

Sir—My reply to the letter by E. H. Nutter in your issue of January 25, is that nothing is to be gained by the discussion of matters which the courts of justice will soon settle.

London, February 20. J. D. Wolf.

Special Correspondence

NEW YORK

LEGISLATION AFFECTS SITUATION. — COPPER MARKET UNRESPONSIVE. — RAY CON. — HEDLEY G. M. CO. — GREENWATER.

Legislation, both state and national, threatens a degree of regulation under which, according to the unanimous voice of the older conservative forces in New York, the doing of business will become impossible. The enforced incorporation of the stock exchanges is a possibility, if not a probability, and to most members of the New York Stock Exchange this appears sacrilege, leaving nothing to be despoiled. The most recent measure which has spread consternation is a threatened doubling of the transfer stock tax. By a statute of the state of New York there is required to be paid by the seller of any stock, when sold within the state, a tax of 2c. upon each $100 of par value; on most stocks dealt in on the New York Stock Exchange, being of $100 per share par value, the tax amounts to $2 per hundred shares. There has been a deal of heated discussion concerning the possible action of the state legislature and much talk of removing the exchange to Boston or Philadelphia. The matter has not sufficiently crystallized as yet to justify any prediction beyond the one that one effect of such action will be to bar the small trader out of the market, and such might, on the whole, rather commend the idea to one not impregnated with Wall Street atmosphere. As to moving the Stock Exchange, romantic minds have more than once tried to picture New York's financial district uninhabited, its busy streets transformed into deserted canyons. Inasmuch as the great financial machinery of New York has been built around the Stock Exchange, it is hard to picture what would happen—the slump in realty values, the palatial skyscrapers without tenants, or at least without that class of tenants for which they were constructed. Yet many brokers have already notified owners of office buildings that leases would not be renewed, or would be renewed only subject to cancellation upon the passage of the threatened legislation.

The question of amortization, income, or liquidation of assets of mining properties, is being considered by the Supreme Court of the United States. The case is one which involves the Stratton's Independence, and was certified by the Circuit Court of Appeals to the Supreme Court for the construction of the corporation income tax law, the question broadly being whether such tax may be collected from mining corporations on the proceeds of the sale of minerals extracted, and going really into the question as to what is the net profit produced by a mining company.

In view of all the untoward factors, the Balkan situation abroad, and the Mexican upheaval, it is not to be wondered at that the copper situation has failed to improve. Sellers have been making a price this week of 15c. per pound, but have failed to attract buyers in large numbers. The truth is, the buyer realizes his advantage under present conditions. The vastness of the operations of the modern copper mine is at once its strength and its weakness. The manufacturer can curtail and cut close, but commercially speaking, the large copper mines of today are in a position where time is the essence; the investment of the huge sums necessary for production on a profitable scale makes imperative the forcing of such production at top speed in order that carrying charges may not eat any more than necessary into net profits. This simple financial analysis has by no means been lost upon the user of copper, who is apparently inclined to take to himself all the advantage of the present situation. It is expected that the Lewisohn interests, which have for so long controlled the Tennessee Copper Co., will step down and out at the coming annual meeting. The estate of Leonard Lewisohn, who was a brother of Adolph Lewisohn, formerly held control of the company, but this holding is now said to have been liquidated. The younger generation, which has been in the active management for some years, will probably withdraw entirely, although they have been requested to continue to act, at least in an advisory capacity, with the new executive heads. James Phillips, Jr., the former head of the Nevada Consolidated, will probably have an active part in the new management.

The Ray Consolidated Copper Co. reports a net profit for the quarter ended December 31 of $583,827; the total production of copper during the quarter was 10,490,661 lb. The production for the year was 35,861,496, which when compared with the output of the previous twelve months of 15,721,520 lb., shows that Ray is getting into its stride as a producer of copper. Copper costs for the quarter were 9.3754c. per pound, and for the year 9.828c. Chino's output is showing an equally gratifying growth. For the quarter ended December 31 there was produced 11,067,864 lb., which compares with 10,608,478 for the third quarter, 4,289,644 lb. for the second quarter, and 3,271,980 lb. for the first quarter. Copper costs for copper produced by milling operations for the last quarter of the year were 8.49c., as compared with 6.57c. for the preceding three months. In this figure, however, are included all operating, administration, and general charges, and a charge of 30c. per ton of ore treated to cover mine development and stripping expense. The cost per pound from crude ore shipped was 7c. after allowing for smelter deductions. Increased costs are stated to be due to a high percentage of iron resulting in a lower ratio of concentration and a lower grade concentrate. The average daily tonnage treated is now running nearly 5000 tons.

The directors of the Calumet & Hecla have declared a dividend of $10; this is a reduction of $2 per share as compared with the last quarterly disbursement. The company is paying $1,685,000 of its 5% notes which were issued in connection with its purchase of the Bigelow properties. The notes are being redeemed at 102 and interest, and when the present payment shall have been completed will leave but about half of the original $8,519,000 issue outstanding. The Isle Royale, one of the Calumet & Hecla properties, is paying an initial dividend of $1 per share, and this company is acquiring increased importance by reason of the purchase of the Montezuma tract adjoining the Isle Royale ground. The taking over of this property is estimated to give to the Isle Royale some 60,000,000 lb. of additional copper net. The Lake Copper Co. announces that openings on the 11th level, the deepest workings in the property, show rich copper. There have been some recent rumors as to the showings in the lower levels of the Lake property, which make the announcement of no little importance to the shareholders.

The Hedley Gold Mining Co.'s report for the year shows a tonnage handled of 70,455 tons, of an average value of $11.19 per ton, or a total value of $788.715, an average extraction of 95% being maintained, yielding gold to the value of $748.133. Dividends of $360,000 were paid, and an undivided surplus carried forward of $226,841. In his report, I. L. Merrill, president, states: "We have acquired the adjoining claims known as the 'Windfall group,' lying to the northwest of our property. Our exploration work demonstrated that the ores passed into this acquired territory, which promises well for a long life to our mines."

An echo of the boom days of the abandoned camp of Greenwater, Nevada, is heard in the recent annual report of the company, which, as its most interesting item, contains a list of some $83,000 in gilt-edged bonds held in its treasury. The company is operating at Dale, California, but has for some time been casting about for a mining property in which to invest its treasury funds.

Receivers have been appointed for the United Copper Co., for so long one of the market footballs and mysteries under the control of Fritz Augustus Heinze. Liabilities are set down as $4,501,734, with nominal assets of $6,000,000. Cash on hand is less than $1000, and among the assets are accounts due for large amounts from the Montana Ore Purchasing Co. and the La France Copper Co., both of which are or were Heinze properties. At present Heinze is making war against William Guggenheim and his associates on claims growing out of the overthrow of the firm of Otto Heinze & Co., which latter firm went down in the panic of 1907.

LONDON

TIN IN SIAM.—RADIUM AND PROMOTION.

In my last letter I gave some particulars of a new tin lode deposit discovered at Ardlethan in the centre of New South Wales. Another Australian tin venture that is attracting attention in London is at Tongkah harbor on the west coast of the Western Siamese States between Burma and the Malay Peninsula. Australian capitalists are not so ready nowadays as formerly to put money into tin properties within the confines of their own continent. In this way they resemble the Cornishmen who would rather invest in Malayan propositions than in the old has-beens at their own doors. The Tongkah harbor business has rather a curious history, for after the flotation of the company three years ago experts sent to make a further examination unanimously condemned it. However, the promoters went ahead undismayed, and have had the gratification of making large profits. The first dividends were distributed about 18 months ago, and as far as can be ascertained, the prospects continue excellent. There are four dredges at work, two built by William Simons, of Renfrew, Scotland, and two by Werf Conrad, the Dutch firm. The last yearly statement shows that the amount of material treated was 3,157,549 cu. yd., as compared with 2,217,343 cu. yd. the year before. The produce was 1385 tons of tin concentrate, as compared with 1142 tons. The average yield was just under 1 lb. per cu. yd., as compared with 1.15 lb. The receipts were £153,465, being £110 16c. per ton, of 11⅝d. per cu. yd., as compared with £117,487, £102 15s. and 12¾d., respectively. The working cost was £53,884, and £26,482 was paid as royalty spent in work required by the Siamese government as part consideration for the concession. The working cost per cubic yard was 4d., as compared with 4½d. the year before. The total cost was 6d. The divisible profit was £80,366, and £84,563 was distributed as dividend, being at the rate of 55%. The extra expenses referred to above were due to the work done by one of the dredges in opening the harbor at Tongkah. Not only did this mean the expenditure of much money, but it kept the dredge away from its regular duties. The dredging of the harbor formed part of the agreement when the concession was obtained from the Siamese government. Naturally the inclusion of its cost in the 'working' cost is not popular with the engineers in charge.

For colossal impudence, the batch of so-called literature masquerading as a prospectus for the Société Industrielle du Radium is quite in advance of anything that has been offered to the public during the last few years. The scheme is an 'emanation' from the brain of one Frank Sherwood Gray (if that is his real name), who, I regret to say, is an American. For some time he has been pushing the shares of a company called the British Radium Mines. He has had to return such money as was subscribed. This company was supposed to own the Tolgarrick mine, between Falmouth and St. Austell, Cornwall. The new company owns its better-known neighbor, the South Terras or Uranium mine. This mine has for many years yielded a desultory output of pitchblende and other uranium ores such as autunite and torbernite, which were treated by Benedict Kitto for the extraction of uranium oxide. But the demand for uranium compounds is small. The circulars now issued in French and English use Madame Curie's name as their leading line. Elaborate documents are issued containing copies of reports written at her establishment in Paris relating to the radio-activity of the minerals and of the mine-water. On the strength of all this, 5000 shares of the nominal value of £4 each are being offered to the public at £5 each. Statements are made to the effect that the proved content of radium in the developed ore and dumps is worth over a million pounds. The difficulty that strikes the candid critic is that when the radium has been obtained it will be unsalable. Another Cornish venture has in its strong-room a fabulous amount of radium compounds bottled up like King Solomon's genies in leaden vessels, but unfortunately there is nothing doing in the radium market. The saddest feature of the whole affair is that a member of the Institution of Mining and Metallurgy has lent his countenance to the scheme by becoming a director.

BUTTE, MONTANA

CHANGES AT ANACONDA.—LEACHING SUCCESSFUL.—FIGHTING FIRE.—BARNES KING, ELKHORN, SOUTHERN CROSS, AND OTHER MINES ACTIVE.

As a result of a long series of tests at Great Falls and Anaconda, some important changes in concentrating methods have been decided on. These changes are expected to bring the saving up to 80 or 85%. The work of remodeling the Anaconda plant is now in progress. As it is not desirable to shut down more than one unit at a time for this work, it will be fully a year before the change is completed. Both the new copper leaching plants at Butte are said to be in successful operation now. The published statements concerning the plant of the Butte & Duluth M. Co. indicates remarkable success, and, if true, give promise of opening up an important new industry for Butte. It is not claimed that the ore will average better than 1½ to 2% copper, and yet this is to be treated profitably by leaching. Two steam-shovels have been ordered and will dig the ore for the leaching plant, which is to be enlarged to a capacity of 1000 tons per day. It is claimed that a 90% extraction is made, at a total cost for mining and treatment of less than $2 per ton, or less than 5c. per pound of copper produced. As leaching solutions containing 10% sulphuric acid are used, the leached ore is moist with a valuable amount of acid. It is hoped to save this by subjecting the leached ore to weathering agencies, storing it in open piles that can be drained.

The Butte mines have a lot of trouble with fires. So much timber and other combustible matter have been left in the stope that spontaneous combustion is a dangerous possibility in any of the old seldom-visited workings. The most recent fire of this kind was discovered on the 500-ft. level of the West Colusa mine on February 12. Steps were immediately taken to get the fire under control, and the miners were removed from danger zones by way of the Mountain View shaft. The great difficulty in fighting such fires is in controlling the noxious gases resulting from combustion. The fire-fighters have to wear oxygen helmets and are supplied with portable electric lights. New ventilation cross-cuts and laterals must be driven, burning workings bulkheaded off with concrete, and the supply of fresh oxygen cut off as much as possible from the burning area. The danger to the firemen from suffocation is not inconsiderable, and it is not unusual for workmen in the bad places to be paid as much as $15 per shift. The West Colusa mine now has two fire zones which are not connected, the other one, on lower levels of the mine, having been burning for several years. These fires increase the cost of mining and withhold a lot of minable ore until they can be extinguished.

The Badger State shaft of the Anaconda Copper M. Co. is to be deepened from the 1800-ft. level at least to the 2400-ft. level. The rapid deepening of nearly all the shafts at Butte is suggestive as to where new ore is to be looked for. The lateral extensions and discoveries are manifestly unable to supply the demand for tonnage.

In December the mill of the Barnes King D. Co., in Fergus county, treated 1757 tons, assaying $8.56 per ton. In January 3286 tons was treated, assaying $9.74 per ton. The February production will be about 3000 tons, assaying close to $11 per ton. The North Moccasin orebody is holding out well, so that the outlook for the property is promising. The Elkhorn Mining Co. has been organized, by Butte interests to operate the Sour Dough mine at Elkhorn. The ore is gold and copper in a gangue which has a high iron content, divided by smelters.

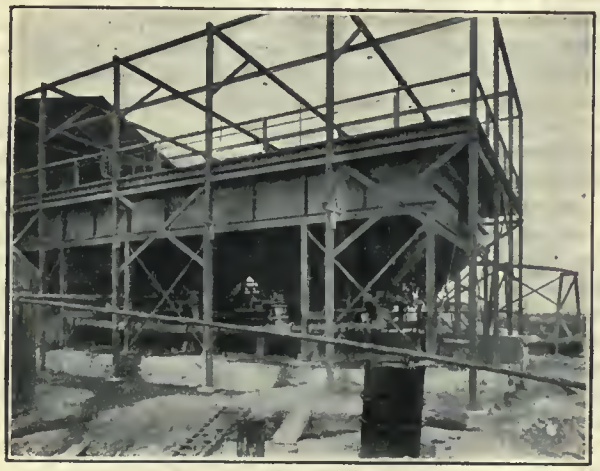
Fifty men are now employed at the Southern Cross mine, in Deer Lodge county. Large ore-bins are under construction and the shaft is being sunk 300 ft. deeper. The Holdfast lease is making regular shipments to the Anaconda smelter. The Hidden Lake shaft is said to be in good ore. The company plans to erect a 50-ton cyanide mill in the spring. Work is progressing at the Blue-Eyed Nellie mine near Anaconda. The burned part of the shaft has been retimbered and the lower workings put in shape for operation.

JOHANNESBURG, TRANSVAAL

GOLD YIELD.—LIFE OF RAND MINES.

The total yield of gold in the Transvaal for the year 1912 has been officially declared by the Chamber of Mines as 9,124,299 oz., value £38,757,560. This is a larger yield than the most optimistic estimate, the last two months' contributions exceeding anticipations. The increase over 1911 was 886,576 oz., value £3,765,940, an increase greater than during any year since 1906, when the mines on the Rand may be said to have got into full swing after the war. There can be little doubt that the new producers such as Brakpan and Modderfontein 'B' in the Far East Rand, City Deep in the Central Rand, Bantjes and Randfontein Central in the Western Rand have materially contributed to this increase, which is all the more welcome on account of several of the mines on the rich part of the Central Rand showing signs of exhaustion.

Out of this huge total the Rand alone was responsible for 8,753,568 oz., value £37,182,795, being an increase over 1911 of 856,576 oz., value £3,639,316, which, it may be remarked, left the outside districts scattered all over the Transvaal, only 370,731 oz., value £1,574,765. Even these outside districts showed a satisfactory increase of 29,810 oz., value £126,624 when compared with 1911, an indication that the old fields of Lydenburg and Barberton are fully maintaining their position, and if the Heidelberg district returns could be included in their proper place with those of the Rand, the term 'outside districts' would



FILTER-PLANT, CROWN MINES.

be more correct, and the division thus made of greater mining value.

In the light of this remarkable increase in the gold production of the Rand last year, it may be interesting to enquire how long the Rand will be able to enjoy the luxury of a progressive gold output year by year as it has practically done since gold was first discovered on the Rand. The difficulties are connected principally with the impoverishment of the Rand banket reefs in depth, a fact known for many years, but which, up to the present, has not been of sufficient potency to neutralize the effects of the continued expansion of mining developments on the Rand. In 1912, however, the effects of this impoverishment with depth has for the first time been shown in a practical manner by the Simmer East finding profitable mining out of the question to such an extent as to go under, the property meanwhile having been taken on option by a neighboring mine. Other mines may find themselves in a similar difficulty before long; in fact, since the close of 1912 the Lancaster West has announced the intention of closing down indefinitely, owing to being unable to work £1 ore at a profit. There is not likely to be any marked growth of gold output, either on the Central or Western Rand, according to the present outlook, so that there only remains the Eastern part of the Rand to supply the necessary new producers to enable the progressive output to be continued in the future. Fortunately, there are indications that several of the new producers on the Far East Rand may be able to increase their present output, others are likely to enter the producing list, particularly if the Government Areas improve as they probably will on being further developed, while, providing the Springs shafts, now approaching the reef, confirm the borehole results, a large area will be considered to be added thereby to the profitable part of the Far East Rand. Nevertheless, there are large areas of the Far East Rand of somewhat doubtful value, and conditions must alter considerably before they can be expected to contribute materially to the output of gold on the Rand. Taken on the whole, therefore, it would appear that most of the new producers will, in the immediate future, probably be established on the Far East Rand, and that on the Central and Western Rand there does not seem much probability at present of new producers being started owing to the immense depth to which most of the deep-level properties have already secured ground. Both the Central and Western Rand should, however, maintain their present output over many years; properties may become exhausted, but by amalgamation or otherwise the mills are likely to be kept fully employed in most instances, while no efforts will be spared in the future at individual mines to increase the present output. On the Far East Rand the output of gold must continue to increase for some time to come, and even when the progressive output has reached its limit, some time must necessarily elapse before the gold-mining industry of the Rand takes a downward course. It is impossible to agree with H. C. Hoover that the Rand even now has reached its limit of progressive gold production; for, as a matter of fact, such is far from being the case. Every year in the future will, however, bring the Rand nearer to such a position; but a marked, distinct, and continued decline in the production of gold on the Rand is still apparently situated some distance in the future.

BOSTON

BUTTE NEWS.—ZINC DISAPPOINTING.—TENNESSEE COPPER.

The new mill of the Butte Central company started off February 16 with some 200 people in attendance, among them a few Boston stockholders. It is claimed that the concentration is excellent and that when the tailing is cyanided the expected recovery of 85% will be obtained. A statement was made here a few days ago that the Davis-Daly Copper Co. had abandoned its workings on the 1900-ft. level. This brought out a denial from the company's secretary, Charles G. Schirmer, who explains that there were two small drifts on the west cross-cut which were started a few weeks ago with the idea of ascertaining the nature of the ground and, as it was found that it was not mineralized, work on these ceased. Mr. Schirmer says: "We are now getting some of our best ores from our 1900-ft. level and shall continue working on this level, without a doubt, for some time to come."

Recent liquidation in the Boston copper-share market has carried prices to new low records for 1913, and in the cases of Allouez, East Butte, Miami, Mohawk, Nevada Consolidated, Superior, Franklin, Quincy, Utah Copper, and Copper Range, to the lowest selling figures since 1911. In the case of Copper Range, the price is the lowest since 1904. Hancock sold at the lowest since 1909, and Lake at the lowest since 1908.

Interests here identified with zinc mining at Joplin express much disappointment at the unsatisfactory condition of the ore market in that district. The price has dropped to a point where it is no longer profitable for any mines except large and well equipped ones to ship to advantage. After postponing the matter from week to week for four weeks, the Executive Council here, by a vote of five to four, denied the petition of Cardenio F. King, a former Boston promoter, for pardon. Word is received in Boston that the active interest in mining shares is shifting to the Cobalt issues and that London is backing the market. Cobalt and Goldfield issues have never secured any particular footing in the Boston market.

The news that control of the Tennessee Copper Co. has passed from the Lewisohns to a new group headed by James Phillips, Jr., formerly of Nevada Consolidated, is

interesting Boston in many ways. The news is correlated with the news of a few weeks ago that the same interests, which are dominant in Miami, offered the control of that property to others, presumably those in control of Inspiration, but the offer was not accepted. Since the fight made by Mr. Phillips against the control of Nevada Consolidated going to Utah Copper resulted in his defeat, he has not been prominently before the copper public, though it has been known that he has been identified with big copper developments in Alaska. Mr. Phillips, many years ago, was the publisher of the New York *Press*, now owned by Frank A. Munsey, and has had a prominent newspaper and mining career. The remarkable slump in the price of Lake Copper stock has turned loose a number of rumors about the property. One is that it is to be included in a combination with Copper Range. Another is that it is to be merged with South Lake, the latter company being thought to stand a good chance of getting the Lake lode in its developments.

The Department of Justice has at length been brought to investigate the 'smelter trust,' but whether the National Lead Co. and the American Smelting & Refining Co. are to be put through a dissolution course has not yet been revealed.

BLACK HILLS, SOUTH DAKOTA

ELECTRIC POWER.—GOLDEN REWARD TREATMENT.

Considering the season and the condition of the ground, good progress is being made on the pole-line to connect the Dakota Power company with the transmission lines of Lawrence county serving the big mines. The line is approximately 30 miles in length, from Whitewood to the power plant on Rapid creek, 2 miles below Pactola. Under the terms of an agreement made last fall, the Consolidated Power & Light Co. will take about 1000 hp. from this plant. The latter company has the field in Lawrence county thoroughly covered, and new mining work makes it necessary to secure additional power, as the two generating stations at present maintained are often working to the limit of their capacity. The Revenue Mining Co., recently reorganized at a meeting held in Lead, and elected the following directors: William Bertolero, president; N. W. Gregory, vice-president; J. F. Peters, treasurer; Dan Walsh, secretary; and J. G. Spencer. An assessment of 3 mills per share was levied, which will be used immediately in development work. The company owns property on Nevada gulch, and has produced good ore in the past. Several offers to lease it have been refused, and the company hopes to produce soon.

During development work at the Astoria mine of the Golden Reward company between 5000 and 6000 tons of wet sulphide ore was put on the dump, and when the recently completed roaster was started the first ore to be used was this dump. It was found to have altered considerably, the pyrite having oxidized to sulphate to a large degree. The decided change in the character of the ore has occasioned a change in treatment methods, and a number of details are being worked out, prior to starting regular treatment of the dump. It appears necessary to move this dump before starting work in the mine. A preliminary wash with water is being tried on the roasted dump ore at the mill in Deadwood; following this an alkaline wash makes a product amenable to cyanidation. The ore is crushed to approximately 20-mesh preliminary to roasting, and this is being leached without classification. Should this method prove a success it will cheapen milling costs. C. C. Tegethoff has been elected president of the company, succeeding A. G. Hackstaff, who recently died. The board of directors, with the vacancy caused by Mr. Hackstaff's death, which has not been filled, is as follows: C. C. Tegethoff, Harris Franklin, R. W. Goelet, C. G. DeWitt, W. B. Devereux, Walter Luttgen, H. D. DeForrest, and O. H. Kahn, all of New York City. The officers are: C. C. Tegethoff, president; Harris Franklin, vice-president; W. C. Johnson, secretary and treasurer; N. E. Franklin, assistant secretary; and Henry Schnitzel, general manager. F. R. Baldwin is superintendent and R. Mosely, mill superintendent.

General Mining News

ALASKA

JUNEAU

The Alaska Mexican, Alaska Treadwell, and Alaska United companies have declared dividends of 20c., $1, and 70c. per share, respectively, payable on February 28.

According to the Collector of Customs, the trade of Alaska during 1912 was valued at $72,741,000, which is 27% higher than any previous year. Some of the principal items were as follows:

Vessels entered at Alaskan ports, tons	487,379
Shipments from United States to all districts	$21,992,761
Shipments from foreign ports	925,034
Passengers arrived	20,645
Passengers departed	18,502
Exports:	
Salmon canned, and others	$16,459,036
Gold and silver	16,031,705
Copper ore and matte	4,904,715
Other fish and products of the industry	914,571
Furs	728,554
Gypsum	129,375
Marble	77,159
Tin ore and concentrate	90,831
Whalebone	18,012
Other merchandise	1,000,261
Total	$40,354,219

ARIZONA

COCHISE COUNTY

The Dragoon district is attracting attention through its zinc deposits. The Wolfram properties are shipping ore to Philadelphia. The Texas-Arizona company employs 20 men, and is shipping ore regularly. At 800-ft. depth the Arizona United Mine Co. encountered water, and opened a large body of high-grade ore on the 700-ft. level. A pump is being installed. The Tyrone Clark mine, 14 miles northeast of Benson, in the Little Dragoon mountains, is installing a hoist and pump. The shaft is down 130 ft. The Commonwealth Mining Co., of Pearce, is doing considerable development, and expects to have its stamp-mill working early in 1914.

GILA COUNTY

During the last quarter of 1912, the Ray Consolidated Copper Co. produced 10,490,661 lb. of copper, making a total for the year of 35,861,496 lb. Ore treated amounted to 460,181 tons, averaging 1.67% copper, and the year's total was 1,565,875 tons, wtih an extraction of 68.28%. Development during the quarter covered 28,000 ft., and to date 292,000 ft. Mining costs were 71c. per ton. Including earnings from the Ray & Gila Valley Railroad Co., the year's profit was $2,069,903. The tonnage treated at the latter end of January was 6200 tons per day; and early in February there was hoisted 8000 tons in 16 hours. The large chalk deposit 20 miles from Winkleman is now being worked by C. H. Patrick, of Phoenix, and several shipments have been made to Los Angeles.

MARICOPA COUNTY

J. T. Lewis on February 18 introduced in the House a bill which prescribes a minimum wage in hazardous mining operations and providing for the punishment of violations of the law. According to the terms of his bill, $4 per day is fixed as the minimum wage to be paid to any person employed in underground work, all work in open pits and open cuts, operating smelters, reduction works, stamp-mills, concentrating, chlorinating, and cyaniding mills, mine sawmills, and all other work where any machinery, powder or dynamite is used or employed under or above ground in the mining industry. In the event of a violation of the law by any employer failing to pay the sum named or proposing to contract for labor at a less sum a trial of the case must in all events be by jury, and each day during

or for which a violation is made constitutes a separate offense.

YAVAPAI COUNTY

Diamond-drilling is under way at the property of the Ford Mining Co., situated in the Black Hills. The vein should be cut at about 600-ft. depth. A pump has been installed on the Haynes Copper Co.'s mine 700-ft. level, and sinking can be resumed. The Mark Twain silver mine is to be worked by lessees. The Fortune Mining Co., which is working the Wizard mine at the head of Big Bug creek, has driven an adit 700 ft. on a vein, the last 200 ft. averaging about 5 ft. wide.

YUMA COUNTY

W. A. Clark has acquired the American Eagle property, situated in the Whipple mountains, 16 miles northwest of Parker. Fifteen men are employed at present, and two auto trucks will haul ore to Vidal, whence it will go to the Clark smelter at Jerome. At the Arizona-Empire mine, about 400 sacks of rich gold-bearing ore is ready for shipment. A carload of copper ore is also ready at the Eagle adit. Owing to the condition of the roads, auto trucks cannot work until they are repaired. It has been suggested that the caterpillar type be used over desert and sandy roads.

CALIFORNIA

On January 31 there were 5845 producing oil wells in the state, and during the month they yielded 7,566,789 bbl., an average of 244,090 bbl. per day, of which the Midway field produced 2,323,803 bbl.; Coalinga, 1,528,115 bbl.; Kern river, 1,000,389 bbl., and McKittrick, 877,114 bbl. Stocks total 47,756,517 bbl. Sixty new wells were completed during January.

CALAVERAS COUNTY

The dredge of the Oro Development Co., of San Francisco, at Comanche started work on February 13. This is the first machine to work in the district. Power is supplied by the Oro Electric Co. At a depth of 160 ft. from the surface, a deposit of gravel 4 ft. thick, averaging $20 per ton, was opened in the Rising Star placer claim at Central Hill, near San Andreas. C. W. Neilsen is in charge for J. E. Richards, of Boston, who has an option on the property for $20,000.

(Special Correspondence.)—F. J. Martin, superintendent of the Utica mine, is exhibiting the Heinze plate which was invented for use in concentrating gold from black sands. The Angels mine, after being closed for a month, has resumed operation. The Lightner is still idle and there is no immediate hope of work being resumed. The Utica company has most of its men above Bigtrees repairing flumes. H. L. Kuns, president of the Waterman Mining Co., is on a visit to that property. Drilling is going on to the satisfaction of the company, but H. A. Kuns, the manager, is considering putting on another shift to rush the work.

Angels Camp, February 22.

INYO COUNTY

From the Cerro Gordo mine, near Keeler, 14,000 tons of zinc ore has been shipped. L. D. Gordon is superintendent. The report of the Saline Valley Salt Co. has been distributed. The tramway will be in operation in 60 days. The greater part of the salt-grinding machinery is on the property near Swansea.

MONO COUNTY

An option has been taken for $50,000 on claims near the Inyo county line, between Deep Springs and Oasis. A shaft is down 60 ft. and will be sunk to 500 ft. A large lode has been exposed on the surface for 600 ft., carrying 12% copper over a width of 5 ft. About 12 miles south from this place a large lode of 3% copper ore is being developed by C. M. Schwab and associates. The shaft is down over 800 ft., and other work done. A power plant costing $20,000 has been erected.

PLUMAS COUNTY

The remodeled stamp-mill at the Oro Fino mine is working well. An adit has been driven on the vein for 500 ft., and the ore is at present 16 ft. wide, worth $9.50 per ton in free gold and sulphides. This mine is situated on a ridge between Hopkins and Poorman's creeks, and is owned by Hewitt Bros. It is said that several stamp-mills will be erected at the quartz mines on Winters and Washington creeks next summer.

TRINITY COUNTY

The Bonanza King stamp-mill, near Trinity Center, which was destroyed by a snowslide in January, will be rebuilt as soon as the weather is suitable.

TUOLUMNE COUNTY

(Special Correspondence.)—Another shaft, and an adit that will connect with it at depth, have been started at the gravel mine of the Springfield Tunnel & Development Co. The erection of a new hoist will be commenced at once, the material already being on the ground. Larger pumps will also be used to cope with the flow of water that has been a serious drawback in the working of the mine. The sinking of a new shaft to a depth of 300 ft. is about to commence at the Louisiana mine, near Tuolumne, which has not been worked for many years. Lumber and other material is being hauled to the property. Recent developments at the Italian Camp mine, owned by Joseph Rolleri and others, have revealed a body of fine ore 5 ft. wide. It is reported that a company is negotiating for the property. A large electric pump has been purchased for the Longfellow mine, which is being unwatered preparatory to the resumption of operations. The Phoenix Lake mine, at which a few men have been employed in development work during the winter, is showing some good ore, and it is proposed to increase the working force in the early spring. After a brief period of idleness caused by the heavy snowstorms in January, active operations have been resumed at the Gem mine, near Confidence. With the beginning of spring there will be a marked increase of activity at the Paymaster. Several buildings are in course of erection. At the Driesam, at Arastraville, which, it is understood, is being worked by the company operating the famous Black Oak, 20 men are employed and extensive development work is being done. A payment is to be made on the property shortly. The company operating the Moccasin Creek mine has developed extensive orebodies and contemplates the erection of a 20-stamp mill in the near future. The Wilson & Means mine, on Jackass hill, operated by Gillis Bros., has yielded another $2000 in gold during the past few days, making almost $5000 in the last few weeks.

Sonora, February 15.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—B. C. Catren, manager of the Whiting Mining Co., is to resume operations on the Terrible mine, situated on Brown mountain. It is stated that the shaft will be retimbered from the No. 10 level to No. 14 level when sinking will be resumed for 200 ft. Driving will also be started from the five lower levels for the exploration of Dunderburg ground. A force of 50 men will be employed within 60 days. The Golden Glory adit on Saxon mountain has been driven 1515 ft. The heading is now nearing the west extension of the Anamosa vein. Heavy shipments are being sent out from the Josephine mine on Kelso mountain. The ore is galena and brings $75 per ton in silver and lead. The Red Oak Mining Co., at the instance of bondholders, has filed a petition in bankruptcy. The debts of the company amount to $18,000. A. B. Montgomery, of Denver, is in charge. Von Tilborg & Co., leasing on the Gem mine at Idaho Springs, are shipping two carloads of ore each day that averages $15 per ton in gold. The output from the Shaffer & King lease amounts to 20 tons per day.

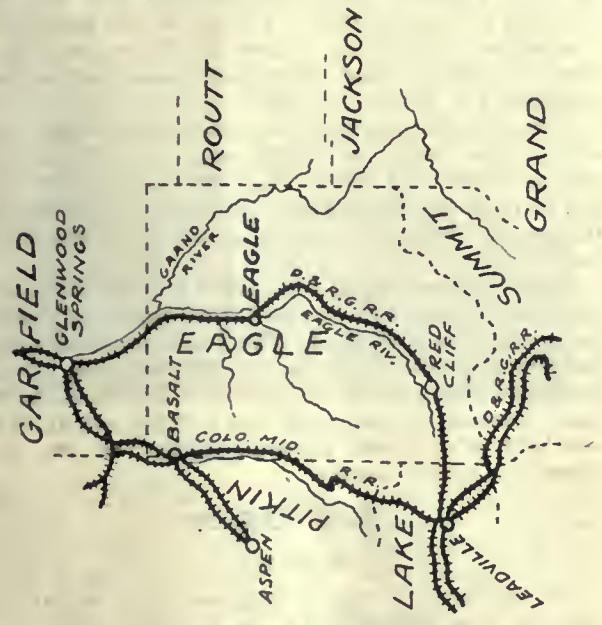
Georgetown, February 17.

CONEJOS COUNTY

A party of 17 men from Cripple Creek is on its way to the new mining district at Gilmore, near Platoro. Samples from Gilmore's claim have assayed $104 per ton. The distance from Alamosa is 47 miles, and there is a good road most of the way.

EAGLE COUNTY

(Special Correspondence.)—The Brush Creek district has always been regarded as an agricultural section, but recently rich silver ore was discovered 10 miles from Fulford, toward the head of Brush creek, and at the junction of Salt and West Brush creeks. Oscar Kempf, E. E. Glenn, and R. S. Wolverton made the discovery. The vein outcrop assays 250 oz. of silver per ton, and the present drift is in over 15 ft. in ore averaging 100 oz. per ton. The formation is laminated sandstone, and the silver in the ore is scarcely visible. Some of the ore contains vanadium. There



MAP SHOWING NEW DISTRICT.

is every reason to believe that this new find is genuine, as Charles Hannington, manager of the Iron Mask mine, has inspected it; also, Thomas R. Henahan, State Commissioner of Mines, who, upon his return, stated that the ore is rich, and his own sampling gave returns from 93 to 477 oz. of silver per ton. On account of the snow, the district having an elevation of about 7500 ft., nobody should go there for 60 days. It looks to reliable people who have been there that the district is destined to furnish the 'new camp' for which Colorado has been looking for some years.

Central City, February 20.

GUNNISON COUNTY

An incline shaft was sunk 200 ft on the Fremont lode in the old Pitkin mine several weeks ago, and about two weeks ago a drift was driven 18 ft. west of the incline and opened rich gold and silver-bearing ore.

TELLER COUNTY (CRIPPLE CREEK)

The Isabella Mines Co. has decided to reduce the royalties on ore charged lessees on the property, and also give assistance in any development thought necessary. The new royalties are as follows:

	Per cent.
Up to and under $10 per ton	10
From $10 to $20 per ton	15
From $20 to $30 per ton	20
From $30 to $50 per ton	25
From $50 to $75 per ton	30
Over $75 per ton	35

A 75-ton mill will be built by Howard Schultz, who has an option on two dumps in the district. Several of the mines have been troubled with gas lately on account of the bad weather.

IDAHO

SHOSHONE COUNTY

The Bell mine, near the Morning and Frisco, has been idle for 5 years, and is to be worked again. Underground workings cover over 5000 ft., down to several hundred feet depth. A lower adit is to be driven. Ohio people are largely interested. The Federal Mining & Smelting Co. has declared a dividend of 1½%, amounting to $180,000, bringing the total to $10,249,750. At the Mayflower mine a drift has been driven 270 ft., and a cross-cut from this 100 ft., opening ore averaging 45% lead, and 45 oz. silver.

MICHIGAN

HOUGHTON COUNTY

W. H. Weed, of New York, has taken an option on the publishing rights of the *Copper Handbook*, the yearly publication compiled by the late Horace J. Stevens for the past 11 years. R. H. Maurer, who was associated with Mr. Stevens, has been arranging for the next issue in July.

MONTANA

JEFFERSON COUNTY

The Elkhorn Mining Co., which has acquired property 12 miles from Boulder, and less than a mile from the old Elkhorn mine, has been incorporated with a capital of 1,000,000 shares of $1 each. Since 1898 the mine has been worked by lessees, who have received net returns of $250,000. At present there is 150,000 tons of ore blocked out, which contains 48% iron, 1.8% copper, 10 oz. of silver, and $5 in gold per ton. The property has been partly developed by an adit, and three raises to the surface. It is proposed to drive an adit at a lower level so as to give a vertical depth of 275 ft. The present workings are below an open-cut, and show 16 ft. of ore. It is said that seven mining men have examined the property with satisfaction.

LINCOLN COUNTY

(Special Correspondence.)—With the filing of deeds in the office of the County Clerk and Recorder at Libby, the news of the sale of the Big Eight mine, near Troy, is confirmed. By these deeds, the Big Eight Mining Co. has transferred to R. C. McCaffrey two patented mining claims, one unpatented claim, and a millsite, which compose what is generally known as the Big Eight property. Two other deeds have also been recorded, in one of which Mr. McCaffrey conveys to Harry L. Day of Wallace, Idaho, a 51% interest in the property. The other shows that he has sold a 14% interest to J. D. Finley. It is stated in the deed to Day that he pays for his interest the sum of $39,231, while Finley pays $10,769. As the parties now owning the property are mining men of means and of good reputation as mining operators, it is supposed here that the mine will be developed. The Big Eight has long been known as one of the most promising properties in the Troy district, and those who are familiar with the mine are confident that it can be developed into a large producer and dividend payer.

Libby, February 18.

NEVADA

CHURCHILL COUNTY

The annual report of the Nevada Hills Mining Co. gives the following details, covering 9 months to December 31, 1912:

Development, feet	5,866
Cost per foot	$10.56
Ore treated, tons	29,976
Value	$798,145
Ore shipped, tons	8
Value	$6,539
Costs:	
Mining	$4.06
Treatment	3.07
Moving ore from dumps	1.98
General	0.49
Total	$9.60
Net profit	$438,909

The Nevada Wonder mill is working full time again after a month's stoppage due to the water-supply being frozen. The pipe broke in a hundred places during the recent cold weather, and extensive repairs were necessary.

EUREKA COUNTY

Contracts have been awarded for machinery for the new

mill of the Buckhorn Mines Co., which is controlled by G. Wingfield of Goldfield. J. W. Hutchinson is consulting metallurgical engineer to the Buckhorn company with F. J. Siebert, consulting engineer for the Wingfield properties. S. J. Kidder, who was in charge of the Pittsburg Silver Peak mill, will have full charge of construction of the new mill. Contracts were let as follows: Lumber and building material, Verdi Lumber Co.; ironwork, Dunham, Carrigan & Hayden, of San Francisco; ore-bins and gates, Power & Mining Machinery Co., of San Francisco; crushing equipment, tanks, agitators, thickeners, classifiers, and filter-presses, Trent Engineering Co. The electrical equipment will be awarded on March 1. The mill will have a 350-ton capacity. Nearly all excavation has been completed.

Humboldt County

The annual report of the Seven Troughs Mining Co. shows a revenue of $110,621, of which $71,624 was from ore settlements and $38,244 from royalties. The surplus is $19,416. At present the property is under lease, which will expire in October, and the company will sink a winze from the lowest level.

At Rochester things are still booming, and everybody is optimistic. Four contracts are to be let for construction of 13,000 ft. of road from Nenzel peak to Oreana. The surveys for the water-supply show that pumping will not be necessary, and a tank of 250,000 gal. capacity will be built above the town of Upper Rochester. In the adit of the Big Four lease the vein at 70-ft. depth has widened out to 11 ft., worth up to $225 per ton in silver.

Since starting work about two years ago, the Winnemucca Mountain Mining Co. has done 4000 ft. of development and shipped ore worth $30,000, while the dumps on the property contain several thousand tons of good ore. The shaft will be sunk to 500 ft., and a mill will probably be erected. The Bonanza Mining Co., north of the former property, is worked by lessees, who have sunk to 200 ft. and will ship ore in March.

Nye County

The January production of all Tonopah mines was 44,755 tons, worth $900,182. During the week ended February 22, the output was 11,499 tons, worth $241,352, the totals for the current year being 86,737 tons and $1,814,882. On the 1400-ft. level of the Halifax mine a cross-cut has passed through 9 ft. of heavily mineralized quartz worth $5 to $7 per ton. The main shaft is down 1555 ft., and will be continued to 1700 ft. The ore-shoot on the 535-ft. level of the Midway has widened out to 5 ft., and shows high-grade silver ore. The Montana-Tonopah has cut the north branch of the Martha vein on the 565-ft. level, where it is 4 ft. wide. The firm of Campbell & Kelly, which erected the Belmont mill and is well known for its pumps and mill spares, will erect the new stamp-mill for the Commonwealth Mining Co., a subsidiary of the Montana-Tonopah Mining Co., at Pearce.

At Manhattan, the Big Four mill only awaits the installation of two large motors before being given a trial. On the Riley fraction of the Manhattan Crescent company a body of schist has been prospected by open-cuts and churn-drill holes across a width of 40 to 50 ft., and yields by panning from $10 to $40 per ton. This is considered to be the greatest surface showing seen at Manhattan. G. B. Rymal and J. W. Choklat are the prospectors, and shipments will be made at once.

Washoe County

(Special Correspondence.)—Fourteen miles north of Reno, C. W. Nelson, T. Warner, P. Kirkegaard, and J. Ray are developing a copper property. A shaft is 82 ft. deep, at the bottom of which a vein is 18 in. wide, worth $150 per ton. At the 60-ft. level a cross-cut was driven 43 ft. to the vein, and then driven on for 125 ft., opening a shoot 12 to 36 in. wide for 90 ft., worth $100 per ton. There are 12 tons on the dump, and one shipment has been made which averaged $112 per ton in copper, gold, and silver.

Reno, February 21.

White Pine County

Returns from the fourth carload of ore from the Kellogg lease on the Cuba mine returned 70.1% lead with 2.55 oz. of silver, 0.5% iron and 10.45% sulphur, the net yield being $40.98 per ton.

The Smokey Development company has been properly financed, and now extensive development can be done in this promising property. During the past year, Giroux Consolidated company shipped 140,877 tons of 2.15% copper ore to the Steptoe plant, and 410 tons of smelting ore was shipped, 152 tons yielding 8.16% copper at Tooele. Production was 3,817,083 lb. of copper, 1232 oz. of gold, and 3032 oz. of silver. The cost was 10.8c. per pound of copper, and net profit $150,000. The strike interfered with work last year, but the daily output at present is 1100 tons of ore. The company did 2485 ft. of churn-drilling on the Liberty, Herstelle Fraction, and Westphalia claims, and cut ore averaging 1.08 to 2.01% of copper.

J. Tilford, who owns tungsten claims on the eastern slope of the Snake range, near Baker, states that the vein has been prospected for 800 ft. The ore is up to 3 ft. wide, and averages 25% tungstic acid. Shipments will be made in the spring. There is plenty of timber and water in the vicinity.

During the quarter ended December 31, 1912, the Nevada Consolidated Copper Co. treated 512,988 tons of ore, averaging 1.44% copper, of which 477,948 tons was mined from the pits, and 35,040 tons from the Veteran mine. Copper production was 8,986,905 lb., making 63,063,261 lb. for the year. Revenue for the quarter was $707,256, and $1,749,524 was paid in dividends, the extra dividend of 50c. being charged to surplus account.

NEW MEXICO

Grant County

The opal mine situated 12 miles east of Silver City and one mile from Bayard station, on the Santa Rita branch of the Santa Fé railroad, is developing into a first-class property. Opals sent to Los Angeles to be cut and mounted show the gems to be of first quality and equal to the best Australian opals. The opals cut were practically taken from the surface and all experts declare they will undoubtedly improve with depth. The owners have located all the opal outcrops, and have covered eight claims. A shaft has been sunk 25 ft., part of the way through talc. The opal camp is well situated with regard to wood and water.

Eddy County

(Special Correspondence.)—Oil has been found at Dayton on the Santa Fé railroad, and a number of important Texas and California concerns are taking leases and preparing to drill. The country is devoted at present to farming, and small amounts of oil have been found in a number of water wells. Recently the water was cased off in one well and an attempt made to collect oil. This resulted so satisfactorily that a test well was bored, and this is now yielding at a rate reported to be 25 to 100 bbl. per day. The grade of the oil is unusually high, and over 20% of gasoline was recovered from one sample tested. The field has been examined by Denver and San Francisco experts, and reported to be worth drilling, though the geology and structure have not yet been worked out.

Dayton, February 20.

Luna County

Phelps, Dodge & Co. are to spend about $1,000,000 on development of the Burro Mountain and Chemung copper properties. The former was acquired in 1910, and the latter in 1912, both being estimated to contain up to 4,000,000 tons of 2 to 3% copper ore. A line will be constructed from the A. T. & S. F. railroad at Whitewater to the mines, a distance of 18 miles. A concentrating plant will be erected at Tyron or Leopold, with 1000-ton capacity.

UTAH

Juab County

The Eagle & Blue Bell of Tintic produced 3800 tons of ore in January from the 700 to 1250-ft. levels. From the 1000-ft. level of the May Day, over 200 tons of zinc ore is mined per month.

SALT LAKE COUNTY

The Yampa mine, which was closed down during the miners' strike last September, has resumed operations, and 100 men are employed, present shipments to Goldfield being 150 tons of ore per day.. The number of employees will be increased to over 200, and shipments will increase to over 500 tons per day.

SUMMIT COUNTY

Ore shipments from Park City during the week ended February 22 were 1419 tons. Development in the Daly-

YAMPA SMELTER, BINGHAM CANYON.

Judge, under the contract system, covered 700 ft. in January. At the California-Comstock property, in Thaynes canyon, the shaft is to be sunk 1000 ft. deeper. An electric hoist and air-compressor have been ordered.

TOOELE COUNTY

The International Smelting & Refining Co., at Tooele, has resumed smelting copper ore, and three reverberatory furnaces are in full blast. In the lead plant, No. 4 furnace has been blown in.

WASHINGTON

FERRY COUNTY

Work has been resumed at the Lone Pine mine of the Republic Mines Corporation, where a large tonnage of ore had accumulated in the stopes. It will be shipped to the North Washington Power & Reduction Co.'s mill, which has been shut down for a short time for repairs.

CANADA

ONTARIO

(Special Correspondence.)—Development on properties in the Pearl Lake and Dome sections, northern Whitney and Tisdale, and several outlying districts has been so encouraging of late that there are signs of a revival of outside interest in Porcupine. The Hollinger Reserve has cut No. 1 vein on the 200-ft. level, where it is 12 ft. wide and of good value. It is reported on good authority that the Cartwrights have regained control of the Pearl Lake company.

Timmins, February 22.

The McEnaney mill is at work, and 5 stamps are crushing 40 tons per day. On the No. 4 level of the mine 6 ft. of ore, worth $48 per ton, has been opened for 30 ft., and on No. 2 level the vein has been proved for 550 ft. It has been decided to increase the capacity of the mill.

MEXICO

SONORA

(Special Correspondence.)—The mills of the Tigre Mining Co. crushed 5732 tons of ore in January, and treated 5502 tons of current and 1618 tons of dump tailing, yielding $132,699. Total expenses, including taxes, were $77,257, leaving a profit of $55,442. Owing to unusual cold weather, recovery from the cyanide plant was not as good as usual.

Kansas City, Missouri, February 20.

The third Great Falls type of converter is in operation at the Cananea smelter, and the fourth is nearly completed.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

THOMAS T. READ is at El Paso.

MAX J. WELCH is in Los Angeles.

PIERRE BOUERY is in San Francisco.

EDGAR RICKARD is in San Francisco.

B. A. HOSKINS is visiting California.

L. J. PEPPERBERG is in Lower California.

F. L. SIZER was in San Francisco this week.

J. A. BURGESS was in San Francisco Monday.

RALPH ARNOLD was in San Francisco this week.

C. C. BROADWATER has returned from New York.

DOUGLAS D. STAVELEY has gone to Saskatchewan.

SUMNER S. SMITH has gone to Washington, D. C.

R. H. HUMPHREY is at the El Tigre, Yzabel, Sonora.

EUGENE VALENTINE has moved to Chicago from Denver.

BOND COLEMAN is with the Santa Gertrudis, at Pachuca.

L. C. GRATON is now living at Cambridge, Massachusetts.

CHARLES H. URQUHART has gone to Newark, New Jersey.

GEORGE WINGFIELD is at the St. Francis hotel, San Francisco.

GEORGE MILTENBERGER, JR., is at Real del Monte, Hidalgo, Mexico.

HORACE F. LUNT is now at the Hillabee gold mine, Alexander City, Alabama.

J. NELSON NEVIUS has returned from New York and was in San Francisco this week.

HARRY CECIL, of London, is in Cobalt, representing the interests of the Cobalt Aladdin.

C. O'BRIEN has gone to Portobelo, Zaruma, Ecuador, with the South American Development Company.

ARCHIBALD STARK has left Valparaiso and is now at Craignoar, Giffnock, near Glasgow, Scotland.

CLARKE SULLIVAN is metallurgist for the Zapilote mine, in Tepic, and has not been appointed superintendent as stated in this column recently.

HOWLAND BANCROFT left last night for Ludwig, Nevada, where he expects to spend the next three weeks on examination work, returning to Denver about the middle of March.

NITRATE production of Chile, during the 'nitrate' year, July 1, 1911, to June 30, 1912, was as follows, in quintals of 101 lb., according to *The West Coast Leader:*

Production, 1911-1912	53,324,534
Production, 1910-1911	53,087,689
Estimate for current year	60,000,000
Stocks of nitrate:	
June 30, 1911	14,625,248
June 30, 1912	13,695,311

Nitrate shipped for the year 1911-1912 was distributed as follows:

	Quintals.
Iquique	12,725,047
Mejillones	7,434,869
Antofagasta	6,927,453
Tocopilla	6,522,180
Taital	6,418,826
Caleta Buena	6,050,243
Caleta Coloso	3,403,415
Pisagua	2,861,897
Junin	1,910,541
Total	54,254,471

DUTIES on nitrate and iodine received by the Custom House at Valparaiso in 1912, representing the shipping ports of the Chilean nitrate industry, was $85,470,812 Chilean, equivalent in value to 36c. each gold.

New York Metal Market Review

February was a month of declines in metal prices, with copper leading and seemingly justifying a common belief that as copper goes so go the other metals. The latter part of the month found copper selling below 15c., almost the price of February 1912. Lead maintained its price despite a dull market. Spelter was subject to repeated declines, its price going lower than at any time in the previous 13 months. Antimony fell off, while aluminum dropped a few points, but only a few. The premium over the import cost of tin diminished, and prices receded from the 50c. level.

Copper

Following a market that had been uncertain, irregular, with very little business, and a steady trend toward further weakness, the large sellers of copper, on February 14, reduced prices of both Lake and electrolytic to 15c. cash for Lake, and 14.87½c. cash, New York, for electrolytic; equal to 15c. delivered cash 30 days. At these prices there was some shading of prices by holders of resale lots. With the lowering of price came the long-looked-for buying movement which it was predicted would take place as soon as the 15c. level was reached. Practically every important copper consumer in the country entered the market and bought, but despite all this the movement was disappointing. The attitude of the consumers was indicated by the fact that nearly all the copper bought was for quick delivery, and the purchasers not only proved that stocks were low, but also showed that faith in the market had not been fully restored. No one consumer took any exceptionally large quantity, but in the aggregate probably 50,000,000 to 60,000,000 lb. was taken. The buying soon subsided and the market resumed its uncertain course again. It looks as if the large selling agencies delayed too long the reducing of prices. Certainly, while the buying was good, it should have been better, and the fact was disclosed that consumers are determined to carry as little surplus supply as possible, just as the consumers of pig iron have been doing with that commodity. A further disappointing fact was that Europe did not take hold to the extent which had been hoped for on the announcement of the 15c. price. While foreign shipments in February were improved, it is believed that some of the copper shipped abroad is to be held pending the real awakening of demand. At the beginning of February the sentiment was bearish, the market dull, and copper for early delivery could have been had at close to 16c., especially from second hands. Future deliveries were selling below 16c. The report of the Copper Producers' Association, issued February 7, showing an increase of nearly 18,000,000 lb. in stock, was expected to precipitate an abrupt decline, but it did not occur. On the day previous to the report actual sales were made at 15.62½c. cash, New York, for prompt delivery metal. Prices hovered around this figure until the reduction came February 14. Despite their reluctance to load up with copper, American consumers are busy, and this constitutes the most hopeful note in the situation. Another is that consumers usually admit that they believe 15c. to be a fair price for copper. Exports from January 31 to February 21 amounted to 22,905 tons.

Lead

This metal was quoted, between February 1 and 21, without variance by New York sellers at 4.35c. New York and 4.20c. St. Louis. Dullness was a continuous feature in all this time. An effort was made early in the month by sellers in St. Louis to get slightly higher prices, and 4.22½c. was asked, but the move was not successful, as consumers found they could get plenty of lead at the lower price. Buyers appeared to be well supplied, and sellers were satisfied with conditions, and the market during the greater part of the month was without trend one way or the other.

Spelter

In February spelter lost over 50 points, there having been declines from about 6.80c. to 6.25c. New York. Indications were that still lower prices would be reached. Expectation of tariff change has affected spelter more seriously than some other metals, and with reason, in view of the fact that a few big galvanizers are using foreign spelter on products that are to go abroad and which are subject to a draw-back duty. The average price paid for brass-mill spelter in the Naugatuck valley in January was 7.56c. While the metal has repeatedly declined in price and February saw little new business, deliveries against contracts have been excellent, largely due to the quantities used by sheet mills. The lower price of the metal has naturally led to declines in prices of sheet zinc.

Antimony

There was little of interest in antimony throughout the greater part of the month. It is several points lower and was quoted February 21 at 9 to 9.25c. for Cookson's, 8.75 to 8.87½c. for Hallett's (8.87½c. being the import price), and 8.12½ to 8.25c. for Chinese and Hungarian grades. It is plain, as heretofore stated, that large quantities were bought on the rise of the market.

Aluminum

The light metal is quoted at 26 to 26.25c. for ton lots for remelting, guaranteed 98 to 99% pure. While the market is easier, it is off but a few points, and has held up well because of the heavy demand and the fact that the present sources of supply are taxed nearly to their full capacity.

Tin

Tin prices were sustained to a considerable degree in February through a fear that the excellent consumption and unprotected contracts would cause a shortage at the end of the month. In January 2700 tons was delivered into consumption, leaving stocks on hand, February 1, 1759 tons. In the first week of February unusually heavy sales were made, 600 tons having changed hands on February 4 alone. The business of the first week totaled at least 1200 tons, the deliveries ranging all the way to next August. Fair buying occurred on subsequent days also. At the beginning of the month the price left 50c. and has been down to 48.50c., standing February 19 at 49.25c. London prices have been as uncertain as ever, but declining rather steadily, a tendency which is attributed to bear selling. An example is the decline on London spot from £228 15s. January 31 to £219 10s. February 6. The imports this month to February 20 amounted to 2570 tons, and there was afloat at that time 4260 tons, with indications of about 3700 tons arriving in the entire month.

Cement manufacturers of the United States during 1912 had to put up with adverse business conditions during the first six months, and prices were lower than in 1911. Production from the various districts, as estimated by the U. S. Geological Survey, was as follows:

	Barrels.
Eastern Pennsylvania and New Jersey	24,449,523
Iowa and Missouri	7,557,090
California and Washington	7,258,542
Ohio and western Pennsylvania	7,239,775
Kansas, Oklahoma, central Texas	5,760,938
Maryland, Virginia, West Virginia, Tennessee, Georgia, Alabama	4,664,454
New York	4,490,180
Michigan and northeastern Indiana	4,519,726
Kentucky and southeastern Indiana	3,071,467
Colorado, Utah, Montana, western Texas	2,298,649

The total production was approximately 81,941,998 bbl., as against 78,528,637 bbl. in 1911, while stocks were reduced from about 12,000,000 to 9,200,000 barrels.

Calumet & Hecla has declared a quarterly dividend of $10 per share, payable March 20. Three months ago the dividend was $12 and one year ago $8. With the payment of this dividend stockholders will have received $121,050,000 in dividends since the formation of the company in 1871.

National Lead Co. has declared the regular quarterly dividend of 1¾% on preferred stock.

Market Reports

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	February 27.
Camp Bird Ltd	$ 4¾
El Oro	4⅛
Esperanza	7
Oroville Dredging	1¼
Santa Gertrudis	6⅝
Tomboy	8⅜

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. February 27.		Closing Prices. February 27.
Adventure	$ 3½	Mohawk	$ 48
Allouez	35	North Butte	25½
Calumet & Arizona	60½	Old Dominion	45½
Calumet & Hecla	445	Osceola	86
Centennial	13½	Quincy	68
Copper Range	44½	Shannon	10½
East Butte	12¼	Superior & Boston	3¼
Franklin	5¼	Tamarack	27½
Granby	59½	U. S. Smelting	38½
Greene Cananea, ctf.	7⅜	Utah Con.	9⅛
Isle-Royale	25½	Victoria	1½
La Salle	3⅛	Winona	2⅜
Mass Copper	4¾	Wolverine	65

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 27.

Atlanta	$ .17	Midway	$ .52
Belmont	7.00	Montana-Tonopah	1.60
Big Four	.89	Nevada Hills	1.17
Buckhorn	.90	North Star	.23
Con. Virginia	.17	Ophir	.19
Crown Point	.25	Pittsburg Silver Peak	.57
Florence	.46	Round Mountain	.40
Goldfield Con	2.30	Sierra Nevada	.12
Halifax	1.00	Tonopah Extension	1.77
Jim Butler	.74	Tonopah Merger	.81
Jumbo Extension	.31	Tonopah of Nevada	6.00
MacNamara	.20	Union	.10
Manhattan Consolidated	.08	West End	1.27
Mexican	.72	Yellow Jacket	.21

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, February 27.

Associated Oil	$42.50	Monte Cristo	$ .81
Brookshire	.50	New Pa Pet	.42
Caribou	.90	Palmer	.16
Claremont	.60	Palmer Union	.18
Coalinga Central	.20	Premier	.30
De Luxe	.60	Republic	.15
Maricopa 36	.33	United Oil	.32
Maricopa National	.20	W K Oil	1.95

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. February 27.		Closing Prices. February 27.
Alaska Mexican	$12¼	McKinley-Darragh	$ 2
Alaska Treadwell	43	Miami Copper	22¼
Alaska United	24½	Mines Co. of America	3⅛
Amalgamated Copper	67¼	Nevada Con	16⅜
A. S. & R. Co	68½	Nipissing	8⅛
Braden Copper	8½	Ohio Copper	⅝
B. C. Copper Co	3⅜	Ray Con	17⅜
Chino	36½	Tenn. Copper	37
First National	2	Tonopah Belmont	7
Giroux	2½	Tonopah Ex.	1⅜
Goldfield Con	2½	Tonopah Mining	5¼
Greene-Cananea	—	Trinity	4½
Hollinger	16	Tuolumne Copper	2⅜
Inspiration	16½	Utah Copper	52
Kerr Lake	3⅛	West End	1½
La Rose	2⅛	Yukon Gold	3
Mason Valley	8		

ASSESSMENTS ON COMSTOCK MINES

Company	No.	Del. Board	Sale Day	Amt.
Belcher	99	Feb. 3	Feb. 28	.10
Gould & Curry	24	Feb. 4	Feb. 28	.03
Con Virginia	23	Feb. 7	Mar. 4	.15
Utah	16	Feb. 21	Mar. 18	.05
Overman	41	Mar. 14	Apr. 8	.05
Alta	82	Mar. 20	Apr. 14	.05

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco, February 27.

Antimony	12—12½c	Quicksilver (flask)	41
Electrolytic Copper	18—18½c	Tin	53½—54c
Pig Lead	4 60—5.55c	Spelter	8¼—8⅜c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, February 27.—Copper is now quiet and steady, sellers being comfortably sold ahead are not pressing the market. Lead remains unchanged. Spelter prices are easier, consumers not buying for the future. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Feb. 20	14.45	4.33	6.10	61⅜
" 21	14 15	4.33	6.10	61⅜
" 22	Holiday.	No market.		
" 23	Sunday.	No market.		
" 24	14.45	4.33	6.10	61
" 25	14.45	4.33	6.10	60⅜
" 26	14.45	4.33	6.10	60⅛

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
February	1912	66,280,643	153,820,800
March	"	62,939,988	141,126,680
April	"	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	.....

UNITED STATES PRODUCTION AND CONSUMPTION

	Production.	Domestic deliveries.	Exports.
January 1912	119,837,753	62,343,901	80,167,904
February	116,035,809	56,228,368	63,148,096
March	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	63,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600
August	145,628,521	78,722,418	70,485,150
September	140,089,819	63,460,810	60,264,796
October	145,405,453	84,104,734	47,621,342
November	134,695,440	69,669,795	55,906,550
December	143,353,280	58,490,880	65,712,640
January	143,479,625	65,210,030	60,283,845

SILVER

Below is given the average New York quotation, in cents per ounce, of fine silver for the months indicated:

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	....	Sept.	62.95	....
Apr.	59.20	....	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations in cents per pound:

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch	14.68	....	Sept.	17.56	....
Apr.	15.74	....	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. Below are the average New York quotations by months:

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	....	Sept.	5.00	....
Apr.	4.20	....	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	....	Sept.	7.45	....
Apr.	6.63	....	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	....	Sept.	42.12	....
Apr.	42.25	....	Oct.	41.50	....
May	41.75	....	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations in cents per pound:

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	....	Sept.	48.64	....
Apr.	43.92	....	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.60
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	3.00	4.35
Borax, powdered, bbl., ℔ 100 lb	3.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.50	13.50
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	11.50	13.50
Litharge, com'l, ℔ 100 lb	8.00	9.50
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—½% Fe)	36.00	47.50
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.10½	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.55	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	9.75	11.00

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.05	0.05½
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	450.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Sulphur, 80%, ℔ ton	16.50	18.50
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	475.00	500.00
Tungsten ore, 65%	450.00	600.00
Vanadium ore, 15% V_2O_5, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

Company Reports

ASSOCIATED NORTHERN BLOCKS (W. A.), LTD.

This company owns 48 acres of mining property at Kalgoorlie, 93 at Ora Banda, 40 miles from the former centre, and 112 acres at El Refugio, Mexico. The mine at Kalgoorlie is now practically in the hands of lessees, the mill having been on custom ore for the past two years; the new mill at Ora Banda is in full operation; while in Mexico, the revolution has caused a suspension of work and it is proposed to lease the mine on a royalty basis.

The orebody in the Associated Northern mine is that well known shoot which outcropped in the Brown Hill lease, passed through a corner of the Brown Hill Extended and Cygnet leases, entered the Iron Duke at 360-ft. depth, leaving it and entering the Oroya North Block at 550 ft., and entering the Associated property at about 900-ft. depth, the full distance being about 2600 ft. It may be described as a pipe-like shoot of lenticular cross-section, the major axis of the lens dipping west about 30°, while the general course of the pipe, on plan, is nearly due south, with a descending pitch in that direction of about 1 in 3. The core of this shoot was very rich, containing large quantities of tellurides and free gold. In the mines mentioned, save a little ore in the Associated Northern and Oroya, the shoot has been worked out, after producing approximately 1,400,000 tons of ore, yielding $33,000,000, and paying $15,000,000 in dividends, the figures for the company under review being 347,395 tons, worth $8,000,000, and yielding $3,300,000 in dividends.

During the year ended September 30, 1912, the Kalgoorlie mill treated 27,768 tons of mine and custom ore, worth $480,000, the profit being $82,000. The Oro Banda mine has been equipped with a plant capable of treating 300 tons per day, comprising rock-crusher, Huntington mills, grinding-pans, pulp-thickeners, Ridgway vacuum-filters, and zinc-shaving precipitation. It is driven by two 108 and one 37-hp. Tangye gas-engines. The mine is equipped for work to 600-ft. depth, and ore reserves total 200,000 tons, worth $4.80 per ton. On No. 4 level a rich oxidized ore formation was recently cut, the drift being out 160 ft., the last 20 ft. averaging $55.20 per ton, over a width of 5 ft. Costs at this new mine are: mining, $1; treatment, $1.26; and general expenses, $0.25 per ton. El Refugio mine has 60,000 tons of ore worth $10.20 per ton, in the proportions of gold 60% and silver 40%. During the year, 987 ft. of development was done, including 501 ft. of drilling. In connection with the latter work, a firm in Mexico City had a contract to drill 2000 ft., but at 920 ft. they suddenly quit the district and actually left in the hole their diamond-drill and 315 ft. of rods. G. M. Roberts is manager in Western Australia, and W. E. Simpson in Mexico.

MINERALS SEPARATION, LTD.

This company was formed in 1903 to carry on metallurgical operations, and the purchase price of certain patents was $120,000. Plants with a large capacity are at work at the Sulphide Corporation's Central mine, the Zinc Corporation's plant at Broken Hill, and the Great Fitzroy copper mine, Queensland. The authorized capital of the company is $240,000. The seventh annual meeting was held in London on December 20, 1912. During the year the Minerals Separation and De Bavay's Processes Australian Proprietary, Ltd., in which the company's Australian interests have been merged, was incorporated, and took over the Australian staff and business on July 1. Business anticipations have been realized and a dividend of 10% per annum has been declared on the first quarter's work. The Minerals Separation American Syndicate has renewed its option for another year, as from October 10, 1912, on payment of $24,000. Prospects of this subsidiary are promising. Two important licenses have been granted, tests undertaken, and contracts for others are in process of negotiation. At the Braden mine, Chile, results have been satisfactory; and the Braden company has not only refunded the outlay incurred by the Minerals Separation, but has ordered a plant to treat 3000 tons of ore daily, the first unit of 600 tons being at work. In Sweden, a 150-ton plant has been erected at a well known mine, and profits are now being made. As regards litigation, the Australian amalgamation has settled all pending actions to which this company was a party, and has strengthened the position against future attempts at infringement. In the action brought against Mr. Hyde for infringement in the United States, much evidence has been taken, and the suit will be heard at Butte before March. Research and experimental work is being carried on with good results. During the year ended December 31, 1911, the revenue from royalties and profits from tailing treated was $130,000, and sundry, $4600. Management, traveling, examinations in England and abroad cost $77,000; patent renewal fees, $11,000, London adminstration $27,000, and depreciation, $4700, leaving a balance of $14,900.

Costs at the Ivanhoe Mine, Kalgoorlie

Work at this important mine consists of development down to a depth of 2600 ft., and stoping ore on one to four lodes down to 2420 ft.; treating the ore in a 100-stamp mill, embodying concentration, grinding in pans and tube-mills, separation, cyaniding sand by percolation, slime by bromo-cyanide, and filter-pressing; and roasting of the concentrate, followed by agitation and filter-pressing, all gold being precipitated on zinc shaving.

COST PER TON TREATED

Treatment:		Mining:	
Rock-crusher	$0.08	Breaking ore	$1.25
Ore transport	0.03	Filling stopes	0.26
Stamping	0.40	Tramming and hoisting ore	0.48
Concentrating	0.14		
Roasting concentrate	0.12	Mine total	$1.99
Grinding "	0.03		
Cyanding "	0.10		
Grinding sand	0.15	Development	0.58
Cyaniding "	0.18	General expenses	0.33
Agitating slime	0.38	Charges on bullion	0.09
Filter-pressing	0.14	Buildings, equipment	0.08
Precipitation, clean-up	0.08	Total cost	$5.02
Disposal of residue	0.12		
Mill total	$1.95		

PREMIER DIAMOND CO. treated 9,707,098 loads, of 1600 lb. each, during the year ended October 31, 1912, yielding 1,992,474 carats of diamonds, or 0.205 carat per load. The value per carat was $4.83, making the value of production $9,623,650. The value per load was 99c., and cost 57c. for treatment. The yield is 218,268 carats greater than in 1911, but the value per carat is 96c. higher. The profit for the year was $3,350,000, of which the Union Government of South Africa gets 60% and the shareholders 40%. In commemoration of the tenth year of its existence, the company has created a provident and pension fund, which will provide for those who grow aged or incapacitated in the employ of the company. The fund has $400,000 to start with.

MINING in Portugal is receiving more attention, although as yet the results are not large. The Government is desirous of exploiting and opening up the mineral wealth of the country and has consequently reduced the tax on mining from 3 to 2%, and has offered a reduction of 20% in the freight rates on government railroads to any concern shipping 25,000 tons of ore from one locality within one year. The total mining output of Portugal for 1911 was valued at $1,889,670. The production of tungsten, in which Portugal leads the rest of Europe, amounted to $438,650, while the production of copper was valued at $437,737, and the production of sulphur ore netted $620,454. The mines of Portugal are still largely undeveloped.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

COPPER production of Canada in 1912 was 33,000 long tons.

CONDENSING steam requires about 30 lb. of water to 1 lb. of steam.

COPPER production of Peru in 1912 was 27,400 long tons, as against 26,000 in 1911.

SLIDES at the Panama canal during January will necessitate the removal of about 1,000,000 cu. yd. of additional ground.

LUMBER production of the United States in 1912 was approximately 40,000,000,000 ft., of which 14,144,000,000 ft. was yellow pine.

FLOTATION treatment of copper ore at the Great Cobar mine, New South Wales, requires about ½ lb. of eucalyptus oil per ton treated.

FUSEL OIL is produced in considerable quantities from molasses in a plant at Toronto which treats 30,000 to 40,000 tons of the latter product per year.

RADIUM-BROMIDE is prepared in Sydney, Australia, by the Radium Hill Co., which has produced 2.5 mm. of a purity of 1,800,000 to 2,000,000 radio-activity. In the laboratory there is 350 mm. in various stages of purity.

MINERAL PRODUCTION of British Columbia to the end of 1912 totals $403,303,000. From 1852 to 1902 it was $189,729,000; and from 1902 to 1913 it was $240,574,000. Coal production of Vancouver Island in 1912 was 1,553,000 tons.

RAILROADS of the United States added to their equipment in 1912, 148,357 freight cars, 238 passenger cars, and 4677 locomotives, as against 72,161, 4246, and 3530, respectively, in 1911. During the year, 4072, 2822, and 238 were exported.

AMMONIA SULPHATE production in 1912 was: Germany, 465,000 tons; England, 379,000; France, 68,500; Belgium, 49,500; United States, 165,000; Austria-Hungary, and the rest of Europe, 170,000; the total for the world being 1,300,000 tons.

KOREA, which has a population of 11,000,000 people, has only 7 automobiles, the latest one being purchased by an American mining man to use in inspecting mining properties. This country has an area of 71,000 square miles, but has few good roads suitable for motor cars.

SCUM gathered from the surface of water and treated with hydrochloric acid to find out whether it is iron oxide or oil, may be tested by a less cumbersome method by giving the scum a sharp blow, when, if iron oxide, it breaks into permanently separate angular flakes. If the scum be oil, these soon flow together again and appear as before.

BELL CONES, mentioned by Alfred James in 'Progress in Gold-Silver Ore Treatment in 1912' in the *Mining and Scientific Press* of January 4, are used at the Palmarejo & Mexican new mill for feeding tube-mills. They are similar to Caldecott cones, but have a conical drum inside in place of a diaphragm. In point of date, they are perhaps earlier than the Caldecott type, and are the invention of J. W. Bell, of the McGill Metallurgical Laboratory, Montreal, Canada.

CATERPILLAR traction-engines have been used in a number of places where by reason of the presence of sand or soft bottom, haulage by ordinary means was impossible or difficult. A recent unusual application of the caterpillar is to a Bucyrus drag-line excavator used for stripping phosphate rock at Mount Pleasant, Tennessee. It is reported to work satisfactorily, even in mud half-way up the frames. On the Los Angeles aqueduct a large number of caterpillar engines were used on the desert. While demurrage and repairs were high, such extensive haulage by mules over the desert would have been nearly impossible.

TAILING resulting from milling a given block of ore cannot all be replaced in a mine in the stope from which the ore originally came. This becomes apparent when it is considered that a cubic foot of solid quartz weighs 165 lb., whereas a cubic foot of quartz sand weighs about 106 to 110 lb. This indicates that only about two-thirds of the tailing can be replaced in the stope. This, however, in California mines, would in most cases be no great disadvantage, as almost every mine has already extensive open workings into which the extra one-third of the sand could be stored, so that it would, generally speaking, be a long time before the excess output of the mill would become troublesome.

SEWAGE generally consists of 998 parts of water, 1 of mineral matter, and 1 of organic matter, the germ life being contained in 0.1 of 1% of organic matter. In the Chemulpo sewage disposal system, the Moore filter is used with success. Not over 15-in. vacuum is maintained and discharged cakes contain 40% moisture. This system requires 240 sq. ft. of surface per 1,000,000 gal. of sewage per day, and one man can handle 1,000,000 to 30,000,000 gal. per shift, the cost being $5.50 to $7.50 per 1,000,000 gal. treated. Sand filtration requires one acre for 30,000 gal. per 24 hr.; and continuous filters, the sewage having been previously treated by some process, will deal with 500,000 to 2,000,000 gal. per day.

SAND FILLING of stopes involves consideration of the angle of dip of a vein, the method of mining in vogue, and the situation of the available sand deposit, or the mill from which the tailing flows with relation to the shaft or other passage through which the sand must pass to the underground workings to be filled. In Westphalia, Germany, the workings of the Shamrock mine are 1900 ft. deep, and sand is carried 1500 ft. horizontally from the shaft underground and deposited. At the Myslowitz colliery, 3000 tons of sand per day is sent below, to fill openings in coal seams from 8 to 37 ft. thick. The sand is sent down through two bore-holes, one 780 ft. and the other 1100 ft. deep, from which it is distributed to the openings. In many collieries crushed rock is used instead of sand.

GOLD LEAF is made by a new process, introduced by a London firm, in which a highly polished aluminum ring about 5 ft. diam. and 5½ in. wide is covered with an adhesive substance, such as a solution of gum, and is allowed to dry. The adhesive surface is dusted with metallic powder so that it is covered with a very thin layer of base metal. This layer is polished and the ring is coated slowly with its lower surface in contact with a solution of nickel salt, the ring being connected with one pole of a battery, while the other pole is immersed in the nickel solution. An electro-deposit of nickel is thus produced on the polished layer of base metal. The nickel deposit is washed and the ring is rotated with its surface in contact with a solution of gold, the electrical connections being as before, so that the latter metal is electroplated on the nickel. There are thus four layers on the periphery of the ring, namely, gum, base metal, nickel, and gold, but each layer of metal is so thin that the combination is said to be even thinner than the best gold leaf. To remove the aluminum ring, a transverse cut is made in the continuous film, and, starting from this cut, the ring is rotated slowly with its lower part immersed in a liquid which dissolves the adhesive substance, when the film falls from it and is received upon a band of paper traveling at the same speed as the periphery of the ring. The film and paper are then cut up and made into books.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

TAXATION OF MINING COMPANIES

A company engaged in the business of drilling for and extracting oil is held to be following a mining pursuit within the meaning of the statute levying a license tax upon persons, firms, or corporations engaged in the business of selling timber and minerals from the soil.

Etchison Drilling Co. *v.* Flournoy, (Louisiana) 59 Southern 837. November 4, 1912.

GAS LEASE—ASSIGNMENT ADMITTED

Where the gas leases on which defendant was sued, as assignee, were in its possession when plaintiff directed its president to execute certain contracts with reference to drilling other wells on the land, a recognition in the contracts that the land was held by defendant under an assignment must be considered as an admission by it of such assignment.

Indiana Nat. Gas & Oil. Co. *v.* Duling, (Indiana) 100 Northeastern, 96. (Dec. 13, 1912.)

INSUFFICIENT DISCOVERY

The location of a lode mining claim must be supported by the discovery of the vein or lode within the limits of the claim located: and the exposure of substantially worthless deposits on the surface of a claim which from observation and geological inference are supposed to indicate that other and unconnected veins or lodes lie at a greater depth, does not constitute a discovery within contemplation of the law, and is not a sufficient basis for a valid location. Obviously, the words "the vein or lode" can only refer to the lode which it is expected to develop and mine, and cannot refer to disconnected bodies of ore of no possible value in themselves.

East Tintic Consolidated Mining Co. (on rehearing), 41 Land Decisions, 255. September 5, 1912.

ASSOCIATION PLACER—RIGHTS BEFORE DISCOVERY

The law does not require assessment work to be done on each 20 acres of an association placer claim. An entry upon a mining claim before a prior locator is in default cannot be made for the purpose of making a provisional location to be valid in case the prior locator fails to do the annual work. When six of the eight association locators agree after the location of the claim and discovery of gold thereon to give one of the remaining locators more than a 20-acre interest, such agreement does not invalidate the location. The law gives to the locator of mineral ground before discovery, and while he complies with the federal and local statutes and regulations, the valuable right of possession against all intruders, and this right he can convey to another.

Rooney *v.* Barnette (Alaska), 200 Federal, 700. (Oct. 7, 1912.)

MINING CASE—LIABILITY OF CO-LESSEE

Plaintiff owned a two-thirds and defendant a one-third interest in a certain mining lease. Plaintiff agreed orally with defendant to assign to him one-half of his two-thirds interest in the lease in consideration of defendant's paying one-third of the expense of performing the annual work on seven claims as required by the terms of the original lease. Thereupon plaintiff executed the assignment and delivered it to the defendant and went ahead with the assessment work. Defendant sought to evade payment of the one-third of the expense on the grounds that his contract with plaintiff was not in writing, but the court held that even were this so, the defendant was nevertheless liable under the original lease for one-third of the expense of assessment work, and gave judgment for plaintiff accordingly.

Girton *v.* Daniels (Nevada Supreme Court). Feb. 1, 1913. (Not yet reported.)

Self-Starting Direct-Current Motors for Driving Mine Pumps and Fans

The electric motor has proved so thoroughly satisfactory for driving mine pumps and fans that it seems almost impossible to improve it. It can be placed wherever a pump or a fan can be set; a couple of wires supply it with the power it needs; and while running it requires no attention whatever beyond occasional inspection and oiling. In fact, motors have proved themselves so useful and economical that they are rapidly displacing all other forms of power for fan and pump service wherever electricity is available. An improvement has, however, been recently developed which greatly increases the value of motors for mine work. This improvement consists in making the direct-current motor self-starting.

Heretofore, while it has been possible under some conditions to start them from the power-house, most motors driving mine pumps and fans had to be started by hand. Hence, if the power went off temporarily for any reason, the motors stopped, necessitating an attendant going to each station to start them again.

With the new self-starting D.C. motors, this inconvenience is done away with. When the power fails, the motors stop, but as soon as the power comes on again, the motors start automatically and settle down to work as though nothing had happened. Moreover, starting boxes are rendered unnecessary, and the wiring is of the simplest possible character. An occasional visit of inspection is now all the motors require. Otherwise they can be left entirely to themselves.

These motors have been thoroughly tried out in practical service and their users are commending them highly, as is shown by the number of repeat orders the manufacturers are obtaining. The electrical characteristics of the self-starting motor differ but little from those of the usual type, the only alteration being in the use of a heavier compounding winding which reduces the flow of current when starting. Mechanically, there is no change. Self-starting motors are made by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania, in ratings up to 20 hp. for the voltages usually employed in mine work. They can be supplied for all kinds of fan and pump service.

A New Smoke-Helmet

At Engine House No. 1, of the San Francisco Fire Department, some interesting tests were made on January 17 with the Chapin smoke-helmet, the patented invention of C. E. Chapin of that city. There are already several good types of helmets and apparatus in use which depend on chemicals for a proper supply of oxygen for the wearer and for the absorption of CO_2 expelled from the lungs. The Chapin apparatus uses air and is rather simple, an important consideration in rescue operations. It consists of the following: A pair of cylinders about 3 by 12 in., by ⅛ in. thickness of pressed steel, tested to 3400 lb. pressure, but safe with a working pressure of 2000 lb. per square inch, such as are used to store nitrous oxide gas for dentists. The pair is clamped and strapped together on the back, and each is fitted with a safety valve and a regulating valve for supply to the helmet. The latter valve may be set to any desired quantity, or may be regulated at will by the user. The cylinders are charged with air to 1700 lb. pressure, and will supply a man for 40 minutes, or if working hard, about 30 minutes. The helmet consists of close canvas lined with thin rubber sheeting, in which are inserted two 'eyes' of glass and a small valve which is placed just about opposite the user's mouth, and is adjusted so that it requires no effort to expel the CO_2 breathed out. The helmet is strapped around the neck and is attached to the air-receivers by a flexible metallic tube of about ⅛-in. bore. In operation, the air from only one receiver is used at a time, and this expands in the helmet when turned on, and regulating is easily done, as shown in the accompanying cut. The whole apparatus weighs 22 lb., and costs about

$100. At the engine-house, a concrete building about 12 by 24 by 10 ft. was used in the tests, and in it was burned a mixture of oily cotton waste, straw, sulphur, and cayenne pepper, which made a dense fume through which objects were not visible more than two feet. Tests lasted five and six minutes each, and the wearers of the helmet emerged

CHAPIN SMOKE-HELMET.

from the fume without having felt any discomfort either from heat about the head, smell of the fume, or lack of air-supply. A fire call put an end to further tests for the day. On the transport *Logan* a 20-min. test was made in a similar mixture, with equally satisfactory result. Around mines, there is room for a simple contrivance such as this. Oxygen may be stored in the cylinders, but air is better, and, where compressed-air locomotives are used, high-pressure air is available.

Commercial Paragraphs

THE BALBACH SMELTING & REFINING CO., of Newark, New Jersey, has installed at 4½-ft. Hardinge conical ball-mill to replace a battery of ten stamps.

The H. W. JOHNS-MANVILLE Co. announces the removal of its Newark, New Jersey, office to 239 Halsey street. Also that it has opened a branch office in the Dooly block, Salt Lake City, Utah.

HARDINGE CONICAL MILL CO., of New York, has received orders for two 8-ft. Hardinge patent conical pebble mills from the Butte & Superior Copper Co., of Montana, and for three mills of the same size from the Commonwealth Mining & Milling Co., of Arizona.

L. L. SCOTT, of St. Louis, is introducing a new gasoline drill made in four sizes and ranging in weight from 35 to 265 lb. The drilling engine works on the two-cycle principle, the hammer piston, made of vanadium steel, being acted upon directly by the explosive mixture. The piston is drawn back by the stored energy of a fly-wheel. Either solid or hollow steel may be used and the hole may be cleaned by the gases of explosion driven through the hollow steel. It is claimed that the largest machine will drill 3 to 15 inches per minute with a gasoline consumption of one gallon in five hours.

THE GANDY BELTING CO., Baltimore, Maryland, reports the following performance of an 8-ply 26-in. Gandy belt at the plant of the Bessemer Fire Brick Co. of Birmingham, Alabama. The above belt has been in operation for over 27 years, during which time the plant has not been shut down except for repairs to the machinery. The driving belt recently pulled out at the old lace holes, where leather lacings were formerly used and later changed to belt hooks. This is the first time the belt has given any trouble in the manufacture of over 140,000,000 fire-bricks that have been turned out during its service. The owners are simply splicing on a new piece of belt to repair the damage and the belt has continued in service and looks good for a long time to come.

The telephone, though only thirty-seven years of age, has probably developed more in that short time than any of its humanity-helping contemporaries. Its history has been shown in an interesting way by the exhibit of historical and modern telephone apparatus and supplies recently inaugurated at New York by the WESTERN ELECTRIC Co. The historical section shows the development of the telephone from its earliest stages up to the present time. The smoked-glass records of sound waves made by Alexander Graham Bell, in 1874, using the human ear as a transmitting diaphragm and thus proving that diaphragms would transmit sound waves; parts of Bell's original telephone of 1876, mounted to make a complete model, and numerous instruments showing the gradual improvement in design, are exhibited to great advantage in large glass cabinets with placards giving a description of each article. Included in the historical collection, which is composed partly of apparatus loaned by the American Telephone & Telegraph Co. and partly of Western Electric apparatus, are the switchboard used by Mr. Bell in opening the New York-Chicago line in 1892, and the receivers and transmitters used at the opening of the New York-Denver line in 1911. The modern apparatus section contains switchboards, magneto, and central battery, each switchboard having wired to it a number of telephone sets, so that service demonstrations may be made to visitors.

Catalogues Received

OTIS ELEVATOR Co., New York. 'Incline Railways.' 28 pages. Illustrated. 6 by 9 inches.

THOMPSON BALANCE Co., Denver, Colorado. 'Precision Balances and Weights.' 28 pages. Illustrated. 6 by 9 inches.

DENVER FIRE CLAY Co., Denver, Colorado. Bulletin No. 115. 'Case Oil Muffle Type Furnaces.' 6 pages. Illustrated. 6 by 9 inches.

A. C. CAMERON STEAM PUMP WORKS, 11 Broadway, New York. Booklet on Cameron steam pumps. 48 pages. Illustrated. 3 by 5 inches.

W. S. TYLER Co., Cleveland, Ohio. Catalogue No. 40, describing Tyler wire cloth and screens. 115 pages. Illustrated. 8 by 10 inches.

CHALMERS & WILLIAMS, Chicago Heights, Illinois. Pamphlet describing the 'Torpedo Conveyor.' 4 pages. Illustrated. 6½ by 6 inches.

SPRAGUE ELECTRICAL WORKS, 527 West 34th St., New York. Pamphlet No. 117, 'Sprague Electric Products.' 24 pages. Illustrated. 4 by 9 inches.

JEFFERY MFG. Co., Columbus, Ohio. Bulletin No. 46. 'Jeffrey Swing Hammer Pulverizer for Laboratory Use.' 4 pages. Illustrated. 6 by 9 inches.

FORT WAYNE ELECTRIC WORKS, Fort Wayne, Indiana. 'Fractional Horse-Power Motors and Their Applications.' 28 pages. Illustrated. 8 by 11 inches.

JOSEPH DIXON CRUCIBLE Co., Jersey City, New Jersey. 'Production Catalogue' describing the Dixon line of graphite products. 100 pages. Illustrated.

CENTRAL FOUNDRY Co., 90 West St., New York. Booklets describing 'Universal Pipe' and the equipment needed for laying same. Illustrated. 3½ by 6 inches.

CENTRAL FOUNDRY Co., 90 West St., New York. Reprint of article entitled 'High Pressure Fire Mains in Philadelphia.' 4 pages. Illustrated. 3½ by 6¼ inches.

CHICAGO PNEUMATIC TOOL Co., Fisher Bdg., Chicago. Bulletin No. 124, 'Pneumatic Riveting, Chipping, Calking, and Stone Hammers.' 24 pages. Illustrated. 6 by 9 inches.

EDGAR ALLEN AMERICAN MANGANESE STEEL Co., McCormick Bdg., Chicago. Bulletin No. 55, 'Steam-Shovel and Dipper Dredge Repair Parts.' 20 pages. Illustrated. 6 by 9 inches.

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H. FOSTER BAIN - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

"THIS is a day not of triumph; it is a day of dedication," said Mr. Woodrow Wilson on taking his place as President of the United States. A keynote so suggestive of Lincoln's mental attitude augurs well for the new administration.

AMENDMENT to the Arizona miners' lien law is proposed, to the extent that an owner may be relieved from debts incurred by lessees, on posting conspicuously on the property a notice disclaiming such responsibility; an entirely proper provision.

SCIENTIFIC men of the Pacific coast will meet at the University of California April 10, 11, and 12, in connection with the sessions of the Pacific Association of Scientific Societies. The Cordilleran Section of the Geological Society of America will hold sessions on the days mentioned.

EXTRALATERAL rights are a perennial source of trouble, and mining men are generally in favor of their abolishment. We are glad to present this week an informing discussion by Mr. L. G. Campbell, who treats the subject from the point of view of a lawyer thoroughly familiar with the imperfections of the present law.

ALASKA, after many years of waiting, now has a legislature. The eight senators and eight representatives who constitute the new legislative body, assembled at Juneau for formal organization March 3. No doubt errors will be made, but it is good American doctrine to let each one make his own mistakes, and there are many points of law that none but a local assembly could ever be expected to rectify.

ESTIMATED February production of the Goldfield Consolidated Mines Company was 26,970 tons, of which the gross value was $513,000, the operating expense $165,000, and the net realization $348,000. Final figures for February showed a production of 27,169 tons, gross value $535,736, and net realization $327,956. These figures would be considered excellent for any property except the Goldfield, which has spoiled its friends by doing so unusually well. We are glad to note that payment of dividends has been resumed.

REFERENCE to the Bully Hill smelter in the report by Mr. J. Nelson Nevius, on another page, brings up the matter of electric smelting, since the Bully Hill company has been experimenting both with this process and with leaching. We understand that excellent progress is being made in the development of a wet process for handling the complicated

copper-zine ore found at Bully Hill, and we hope that it may soon be put in operation on a full working scale. In the meantime one of our cherished desk ornaments is a small ingot of zine made from California ores by the wet proeess now undergoing trial. Sueeess of sueh a method of treatment will go far toward solving present smelting troubles.

ENGINEERS in San Franeiseo organized last May a luncheon club where men of all branehes of the profession might meet and strengthen aequaintanee. Permanent quarters at the Palaee Hotel being unavailable, rooms have been found in the Balboa building and will be promptly fitted up for regular headquarters, with serviee from an exeellent eafé in the same building.

VETO of the Sundry Civil Bill by Mr. Taft leaves the Geologieal Survey, Bureau of Mines, and many other important branches of the government serviee without funds after June 30 next. Fortunately it has already been announced that a speeial session of Congress is to be ealled, and doubtless provision will be made for enaetment of a new bill. The difficulty eould be easily avoided by Congress giving the President the right to veto individual items in a bill, as is done in many states.

SOUTH AMERICANS propose the formation of an A B C *entente* to include the Argentine, Brazilian, and Chilean republics. Sueh an allianee of the three great countries to the south would make greatly for peaee and stability on the neighboring continent, and, while to South Americans it makes its strongest appeal in that it would form a power strong enough if necessary to oppose the United States, we believe it would be weleomed by North Americans. In the light of our occasionally unfortunate diplomatic history, it is hard for South Americans to believe that their big brother of the north only wishes peaee and stability with the conquests of commerce rather than polities. Anyone who knows intimately the people of the United States, however, realizes that this is true, however poorly informed our people may be as to South American affairs and however obsessed with the notion of an indefinitely enlarged Monroe doctrine.

Settling Smelter-Fume Problems

Litigation over smelter-fume damage has been in reeent years a prolifie souree of annoyanee and expense to smelting eompanies, especially those operating in the Western states. On another page Mr. J. Nelson Nevius re-tells the story of the contest in Shasta county, California, and deseribes the present conditions—only one plant running and it operating at increased eost and deereased capaeity with still murmurs of diseontent. This is a serious matter not only to the smelting men, but to the miners who, in deereased market and higher treatment charges, must ultimately pay the bill. How far-reaching are the results is illustrated by the eireumstanee that the Chamber of Mines and Oil at Los Angeles, several hundred miles from the affeeted district, employed an engineer to study and report on the situation because of its influence on mining in general. Mr. Nevius, in his report, presents both sides of the case. No one familiar with the situation ean doubt that the smelters have in recent years made earnest effort to prevent damage from fume. To a large extent they have been suceessful, and yet there are persistent opponents of the smelting companies who stoutly maintain that not only is damage being done, but that the smelters are not in good faith attempting to prevent emission of damaging fumes. Smelting men feel that in this they are misjudged, and that the bulk of the present claims for damage are from professional 'smoke farmers.' They point to the fact that in many eases men, extremely solieitous as to damage to crops and who eomplain loudly as to the nuisance arising from odors, beeome contented tenants when they have sold their lands to the smelting companies at a good price. In the Deer Lodge valley of Montana, the Amalgamated company has itself gone into agriculture in the midst of the smoke belt, and prizes for animals, fruits, and vegetables raised on the company farms are regularly won at agrieultural exhibitions. We have heard of dead eattle being purchased and hauled at night to farms in the smoke belt where a plausible claim for their death might be laid. We have also heard of furnaees that gave a much higher duty at night, when smoke could not be seen, than in the day time. There has been entirely too much of misinformation, misunderstanding, and perhaps of sharp practice, and we are glad to see signs of a much better order.

Managers of smelting plants now make much more effort, and more sympathetie effort, to understand the damage done by fumes. The large companies maintain on their staffs agricultural chemists, soil experts, botanists, and foresters, and attempt to know for themselves the exact measure of damage. As might naturally have been antieipated, they find that the smelters have been eharged with, and have frequently paid for, damage due to frost, drouth, hot winds, inseets, and a large number of other eauses. This has naturally made them skeptieal as to damage elaims. Generally speaking, they are willing and ready to pay for any real damage, and merely ask that the relative value of the smelting industry and the damage done be weighed in determining whether a plant must be elosed. Unfortunately, perhaps, the matter is not so simple from a legal point of view. No one has the right to maintain a nuisanee, regardless of the value of the resulting produet. Residents in an aristoeratic suburb resent establishment of a livery stable or a pig-sty on a neighbor's front lawn, and the farmers in Salt Lake valley felt the same about the eoming of the smelters. Relative value does not enter into the question: it is merely a question of faet as to whether the smelter is a nuisanee.

Damage from smelter fumes arises, broadly, from four sourees: (1) Minute particles of poisonous substanees, sueh as arsenie or lead, spread broadeast through the air; (2) dust of any nature which operates mechanieally to injure buds and young fruit or other tender parts of growing plants; (3)

SO_3, which, in moist air unites with water to form sulphuric acid; (4) SO_2, which, under certain conditions, also injures plant life, though to a less extent. In addition, there is in instances the matter of offensive odors. There is little question that in the past large damage was locally done by emission of arsenic and similar metallic particles. These can and should be precipitated and saved; fortunately, this may usually be done at a profit. Inert dust from smelters is no worse than that raised by winds or emitted from other industrial plants. The damage is of the same sort as is created by black smoke in cities. It can be largely prevented at a not prohibitive cost, but there is room for a 'rule of reason' in the speed of abatement of this nuisance. The sulphur fumes are best handled by utilizing them to make acid. Unfortunately, this is not economically feasible at many points. The SO_3 can be neutralized and precipitated or caught in bag-houses as a sulphate. It may also be directly precipitated by the Cottrell process of electrical precipitation. It is probably not unreasonable to ask that it be so treated. The SO_2, however, affords another problem. It is more abundant and harder to treat. At present there is no widely applicable method of neutralizing it. At the Ashio smelter in Japan milk of lime is used with fair results, and at Campo Seco the Thiogen process is being developed. At most plants the only feasible plan now open is to dilute the fume by blowing additional air in at the bottom of the stack. The result is perhaps not entirely satisfactory, but it must be remembered that the amount of damage due to SO_2 is uncertain and probably small. The matter of odors is one into which the personal equation enters largely. On San Francisco bay it was found that the odor came, not from the smelting plant, but from the oil refineries, and in general, complaints on this score are not important.

The smelting companies have been spending large sums to get at the bottom of these various matters and are conducting extensive experiments at present. They are as anxious to avoid or minimize damage as any one. One especially commendable move lately made has been to join in creating non-partisan investigating commissions of technical men to study the particular plants, to recommend any changes that may seem desirable, and to report to the courts if the smelters are failing in any particular to live up to the law as regards noxious fumes. The first of these commissions was created in Montana to study the great plant at Anaconda. It includes Messrs. L. D. Ricketts, J. A. Holmes, and John Hays Hammond, and its employees have now been busy some months in the plant. They are given every facility and full authority to get at the facts, and the report of the commission will be conclusive because of this fact and the high character and attainments of the men composing it. In California a bitter warfare has been waged on the Selby Smelting & Lead Company by certain residents of Benicia who allege great damage as a result of smelter fume. The company has bought easements, made changes in its plant, diverted shipments of high-sulphur ore, and spent large sums of money on investigators, experiments, and in litigation. Still the complaints have continued, and the officers of the concern feel that these are now entirely unjustified. Following the example of the Anaconda, and with the approval of the United States court before whom the matter comes for trial, the company recently asked for appointment of an expert commission to examine and report upon their methods of treatment and the actual measure of damage. In effect, the officers of the company lay their cards on the table face up and ask what more can be done. An excellent commission has just been appointed. It is headed by Mr. J. A. Holmes, director of the United States Bureau of Mines, and with whom is associated Mr. W. F. Snow, secretary of the State Board of Health, and Mr. Ralph A. Gould, whose experience as chemist and expert for the farmers in their Shasta county litigation renders him especially familiar with local problems. It is anticipated that a report will be completed in three months and it ought to have the effect of authoritatively settling the question at issue. Certainly technical matters of fact are much better determined by such expert commissions than by the ordinary jury with the incomplete and distorted information put before them in the course of a trial at law, and the attitude of the litigants in providing for such commission is a welcome sign of a disposition to get at and respect the facts of the case.

Gold-Dredging and Land Destruction

Conservation is a subject in which we take large interest, and we are proud to claim a place among conservationists. We regret to see the force of a great movement dissipated in a too frequent tilting at wind-mills. A case in point, as we see it, is the proposed regulation of gold-dredging in California, discussed in detail on another page by Mr. Charles Janin. Comparison of the benefits of this great industry with the maximum saving possible, one-eightieth of one per cent of the arable land, brings forcibly to mind the man who burned his house to get rid of one mouse. Land protection is a great need, and soil preservation demands much thought and study, but it is still to be shown even that the land dredged is permanently destroyed. There is much evidence to the contrary, and it is fairer to look upon it as temporarily withdrawn from cultivation. In the meanwhile road-side ditches and hill-side cultivation, to say nothing of unregulated streams, annually destroys much more land. Why hamper an important and profitable industry on a contingency when there are so many more important and probably fruitful fields for activity? California lost one great mining industry by the process of regulation that abolished, and is in process of losing a smelting. Gold-dredging is peculiarly a California industry. Nowhere else in the world has it been conducted on the scale and with the success that has been reached in the Golden State. At best it is a temporary enterprise, and it is furnishing the capital necessary to put other industries, notably agriculture, on a sound permanent basis. We hope the proposed bill will be killed, as it should.

Should the Extralateral Vein Right be Abolished?

By L. G. Campbell

*For the purpose of this discussion, let it be remembered that we of the bar have a hand in the construction of a great system of jurisprudence that will stand for centuries to come—one principle upon another, each laid with the cement of justice to endure for all time. Let us also, for this discussion, see the mining states of this great West with a population of twenty times that of the present; with twenty prospectors on hills where one now follows his burros over a dusty trail. Increased prospectors means increased discoveries and an increased number of locations of mining claims. At that time, as now in a smaller degree, it must be realized that definite property rights are essential to the progress of the metalliferous mining industry. Plainly, it is the duty of Congress, as well as other legislative bodies, to enact such laws as will, as far as possible, avert litigation and establish and fix definitely property rights. Surely also, it is the duty of the legal profession to encourage the passage of such laws. As a profession it is faithful to that duty, notwithstanding the oft expressed but unfounded statement that lawyers are fomenters of litigation.

Definition of Extralateral Right

Were I discussing this subject before attorneys of non-mineral states, it would be proper to define the extralateral right as that right given by the laws of the United States to the proprietor of a lode mining claim, to follow veins having their tops or apices within his claim lines, indefinitely to the depths, even though the dip of such veins from the vertical carries them beyond a vertical plane drawn downward from the side-line of his claim beyond which such veins dip; but before you, who are familiar with that law, to define discovery, strike, end-lines, side-line, apex, dip, and extralateral right, would uselessly consume time.

The history of the extralateral vein right seems to indicate that many generations ago that right, in somewhat different form, was permitted by the mining laws of Spain, but whatever it may have been, it was long since abolished. The system was for a time used in British Columbia, but was abolished sixteen years ago. In the sixteenth and seventeenth centuries Germany had in its laws what may be translated "an extended field," or more liberally, "an inclined location"; that is, the proprietor of a tract of mining ground was permitted to follow the vein apexing within it, downward indefinitely on its dip, and with the dip went also the bounding planes of the tract on the same dip, limited perhaps to 30 ft. on either side of the vein. The right, however, in Germany was abolished years ago, and C. H. Lindley quotes Klosterman on Prussian mining law as saying that the reason for its abolition was that "interminable law suits were inherent in the system." It seems a safe statement to say that the extralateral vein right, introduced in this country as it was first in California, was not adopted directly from the laws of any other country, but was one suggested by the conditions surrounding the prospector.

Origin of the Right

In the year 1849 and the few years following, miners and prospectors came to California, lured by the reports of the Golden West. No mining laws whatever were then in existence in this country. Gradually those miners worked their way into the vast expanse of mountains lying to the east. Mining camps sprung up and the system of adopting mining district rules, governing not only matters pertaining to mining, but also prescribing penalties for offenses, was initiated. There were scores of unprospected hills for each prospector there. It was their belief, and is indeed partly true in portions of California, that the veins were the ideal veins with regular dip and width. With so much unprospected territory before them, it was most natural that the miners should determine that the prospector making discovery of a vein should be permitted to follow the same indefinitely to the depths, without regard to whether it remained within his claim or not. Accordingly the mining district rules embodied that plan, which rules were later largely recognized by acts of the California legislature.

A few years passed by and discoveries were made at Gold Hill and Virginia, now in Storey county, Nevada. In June of the year 1859 the miners of Gold Hill, many of them from the mining districts of California, met to pass and did pass, district rules in which was written, "all quartz claims shall not exceed 300 ft. in length including the dips and spurs." In September of the same year the miners of the Virginia mining district met and adopted rules in which they said, "all quartz claims hereafter located shall be 200 ft. on the lode including all its dips and angles." These district rules had the force of law, were recognized by all, and mining locations were made under them. Less than ten years later, in the year 1866, Congress passed the act recognizing the extralateral vein right, and in 1872 that act was in effect re-enacted with certain changes, most marked of which was that the end-lines were required to be parallel to permit extralateral vein right. It is under that act that the metalliferous mines of the West are now operated. In the light of the fact that prior to the passage of the act, a great many locations had been made under district rules which sanctioned the extralateral vein right, and the further fact that there were such extensive stretches of unprospected mountain ranges, it was most natural that Congress should recognize the system and embody it in the mining laws.

Argument in Favor

The supporters of the extralateral system argue that it is unjust that a prospector should spend his

*From an address delivered at the annual meeting of the Nevada Bar Association.

time and money in prospecting for and finding a vein, only to learn later that by its dip it passes beyond his side-line, at which he must cease working. The argument would apply as well to many other lines of industry. A stratum of placer gravel may be many feet below the surface. It is necessary for the prospector for such stratum to spend his time and money in prospecting and sinking for it, but should he find it, he is limited to his common-law right of vertical planes. One familiar with soils may go upon the public domain and by spending his time and money and applying his learning on the subject, discover that some valley, because of its containing the right percentage of, we will say, decomposed feldspar, or gypsum, is particularly and peculiarly suited to raising a certain valuable plant; but he is not given the right to appropriate all of the land valley that is so suited, although it may be one continuous deposit of that particular soil. Instead, he is limited to his common-law right on his homestead. With almost as much force can it be said that the builder of a great building in a city, by reason of which adjoining property is enhanced in value, should be entitled to the unearned increment on his neighbor's property. The inventor of a machine has his patent right to protect his invention; the writer of a book has his copyright to protect his work. Those are the fruits of the brain of the inventor and the writer, who plainly are entitled to such protection, but can the same be said of the prospector, who, as a rule, makes discovery fortuitously rather than by reason of studied systematic effort? It is possible that the two are in different classes.

Discovery and Location

The extralateral right is given, presumably, as a reward for or prize upon discovery. The laws contemplate, indeed they require, discovery prior to location. The courts have held, however, that if discovery is made prior to entry, it relates back and cures the deficient sequence of discovery subsequent to location. Such is discovery in theory only, for it is known, as a matter of fact, that when a new mining district is reported, miners rush to it, willing to locate claims upon a vein or veins if they chance to find them, but primarily looking for 'free ground' upon which to locate claims. It is safe to say that 90% of the claims located are staked because the locators believe that they are upon unappropriated ground, rather than because they believe that they have made discoveries that justify such locations. It is known further, as a matter of fact, that when a prospector makes a good faith discovery of a vein, he does not rely upon the extralateral vein right that the law gives him and locate a claim or claims along the course or strike of the vein only, but invariably, if the land is unappropriated, he locates claims on either side as 'protection' claims. If that is the practice, as I believe it is, then the person for whom the law was enacted does not rely upon it as giving him the property right he seeks, and its abolition could not be a hardship to him.

Had nature formed veins regular in their strike, width, and dip as they pass from their apices to the depths in the earth, the exatralateral vein right system might be with greater force justified, but they are not regular, as experience has shown, indeed, regularity is the exception rather than the rule. Remaining carefully within the generally accepted theories of vein formation, it may be stated that planes of weakness or fractures in the earth's crust are caused by changes of temperature as in cooling; by relief from pressure, as in case of adjustments of the earth's crust; by movement, as in case of upheaval or faulting; and by many other causes. Mineralizing solutions or gases pass along those planes or fractures. In the case of veins that have been formed by replacement, atom by atom, as is true of many, the wall is replaced by silica or other vein matter, perhaps carrying metals of value, and thus is formed the vein as the miner finds it. Those walls of the fractures are not homogeneous. They are soft here, hard there; soluble here, insoluble there. Mineralizing solutions, where the rock is more soluble, may deposit a great swell or tongue of ore underground, hundreds of feet away from, but connected with, the vein and in the ground of the neighbor of the owner of the apex. A case was tried and decided in the Federal Court of Utah recently, wherein the court held that the owner of the apex was entitled to the bedded orebody or tongue of ore which connected with the vein, although it extended for many feet directly away from the vein. Had erosion subsequent to the deposition of the ore disclosed the tongue of ore at the surface, it is possible that its ownership would have been otherwise resolved.

The Broad Apex

It has been held by the courts that if a vein can be identified, even though thrown a considerable distance by a fault (and it is unusual to find a lode mine wherein the vein has not been thrown, or moved by faults), the owner of the apex may show such identity and follow the vein on its dip. Take as an illustration the Leadville, Colorado, veins. These were so faulted and thrown that the operators, realizing the futility of attempting to apply the law of the apex, very generally settled the disputes thus arising by agreement. The broad apex, in some instances reaching into the hundreds of feet in width, is often split by a common sideline between two claims located respectively by different locators. The courts have settled the law that the first locator under such circumstances takes all of of the vein as it goes to the depths. Usually in such cases it takes much time and a great deal of development to disclose the fact that the broad apex is the apex of one and the same vein. Until that extensive development is done, the junior locator has the deluded impression that he has made a discovery and works on in good faith, only to find that his shaft-house stands as a monument above its buried hopes. Does this square with justice?

A Cause of Litigation

There is no line of litigation in American courts wherein the chances for mistakes and irreparable wrong are as great as in those cases growing out of the law of the apex. Few if any apex suits have

been tried, without witnesses on either side testifying in direct contradiction of those upon the other, and all conscientious and intending to speak the truth as they see it. Repeatedly have the courts in their decisions of such cases referred to the fact that the testimony was conflicting. In the case of Butte Mining Co. *v.* Société Anonyme Des Mines, reported in 58 Pacific at page 111, the court in deciding the case said:

"The evidence was conflicting, many experts for the plaintiff claiming that the apex of the vein from which the ores were extracted was in plaintiff's ground and that it was wholly disconnected with any vein in defendant's ground, while an equal number of expert witnesses called by the defendant testified that in their opinion the apex of the vein was in defendant's ground."

Such in substance has been the expression in many decisions. Witnesses may testify, time passes, and workings are sunk to greater depth, and it may be found that both litigants were wrong; that the ore in dispute and over which they litigated was in a spur from a vein belonging to sill another. Nevertheless, property rights must be determined with the scant conflicting evidence only that can be offered at the time of trial.

Substantial Injustice

As an example of the meagre testimony upon which a jury may reach a verdict and judgment be entered in such cases, glance some time, if you are interested in the question, at a copy of a vertical section used in the case of Collins *v.* Bailey, decided in the Court of Appeals of Colorado in April 1912 and reported, with copy of the section referred to, in 125 Pacific at page 543. The bottom of the shaft from an upper tunnel therein shown is approximately 80 ft. from the surface of the ground, and the dip of a vein disclosed by such shaft is 71°. The vertical distance from the bottom of this upper shaft to the top of a raise in a lower tunnel is 550 ft. There were two undeveloped claims lying between those two workings, and the raise mentioned is 200 ft. southerly from the shaft (projected, of course, in the report) to the plane of section. The dip of a vein shown in the raise from the lower tunnel is 67°. For the purposes of the question, no other veins were disclosed, and the two workings mentioned, if projected, on the same plane, would of course not meet. Yet on this testimony the jury rendered a verdict giving to the owner of the upper shaft the extralateral right through and across the two undeveloped claims and into the lower working spoken of. The lower court denied a new trial and entered judgment accordingly. Fortunately, the Court of Appeals saw the absurdity of it, and reversed on the ground of insufficient evidence to sustain the verdict.

Fact and Theory

As I have said before, the extralateral right is given on the theory that it is a reward to the discoverer of a vein for his diligence in searching for and finding the vein, similar in principle to the protection that is given an inventor. The law, however, as it is actually applied, wanders far afield from that theory. An example of the extent to which it is carried by the courts, and necessarily so in order to be consistently construed, may be found in the case of Ajax Gold Mining Co. *v.* Hilkey, 31 Colorado, page 131. It is therein held that the endline established by the law at the point of departure of the discovery vein across a sideline is not necessarily the endline for the purpose of defining extralateral rights on secondary veins, but that the endlines as located limit such right; in other words, that the discovery vein and a secondary vein, although not apexing in the same segment of the claim, may each carry extralateral rights. The discovery vein, for illustration, may contain $100,000 worth of ore as it goes to the depths; a secondary vein may contain several millions of dollars' worth of ore as it goes downward. The discoverer and locator located the claim in the eyes of the law, because of his discovery on the discovery vein. The law gives him the extralateral right on the secondary veins as well, and the result is that he has discovered a vein containing $100,000, but the law gives him several million in the secondary vein, not discovered by him at all at the time of his location. The fallacy is not in court construction, but in the system that permits a law that is susceptible of such unreasonable application. With almost as much reason, the inventor of a carpet-tack might request a patent right on a linotype machine.

As Others See Us

Others who have given much more thought to this subject than have I, have expressed their opinions upon it. For several years past I have attempted to avail myself of every opportunity to talk with the prospector, he of the pick and pan, to get from him his idea of the so-called apex law. He is one of the persons most vitally interested, and is therefore most entitled to be heard. I have yet to meet a good faith prospector who favors the continuing of the extralateral vein right. Presumably, the law is in existence for his benefit, and if those with whom I have talked express the view of the prospector, he himself desires to be delivered from his friends. As early as 1860, J. Ross Browne, writing semi-humorously, said of the Comstock: "Things are in a great mess of confusion; everybody's spurs are running into everybody else's angles. The Cedar Hill company is spurring the Miller company, the Virginia Lode company is spurring the continuation, the Dow company is spurring the Billy chollar, and it's a free fight all around." A. Montgomery, a mining engineer who has written on Australian mining laws, in a recent issue of the *Mining and Scientific Press*, in speaking of the extralateral right under the American system, has this to say:

"The extralateral right principle obtaining in portions of the United States is a standing marvel to the rest of the world, and that it could be seriously proposed to perpetuate it outside of cases in which it has already been unfortunately granted, seems incredible to most outside engineers with whom I have come in contact. If all ore deposits could be relied upon to behave themselves in accordance with elementary diagrams in the text-books representing a few of the simple occurrences of fissure veins,

there might be some hope of maintaining the extralateral right system on consistent and logical grounds, but since their forms are in fact protean and not predictable with any real certainty, and since even the best authorities differ, often radically, in their views as to the nature and origin of ore occurrences, there seems no hope of obtaining such precise legal definitions as will serve to justly decide all cases of extralateral right. The claim of the discoverer to follow out his discovery in all its ramifications has a certain amount of apparent justice, but is practically impossible to be granted in very many cases without infringing upon the equal rights of others. If the first man to obtain petroleum by boring, for example, were to have the right to all petroleum that could come to his wells, thus exercising the right of the discoverer to its utmost, he should be protected from the boring operations of his neighbors, whose bores may and probably will tap oil that otherwise would flow to the discoverer's well. Again in coal seams, should the discoverer monopolize the whole seam? If he is not given this right, why should it be given in the case of a lode? Some limit has to be placed on the rights of the discoverer, and it is surely best to follow the same principles as obtain in all other occupancy of land and confine his operations within the boundaries of the land he has located."

Proposals for Change

Horace V. Winchell, in a discussion of mining laws before the Canadian Mining Institute at Toronto in March 1912, refers to the American apex system as "the generally condemned apex law." Reed Smoot, senator for Utah, introduced Senate bill 6194 in April 1912, and in the bill provides for the complete abolition of extralateral rights and gives to the locator of a claim "such veins, lodes, ledges, and deposits of mineral or minerals in place as lie within the block of ground bounded by vertical planes passing through such surface lines," and provides further "that no such locator, his heirs or assigns, shall have the right under such location to follow any vein, lode, ledge, or other deposit outside of the lines of such claim." That bill is now pending before Congress. Samuel C. Adams, First Assistant Secretary of the Interior, in speaking of certain mining legislation that in his judgment should be passed, says: "This legislation would also well supplement Senate bill 6194 (the bill to which I have just referred) now pending before the Senate, which in brief, as to future locations, abolishes extralateral rights." George Otis Smith, Director of the United States Geological Survey, in his annual report for the year ended June 30, 1911, in speaking of the apex law, says: "The law of the apex has proved more productive of expensive litigation than of economical mining. In many of the more recently established and more progressive mining districts this statute has been made inoperative either by common agreement or by compromise between adjoining owners. Its repeal could not affect established equities under patents already granted, but would render possible more certain property rights in large mining districts, not as yet discovered, where new and valuable claims will be located a hundred years from now."

The West and the East

It is said that a Bostonian, traveling in the West, wrote home that the farther West he came the more he was convinced that the three wise men came from the East. Without admitting that our Eastern brother's estimate of us is correct, it nevertheless remains for us who live in the West to determine whether or not the law of the apex is or is not right in principle, and we of this generation should feel the burden that is upon us to determine that question aright, for the mining laws of this country, hardly yet one-half a century old, are but emerging from their infancy, and the metalliferous mining industry in this country doubtless but seeing its sunrise. In the light of present knowledge of vein formation, the interminable litigation growing out of the extralateral system, and the recollection that in some cases violence and bloodshed have resulted from contentions over it, I am convinced that we must change from our present system to that of vertical planes. Such change can, of course, only affect lode-mining claims located subsequent to the amendatory act, but if, as we suspect, a hundred claims will hereafter be located for every one that has been located thus far, those now located which give to their owners a vested property right in veins on the dip are negligible. No one would contend that John Doe should have a property right in Lot 1 in Block 2 while the wind blows south and the aurora borealis adorns the northern heavens. Those phenomena of nature are caused by changes of temperature and resulting reflection from icefields by air pressure and moisture and resulting refraction, and yet we pretend with the law of the apex to define property rights beneath the surface, where the phenomena are much more diverse, and the causes, while in some degree the same, yet vastly more complex, than are those that drive the winds to the south and set aglow the northern lights.

Mineral Output of Japan

The final returns of the mineral production for the second half of 1912 are not available, but the following shows the output of the principal minerals which account for 90% of the total:

	1912.	1911	Change.
Gold, ounces	75,389	69,909	+ 5,480
Silver, ounces	2,547,992	2,251,955	+ 269,037
Copper, pounds	59,042,741	53,743,314	+ 5,299,427
Iron, tons	28,820	29,835	— 1,015
Coal, tons	8,448,493	7,495,205	+ 953,288
Sulphur, tons	21,918	19,438	+ 2,480
Oil, barrels	627,256	675,193	— 47,937

Kauri-gum is an amber-like resin, varying from light cream to brownish yellow in color, is the result of exudation from the tree *agathis australis*, and is recovered by shallow excavations in swamps and districts near kauri forests in New Zealand. It was 'mined' to the extent of 7587 tons, worth $1,723,000, in 1911, the total production to date being 314,087 tons, valued at $75,880,000. This resin is used extensively in varnish making.

Shasta County Smelter-Fume Problems

By J. Nelson Nevius

*The object of this trip was to obtain at first hand for the Chamber of Mines and Oil information on both sides of the controversy between the smelting companies and the agricultural interests in Shasta county, California, and the following report embodies the information given me by the respective parties. I was most courteously received, both at the smelter and by T. W. H. Shanahan, attorney for the Shasta County Farmers' Protective Association, and my questions were answered freely by both parties.

The Kennett Smelter

When operating under normal conditions, the Mammoth Copper Mining Co. operates three blast-furnaces, each having a capacity of approximately 400 tons of charge, or a total of between 1100 and 1200 tons of charge. The ore is massive iron sulphide, containing some copper sulphide, and ranging from 3 to 5% in copper, with some gold and silver. The object of the bag-house system is to eliminate all dust or solid matter from the fume, and also to eliminate entirely the sulphuric acid gas (SO_3) and to reduce the volume of sulphurous acid gas (SO_2) to less than three-quarters of one per cent, in order to comply with the conditions imposed by the court.

By way of explanation it should be said that SO_3 unites readily with atmospheric moisture and forms sulphuric acid. The SO_2, or sulphurous acid, is the pungent odor familiar to all on the burning of a sulphur match and is less active than the SO_3, though capable of damaging vegetation. The solid matter, or dust, is a whitish powder, weighing about 13 lb. to the cubic foot, and has approximately the following chemical composition:

	Per cent.		Per cent.
Copper	1.04	Arsenic	4.3
Insoluble	7.8	Zinc oxide	4.8
Iron	6.2	Zinc sulphate	47.2
Calcium oxide	1.8	Gold, oz.	0.03
Lead	7.0	Silver, oz.	4.08

The total amount of metallic zinc ranges from 20% upward. In this dust the arsenic is the chief objectionable element, but it is also claimed that, by settling on foliage, the dust mechanically retards vegetable growth.

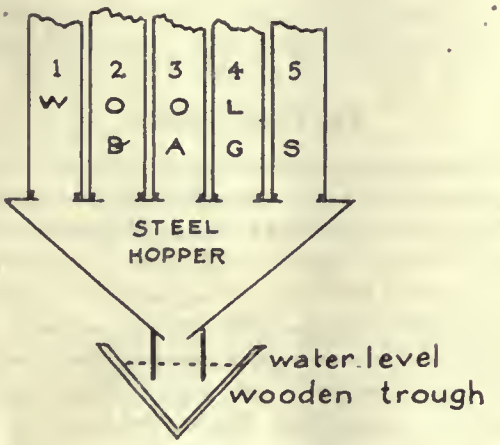
Formerly the fume containing the acids and this dust escaped into the atmosphere and caused damage to vegetation. Under the bag-house system, all the fume from both the blast-furnaces and converters is taken at the base of the former smokestack in four round pipes, 8 ft. in diameter and about 100 ft. long. These convey the fume to a square flue 15 ft. in diameter and about 120 ft. long. The fume is thence conducted to two fans, built by the American Blower Co., each being 11½ ft. in diameter and driven at 300 r.p.m., requiring 400 hp. each. The form of these pipes is merely a matter of convenience and economy, and would be subject to variations at any other plant, as the topography might require. The fans form the suction to draw the fume from the smelter and force it into the 'fan-discharge chamber,' whence it is led into a series of round cooling pipes, 4 ft. in diameter, of which there are 45, arranged in 9 series of 5 pipes each, contained on a rack 180 ft. long. The gas thus travels through 900 ft. of cooling pipes at a rate of 2700 ft. per minute. These pipes discharge the gas into a 'distributing chamber' 15 ft. square and 220 ft. long. The gas is still too hot to go to the bags, so cold air is blown into the top of the 'distributing chamber' through twelve 24-in. pipes leading from a larger supply pipe above, and supplied by a special fan. The temperature of the gas on reaching the distributing chamber is about 130°C., and sufficient cold air is blown in to reduce the temperature to 93°C. The cold air has the further effect of diluting the gas. At the fans the temperature of the gas is 280°C., consequently the loss of temperature in the cooling pipes is 150° Centigrade.

The Bag-House

From the distributing chamber the gas is led to the bag-house through 5 apertures, each of which is under independent control, and leads to one of the 5 bays, or compartments, of the bag-house. The

*From a report made to the Board of Directors of the Los Angeles Chamber of Mines and Oil.

bag-house is 220 ft. long and is divided into 5 bays; there are 4 divisions in each bay, each with a hopper for the removal of the dust. The bags are specially woven of pure wool, 18 inches in diameter and about 34½ ft. long. These are set 21 in. apart, centre to centre, and there are 5 rows of bags to each hopper, making a total of 2960 bags. The bags are suspended vertically from a series of racks, the lower end being fastened in the floor, through which the fume enters, and the closed top tied to a short arm which is a part of an apparatus designed by J. E. Egleston, engineer for the smelter, and operated by electric motors, by which a vertical shaking motion can be given the bags. At fixed



HOPPER UNDER BAGS.

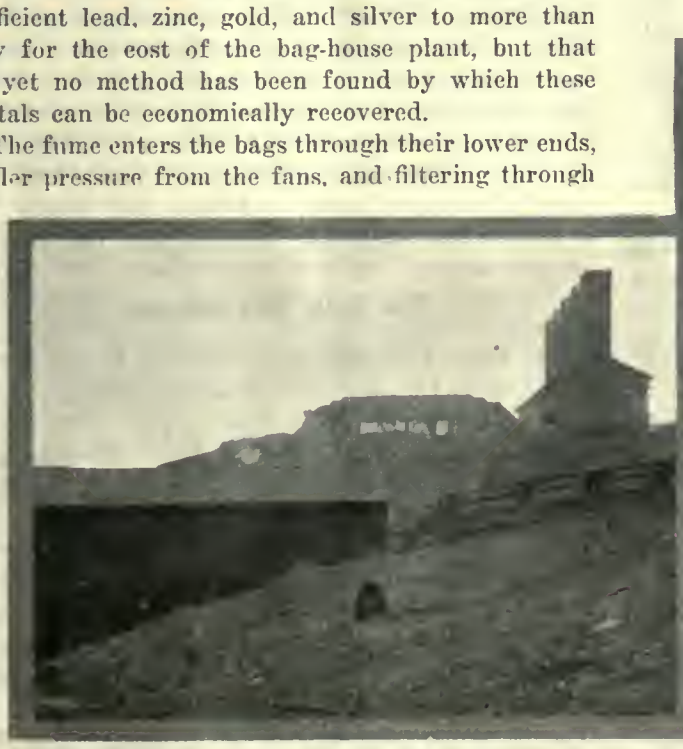
intervals the fume is cut off from the bays, the motor turned on, and the bags shaken vertically, causing the dust to fall into the hoppers below. Originally the dust was removed from the hoppers dry, but the impalpable powder was so distressing to the workmen that a wooden trough was built below the hopper, as shown in the accompanying sketch, so that the dust now falls in water and is drawn off in tanks and settles. It is interesting to note that the dust already accumulated contains sufficient lead, zinc, gold, and silver to more than pay for the cost of the bag-house plant, but that as yet no method has been found by which these metals can be economically recovered.

The fume enters the bags through their lower ends, under pressure from the fans, and filtering through their sides in the closed bag-house, escapes at the roof through 5 large square towers, which distribute the gas to the atmosphere in a much less concentrated form than if it escaped from one flue. The bag-house is open along the sides of the floor and roof to admit free air to dilute the SO_2. The action of the apparatus is as follows: The ore from this mine contains considerable zinc sulphide, which, in the blast-furnaces, is changed to zinc oxide. The zinc oxide has a strong affinity for SO_3, and united with it forms zinc sulphate. In the case of this particular smelter, there is sufficient zinc to completely neutralize the SO_3, but to be certain that none of this gas escapes, hydrated lime is introduced at the fans, at the rate of about 30 lb. per hour, which neutralizes any SO_3 escaping the action of the zinc oxide.

Sampling the Fume

At the distributing chamber a miniature bag about two feet long is operated, from which samples are taken every two hours for purposes of testing for the presence of SO_3. The SO_2 is neutralized simply by the addition of air to the fume, and reduced below the requirements of the court, which, as already stated, is 0.75%. I was informed that the escaping gas varies from 0.4 to 0.6% by volume. The solid matter, or dust, is filtered out by the bags and entirely removed. It is the custom of the company to keep very full and complete records of the results obtained by the entire apparatus, and it claims that the result is as follows: (1) That the escaping gas contains from 0.4 to 0.6% SO_2 by volume; (2) that it contains no SO_3; (3) that it contains no dust.

It is interesting to note that one day's operation showed that the volume of gas passing the fans in 24 hours operation was 333,000 cu. ft. The volume of cold air introduced was 23,000 cu. ft. This was in winter, when the outside air was cold. In summer the volume of outside air introduced may run



SIDE VIEW OF BAG-HOUSE AND SYSTEM OF COOLING PIPES.

LOWER END OF COOLING PIPES.

up as high as 125,000 cu. ft., the reduction in the volume of gas being due to cooling. The volume of gas filtered per minute per square foot of bag surface was 0.631 cu. ft. The amount of dust accumulated in 24 hours varies from 12 to 15 tons, and averages about 13 tons. The gas escaping into the atmosphere carries a little carbonic acid, and an excess of nitrogen, in addition to the sulphurous acid. Tests for the presence of sulphuric acid gas (SO_3) are made every two hours at the miniature bag attached to the distributing chamber. So long as these tests show a deficiency of acidity, it is impossible that SO_3 is escaping. Furthermore, tests have shown that the texture of the bags will show depreciation within a few minutes if any SO_3 comes in contact with them; but the above tests are made and the record kept for the company's protection in case claims may be made of anyone having sampled the outside air and detected traces of SO_3. The bags cost about $6 each, and their life is from 18 months to 2 years.

The Farmers' Side

On December 14 I interviewed T. W. H. Shanahan, attorney for the Shasta County Protection Association, who pointed out that great damage can be done by smelter fumes, without its being apparent at any particular place or time; that is, it may retard the growth of orchards without killing the trees; also, it may retard the development of the size of the fruit, thereby reducing its value; also that damage done is cumulative—a small amount of damage done day after day finally assumes serious proportions; also that the small, almost intangible damage, is very difficult to demonstrate legally. He explained that on being retained by the farmers and looking into the subject in general, he found that the United States Smelting Co., operating at Midvale, Utah, had been closed down by the courts on account of damage done by smelter fumes, and that the company, after making certain agricultural experiments, had petitioned the court to be allowed to operate, provided it eliminated all SO_3 and all dust from the fume, and reduced the SO_2 to less than 0.75% by volume, at the same time so diffusing the gas that it did not damage vegetation. This petition was granted by the court. The United States Smelting, Refining & Mining Co. is the interest controlling the Mammoth smelter, and Mr. Shanahan secured an order from the court that Shasta county smelters must either equip themselves to fulfill the following conditions, or shut down, being given a certain length of time in which to obey its mandate, which provided as follows:

1. That all free sulphuric acid shall be removed from the fume, by the application of zinc oxide or some other neutralizing agent, before reaching the bag-house.

2. That all solid matter shall be removed by the bags in the bag-house.

3. That after the neutralization of the free sulphuric acid, and the removal of all solid matter, that not to exceed 0.75% of sulphur dioxide (invisible gas) in volume, shall be permitted to escape into the atmosphere.

4. That only the amount of sulphur dioxide be permitted to escape into the atmosphere, as not to damage complainants; or complainants' crops, trees, or vegetation; or do any injury to their live-stock; and so as not to cause any discomforts or inconveniences to the complainants or any members of the families of any of the complainants.

Thus it is apparent that unless the Shasta county smelters operate in conformity with the court's decree, they are immediately in contempt of court, and it is not necessary for the farmers to prove any actual damage done, it being necessary for them to demonstrate that the court's order is not being obeyed in order to close any smelter. The Mammoth Copper Mining Co. protected itself by constructing the bag-house at a cost of about $250,000, and the company states that it is now operating within the law.

The Coram Smelter

The Balaklala Consolidated Copper Co., owning the smelter at Coram, Shasta county, installed the Cottrell process at a cost of about $126,000 for equipment, and some $25,000 additional for experimenting. After it had been in operation a while, the farmers still complained, though the company maintained that it was complying substantially with the conditions imposed by the court. Thereupon, Mr. Shanahan engaged the services of Gould & Burt, consulting chemists, to test the fume. They made 44 tests, and found that in 8 out of the 44 the percentage of SO_2 was in excess of 0.75% allowed by the court; that free SO_3 was escaping, as was shown in several of the tests, and also that dust was escaping. The tests showed that the maximum amount of SO_2 found in any one test was 0.921%, and their summary showed that the efficiency of the Cottrell process was as follows: Maximum, 96% plus; average, 74%; minimum, 20%; and they concluded that the process was worthless for the purpose intended. Mr. Shanahan stated that the company did not dispute the accuracy of these tests; consequently that the company was disobeying the injunction on three counts, and was, therefore, in contempt of court. The result was that the company compromised by paying the Farmers' Protective Association $4000, which was about the costs of chemists and legal fees, and closed the smelter. The Balaklala was smelting 700 tons of ore per day.

The Bully Hill Smelter

The Bully Hill smelter is situated 17 miles east of the other two, and is surrounded chiefly by Government land and forest reserve. The capacity of the plant is in the neighborhood of 400 tons per day. Mr. Shanahan stated that when the Government saw the success of his efforts, it enjoined the Bully Hill smelter and gave that company a short time in which to equip a fume destroyer, or close down. This was in 1910, at which time the price of copper was low, and apparently the company closed down rather than go to the expense of questionable experiments. At the present time the Bully Hill smelter is closed, and no one seems to know the plans of the company.

Present Conditions

The Balaklala smelter has been closed and partly dismantled, and the Mammoth smelter is the only one operating. Mr. Shanahan stated that a marked improvement in conditions is apparent since the Mammoth smelter installed the bag-house, and since the other smelters closed. He was not prepared to state whether, in his opinion, the bag-house was entirely successful, or whether there might not be further disputes with the farmers; but he expressed the belief that it was by far the best scheme yet devised, and that he sincerely hoped it would be effective. He stated also that, while most of the farmers appeared to be satisfied with present conditions, some of them were still complaining, but that during the past season the French prune crop in the vicinity of Anderson was the best it has been in years. At the annual meeting of the Shasta County Farmers' Protective Association, held in Anderson December 13, the new officers elected were from the dissatisfied element, and that at least some of the farmers are still dissatisfied appears to be shown in the newspaper accounts of that meeting as appended to this report. Mr. Shanahan protested at the smelters being permitted to experiment with new processes, because of the fact that damage was being done meanwhile, but he was not prepared to state how a successful process could be developed other than by actual experiment. He freely acknowledged that this was the only way the question could be determined, and his only suggestion was that such experiments be conducted on the desert.

Fundamental Conditions

There appear to be two fundamental reasons why the smelter situation in Shasta county imposes peculiar difficulties: (1) the ore is a massive sulphide, in other words the sulphur content is unusually high, which produces an unusual amount of sulphur gases; (2) the two principal smelters were within three miles of each other, and in a narrow valley in which the winds are almost invariably either north or south, consequently the fume was more concentrated than if the region were subjected to varying winds. The natural conclusion seems to be that the smelters should not be congregated near an agricultural region for the reason that while one smelter may operate within the law and without injury to the agricultural interests, it does not follow that more than one smelter, even though they operate within the law, will not have a damaging effect. As a test of present conditions at Kennett, it is interesting to note the lawns, shrubs, and flower gardens surrounding the houses, within half a mile of the smelter. I was informed that it has been possible to maintain those gardens only since the bag-house was built.

Explosives investigations by the Bureau of Mines involved 5727 tests last year, while in the electrical work of the Bureau 2062 tests and 23,611 observations were made.

Miners employed at metalliferous mines in New Zealand totaled 7400, and at coal mines 4290, in 1911.

Progress at the Panama Canal

Of the total of 2,043,730 cu. yd. of concrete to be laid for the three twin locks at Gatun, there had been finished 1,929,306 cu. yd. on January 18. At the Pedro Miguel lock 905,625 cu. yd. has been placed, this being almost completed, while at the Miraflores locks 1,410,541 cu. yd. out of 1,499,800 cu. yd. has been laid. In this concrete work the 2, 1, and ½-cu. yd. mixers have averaged, of late, about 40, 11, and 8 cu. yd. per hour in operation. The Gatun dam is 96% completed, and on January 1 there were 21,068,080 cu. yd. deposited, including 10,124,082 cu. yd. of hydraulic, and 10,943,998 cu. yd. of dry fill. Out of 225,000 cu. yd. for the Gatun dam spillway, 214,218 cu. yd. has been laid. The Ancon rock-crusher plant averaged 290 tons per hour while in operation. Up to January 1, 1913, 100,887,019 cu. yd. had been removed from the Central division, which includes the Culebra cut and Chagres section, leaving 5,239,202 cu. yd. to be excavated.

Population and Commerce

The population of Colon is 20,232, and Panama 47,172, and of the Canal Zone 62,810 persons. Actual working force at the end of December was 39,499 men, and the death rate was 10.42 per 1000, there being one death from malaria fever, and none from yellow fever, smallpox, or plague. Consumption of water at Colon is 1,368,953, and Panama 1,752,419 gal. per day.

Commerce between the Atlantic and Pacific coasts of the United States by way of the isthmuses of Panama and Tehuantepec aggregated approximately $125,000,000 in 1912. The rapid growth of the traffic between the eastern and western coasts of the United States via the isthmuses which developed chiefly within very recent years and seems likely to further increase with the opening of the Panama canal, led the Statistical Division of the Bureau of Foreign and Domestic Commerce to establish, at the beginning of the present fiscal year, a monthly record of the movements of the principal articles forming this traffic. Its record for the 5 months ending with November has just been published and shows $24,500,000 worth of merchandise passing from the Atlantic coast to the Pacific coast via the Tehuantepec railroad, and $5,000,000 worth via the Panama railroad; while the value of that passing from the Pacific coast to the Atlantic was, via the Tehuantepec line, $14,330,000, and via the Panama line $3,750,000. This suggests that the total value of the traffic for the half-year ended December was approximately $30,000,000 westbound across the Tehuantepec route and $6,000,000 via the Panama line; and of eastbound coming from the Pacific Coast ports and Hawaii $16,000,000 via Tehuantepec and $4,500,000 via Panama; and that the total value of this traffic for the full year approximates $125,000,000. The Panama railroad ditching machine, equipped with a ¾-yd. dipper, loaded 1058 cu. yd. of gravel at the Matachin gravel pit on February 4. This record is comparable with that of some steam-shovels. The engineer was E. Richard.

Wisconsin-Illinois Zinc Mines in 1912

By P. K. Kelley

When the Wisconsin-Illinois zinc district increased its ore production in 1911 by 20% over 1910, the magnitude of the growth seemed extraordinary. The final production figures for the year just ended, however, are all the more surprising, in that they show an increase of 33% over 1911. The shipments to smelters, denoted in short tons, are as follows: 100,000 in 1912, 75,000 in 1911, 63,000 in 1910. The table below shows ore shipments from individual camps in 1911 and 1912. The figures are given in short tons and do not include shipments from separating plants to smelters.

	1911.	1912.
Highland	4,457	4,148
Linden	8,174	7,469
Harker	4,173	6,012
Mineral Point	1,173	725
Montfort	1,790	1,148
Livingston	6,483	9,526
Rewey	2,851	1,300
Platteville	14,684	14,185
Cuba City	2,201	3,960
Benton	25,406	24,143
Hazel Green	20,121	17,414
Shullsburg	4,705	12,684
Galena	10,766	15,784
Dodgeville	200	776
Totals	107,194	119,274
	1911.	1912.
Total shipments of lead, lb.	9,002,025	7,896,930
Total shipments of pyrite, lb.	28,679,030	38,660,830

While these figures show a decrease of 500 tons of lead ore, there was an increase of 12,080 tons of zinc and 2990 of pyrite. An expansion as large as this should have other causes than those due to natural growth alone. The strength of the market was the paramount cause, but better railway transportation helped. That the metal content of the ores in this region is not decreasing is evidenced by the fact that the average assay of all ores for 1912 is 36.67% Zn against 34.68% Zn for 1911.

Old Mines Reopened

The year 1912 has been marked by the reopening of many old mines. Among the most important now entering or about to enter the producing list are the Schrier, Brown-Croft, Baxter, Trego, Scrabble Creek, Field, Hodge, Reich, Raisbeck, Grant County, Beloit-Merger, Federal, Black Jack, and Lucky Hit. There have also been new concentrating plants or sinking equipments erected at the East End, Hird, Gruno, Masbruch, Lawrenee, Rundell, Frontier, Winskill, Klar-Piquett, Wallace, Tripoli, and Grotkin. In addition to the foregoing mining properties, there was quite an impetus given to the building of roasting and separating plants during the year. The Joplin Separating Co., at Galena, completed the rebuilding of its plant, with an accompanying increase of capacity. The National Zinc Separating Co. erected a 60-ton plant near Cuba City. A Campbell process separator is in course of construction at the Optimo mine near Linden.

Prices were high, ore prices following closely the spelter market. At the outset, producers were receiving $44 as a base for 60% ore. There was a steady march from that point until August, when there was a slight falling off in the high price. The ore market continued strong, however, through September and October, and the highest price ever received for a car of ore was recorded during that period—$64 per ton was paid for a car of ore on a basis of $63 for 60% zinc. The last two months of the year gave the producers a steady strong market which ranged around $56 to $57 per ton.

NATIONAL SEPARATING PLANT.

In addition to the better facilities given to the mines during the year by the existing railroads, there is a movement on foot for the building of a new steam railway through the districts. It is planned to furnish closer rail connection between the mining districts, the Illinois coalfields, and the smelters. The Mineral Point Public Service Co. is extending its high-tension line to many properties in the northern part of the community. This fact, added to the continual extension of the power-lines of the Inter-State Light & Power Co. of Galena, Illinois, assures the operators of elastic and adequate power service.

Cost of Handling Ore

The annual report of the Premier Diamond Co., Transvaal, gives a chance for comparison of costs of mining and handling material, all published quantities being reduced to short tons. The figures from the copper mines are not strictly comparable because they include smelting as well as mining. Steam-shovel costs alone of the Nevada Consolidated are 68c. per ton and of the Utah Copper Co. 33.73 cents.

	Tons.	Per ton.
Mesabi iron-ore mines	[1]33,600,000	$0.70
Nevada Consolidated mine	[2]3,338,242	2.30
Panama canal	[3]5,748,510	0.40
Premier diamond mine	[4]7,765,600	0.72
Utah Copper mine	[5]4,680,801	1.77

[1]Mainly steam-shovel mining, including drilling and blasting, to loading on cars.

[2]Steam-shovel mining, 3,249,140 cu. yd. of capping removed, and 3,338,242 tons of ore treated by concentration and smelting of concentrate.

[3]Steam-shovel work, including from clearing and blasting to administration.

[4]Native labor employed, 11,000, with 170 overseers. Hand-drilling, rope haulage, crushing, jigging, and concentration on grease tables.

[5]Steam-shovel mining mostly; 5,450,604 cu. yd. of capping removed, and 4,680,801 tons of ore treated by concentration, and smelting concentrate.

Valuation of Mines by the Public

By Heath Steele

Judging from market quotations on mining stocks, the public either does not care about the real investment value of a mining security or else is wholly lacking in knowledge of the fundamentals of mine valuation. No one should expect the average buyer of mining stocks to be an expert at appraisal, but there is such a great difference displayed in the ability to appraise mining and industrial stocks that one cannot help wondering if the gambling element does not trade more in these stocks than in the other forms of securities. Some time ago I had occasion to look up the interest returns on mining and railroad stocks based on the average market quotations, and was surprised to find the public was buying both stocks on about the same basis. To anyone who understands mining, this is ridiculous, as a railroad is at least supposed to maintain its assets, if not actually increase them, while a mine is naturally worth more at the beginning of dividends and depreciates thereafter rapidly in value. So much has been published in the technical and financial press of late on the valuation of mines that it is reasonable to suppose the public is more enlightened on the subject. I am inclined to think this is true, as the recent high prices do not show the overvaluations of 1906 and 1907, but there is still a lot of educational work to be done along this line.

The table given herewith shows the high and low records of 40 copper stocks for a 12-year period, 1901 to 1912. Of these mines, 20 have paid dividends and 20 are non-dividend payers.

A Record of Prices

It will be noticed that practically all the high records were made about 1907, when the price of copper was high. The non-dividend payers serve to show how the hopes and expectations of the public rise and fall, and the enormous prices paid for prospects. For example, basing the calculation on the present outstanding stock, this group of mines was given a market valuation by the high quotations, of $125,392,000; but when optimism gave way to pessimism, as recorded by the lowest quotations, the public's opinion of these mines depreciated $114,439,000 and the appraisal was only $10,953,000 for the group. Some may say this occurred over a long period in which many things happened; that some of these properties looked promising enough at one time or another to warrant a high valuation. But can there be any sound reason for the public's hopes fluctuating 90% in 1912? The record shows the low 1912 valuation of these non-dividend payers to have been $29,423,000 and the high selling prices to have added $26,430,000 to this amount, giving a total valuation of $55,853,000 to the same mines. It is not the valuation of $125,000,000 that staggers one so much as what the public expected of these properties when it placed that valuation upon them. For if a 15-cent average price for copper, and an 11.5c. cost be allowed, which is a very fair cost for these properties, and only a 6% average annual dividend be asked, it would mean that each should produce about 10,700,000 lb. of copper per year for 41 years, or a total of almost 9,000,000,000 lb., figuring interest at 5% on the investment. This would mean practically another Lake Superior district. If these mines be appraised at the average between the high and low quotations of 1912, the valuation would mean the successful development of about five mines out of this group. If the low cost of 9.5c. per pound on 15c. copper be allowed, it would mean a total production of about 400,000,000 lb. each in 41 years, figuring on a 6% annual dividend. The production of the Quincy mine, which has paid dividends for over 41 years, has been about 500,000,000 pounds.

	12-Year Period, 1901-1912.				1912.	
Non-dividend-paying stocks.	Low record....	Date	High record...	Date	Low record....	High record...
Adventure	$0.625	1904	$ 33.00	1901	$ 5.00	$11.25
Allouez	1.75	1901	121.00	1907	35.00	50.25
Arizona Com....	0.10	1911	52.00	1906	2.00	6.87
Centennial	8.00	1911	47.00	1907	15.50	27.50
East Butte.....	3.50	1908	18.25	1907	12.25	16.78
Franklin	5.50	1911	29.25	1907	6.75	16.50
Giroux Con.....	2.37	1907	10.50	1907	3.12	6.37
Hancock	3.25	1908	38.00	1909	22.00	37.00
Helvetia	0.70	1912	7.50	1909	0.70	1.12
Isle Royale	5.25	1903	56.50	1901	20.75	37.25
Keweenaw	0.50	1911	23.25	1905	0.99	2.62
Lake	4.00	1907	94.50	1910	22.75	49.00
La Salle.....	3.00	1911	35.00	1907	4.50	8.00
Mass Con.....	2.25	1908	37.62	1901	5.00	9.00
New Arcadian...	0.25	1904	24.75	1901	2.00	6.25
Superior	7.00	1907	68.25	1910	24.00	48.87
Trinity	2.87	1911	42.25	1907	4.00	9.50
Victoria	1.00	1911	12.00	1901	1.75	5.87
Winona	1.00	1902	15.25	1905	3.12	7.75
Wyandotte	0.10	1907	3.75	1910	1.00	3.25
Dividend-paying stocks.						
Anaconda .....$	15.37	1904	$ 74.00	1906	$34.50	$48.00
Ahmeek	45.00	1907	370.00	1912	240.00	370.00
Calumet & Ariz.	45.00	1911	198.00	1907	57.50	83.50
Calumet & Hecla	360.00	1911	1000.00	1907	405.00	615.00
Copper Range..	34.00	1901	105.00	1907	48.50	66.50
Tamarack	20.00	1911	363.00	1901	26.00	51.00
*Granby Con...	20.00	1910	151.00	1907	33.00	77.75
Greene-Cananea.	5.25	1907	26.00	1906	7.37	11.12
Mohawk	22.00	1901	96.50	1907	50.25	73.00
Nevada Con....	6.25	1907	30.00	1909	18.25	24.62
North Butte....	18.50	1910	120.00	1907	22.75	39.50
Old Dominion..	5.00	1903	64.00	1912	44.00	64.00
Osceola	43.50	1903	181.00	1907	100.00	130.50
Parrot S. & C..	7.87	1911	58.50	1901	12.75	14.50
Quincy	55.00	1911	187.00	1907	72.50	95.00
Shannon	3.50	1904	24.37	1907	9.00	17.87
Tennessee	9.12	1901	55.50	1907	35.12	46.75
Utah Con.....	9.50	1912	79.00	1907	9.50	20.50
Utah Copper....	13.00	1907	67.37	1912	52.50	67.37
Wolverine	42.00	1902	200.00	1907	65.00	117.00

*New stock.

Dividend Paying Mines

Studies of the dividend payers yield figures that give good evidence of the public's erratic appraisals. The high quotations yield a valuation of about $1,063,000,000 placed on these mines, or 366% over the low quotations, which give a valuation of $228,306,000. In 1912 the public appraised these same mines from $465,747,000 to $659,359,000, a difference of 41.4% over the low valuations. These mines have paid approximately $217,000,000 in dividends during this period, or an average of about $18,100,000 per year. If the valuation of $1,063,000,000 placed upon this group be taken, the result figures to 1.71% income. The average annual dividend for the last six years has been $23,367,000, or 2.2% income; on the basis of 1912 dividends, $34,322,000, the return would be 3.2%. This is all that is necessary to say for this valuation. Based on the lowest valuation, $228,000,000, the average rate of income for the 12-year period has been 7.95%, and for the past 6 years 10.1%. On the basis of 7.95% income, with interest at 5%, would mean an expected life of about 21 years for these mines, and on a 10% income a 15-year life. The high valuation of 1912 with an annual dividend of $18,100,000 would give an income of 2.75%; on the 6-year average of $23,367,000 the income would be 3.5%, and at the 1912 dividend-rate, 5.2%. This means that these mines would practically have to last forever and pay at the rate of 1912 dividends, which is about 17% higher than previous years, if bought at the high valuation on a 5% interest basis. On the low 1912 valuation, $465,747,000, the rate of interest return on the 12-year average dvidend is about 3.9%, on the 6-year average dividend 5.05%, and at the 1912 rate about 7.46 per cent.

Mines Overvalued

As the majority of these stocks must have been traded at prices between the high and low average of the two 1912 valuations, $562,000,000 may be taken as indicating the real valuation placed upon these mines by the public. On this the interest return would be 4.15 and 6.12% respectively for the 6-year average and the 1912 dividends. If dividends will equal the 1912 rate for about 40 years, this valuation will be justified. It is evident from these facts that mines as a whole are consistently overvalued by the market quotations. However, one ean very often point to undervaluations in the case of single mines, particularly those operating along sound business lines—not agitating with printer's ink and concentrating (the public's attention) with printing presses.

High-Level Dredging

At Waikaia, in Otago, New Zealand, aecording to the annual report of the Department of Mines, the Mystery Flat Gold Dredging Co. is engaged upon operations which constitute a departure from ordinary gold-dredging practice. After dredging all the available river-flat, this dredge is now working its way up the gentle slopes of the surrounding foothills and terraces. To do this, water has been brought to the claim by a ditch 2½ miles long, and at an elevation of 50 ft. above the river-level. The dredge floats in a pond supplied by this ditch, and continually stacks its tailing behind, forming a dam to maintain the level of the water. As the ground is shallow, a tailing-elevator is not required, the material being passed through a sluice-box. When first attaeking the slopes it was found that the tailing embankment eould not be raised with the ascent of the ground until a low dam had been built to hold the bulk of the tailing. Once started in this manner, the tailing keeps building an efficient embankment for the pond. At present the dredge is about 30 ft. above the river level, and it is proposed to work up to the ditch. After reaching that level, pumping will be necessary to keep the pond full, for the proposed scheme is, if possible, to work over a low ridge at an elevation of about 50 ft. above the level of the ditch, and so into another gulch, down which the dredge will work its way to the river again. From the progress already made it would appear that this method of working is quite feasible, and though in this case it is intended to rise only about 100 ft., there is no reason why this method should not be applied to even greater heights, and so render available ground hitherto considered unworkable owing to the laek of high-pressure water for sluicing.

Operating Costs at the Kalgurli Mine

The last annual report of this company gives the following details of mining and costs per ton, there being 123,800 tons treated during the year by ball-milling in Krupp mills, roasting in Edwards furnaces, classification, grinding in pans, agitation by air (Kalgurli system, introduced in 1901), filter-pressing, and disposal of residue by sluieing.

Mining	
Labor:	
Superintendence	$0.04
Breaking ore	0.66
Timbering stopes and chutes	0.04
Loading and tramming	0.42
Filling stopes	0.16
Tool-sharpening, etc.	0.05
Sundries	0.02
Total labor	$1.39
Stores:	
Tools, steel, drill renewals	$0.03
Candles	0.02
Explosives	0.18
Timber	0.04
Assays	0.01
Sundries	0.01
Total stores	$0.29
Hoisting, machine-drills	0.24
Total cost at shaft mouth	$1.92
Proportion of management and general expense	0.15
Total mine costs	$2.07

Treatment	
Superintendence	$0.07
Rock-crusher, power	0.07
Aerial tramway	0.08
Ball-mills, conveyor and power	0.46
Roasting, and power	0.68
Classification	0.05
Grinding	0.28
Agitating, filter-pressing	0.46
Disposal of residue	0.11
Water	0.13
Oil and grease	0.02
Precipitation, amalgamation	0.08
Clean-up and smelting.	0.02
Sampling and assaying	0.01
General treatment	0.04
Total working cost	$2.56
Proportion of management and general expense	0.20
Total mill cost	$2.76

Proposed Regulation of Gold-Dredging

By Charles Janin

The regulation or restriction of areas otherwise suitable for gold-dredging is the object of a bill recently introduced in the California legislature which is creating serious concern among dredging men. Briefly stated, the bill declares the cultivation of the soil to be necessary for future subsistence, livelihood, and prosperity of the people, while the use of the ground for gold-dredging is more especially for the benefit of the present only. It provides that anyone intending to mine soil for gold or other precious metal, by dredging, must make written application to the State Water Commission for a permit before commencement of work. The Commission is to examine into the merits of the case and to hand down a decision within 90 days after application. The Commission is not limited to a consideration of the value of the annual production of the soil, but may take into account the benefits to be derived from its future use for agricultural purposes. The advocates of the bill thus contend that the fundamental and most valuable use of all ground is for agricultural purposes. This bill will impose onerous conditions upon the dredge operators, who must appear before the board and justify the continuance of their present operations, and it jeopardizes the existence of companies representing an investment of approximately $10,000,000 in machinery and equipment and considerably in excess of that amount in land and other holdings.

History of Dredging

It is not necessary to narrate in detail the history of gold-dredging in this state, but the following table shows the production of gold won from dredging operations, by years, from 1898, when it was $18,878, to 1912, when it was in excess of $7,500,000. The total to date is nearly $50,000,000. This amount has been added to the wealth of the state by means of gold-dredging.

Production by Dredges of Gold in California, 1898 to 1910

Year.	Amount.	Year.	Amount.
1898	$ 18,847	1906	$5,098,354
1899	133,812	1907	5,065,437
1900	200,369	1908	6,536,089
1901	471,934	1909	7,382,950
1902	801,295	1910	7,550,254
1903	1,488,556	1911	7,666,401
1904	2,187,038	1912*	7,500,000
1905	3,276,141		

*Estimated.

These figures show that gold-dredging is one of the most important industries in California. During 1912 there were 65 dredges operating in the state. The dredging and associated companies employ approximately 2500 men; the yearly wages are in excess of $2,500,000.

The proposed bill is not the first attempt to curtail gold-dredging in California. At times in recent years there have been complaints about the tailing from the dredges obstructing the rivers and discoloring the streams. In several instances these complaints came from men who had but a short time before sold their agriculturally worthless land at a substantial price to the very dredging companies to whose operations they were then objecting. The dredge men have for years been impounding the overflow from the dredge ponds, and have spent considerable money in preventing this water from flowing into rivers. Most of the dredges now operating in California, with the exception of those in the Yuba river, are working inland and not in the river beds proper. They are not, therefore, obstructing the rivers with their tailing or causing overflow during flood-times with resultant damage to adjoining land. A committee appointed by an anti-dredge convention, a couple of years ago, reported that the dredges along the Yuba and American rivers, instead of sending down débris, were impounding considerable sand and keeping it from going into the streams.

The present bill proposes a limitation of the industry to a greater degree than any based upon damage due to pollution of streams. It is based upon another assumption entirely, and prohibits the dredging of the land in the first instance if it is land that can be used for agricultural purposes. The contentions of the dredge operators merit most careful consideration, and no hasty action should be taken in the matter. When problems like this are intelligently and honestly studied, it will be found that the amount of damage done by the dredge is not large and is more than compensated for by the good resulting from the industry: one which adds millions of dollars worth of gold annually to the state's products and distributes immense sums through the various channels of trade.

Area of Land Affected

The amount of land attacked by the bill is not great. Compared to the total area of arable lands in the state, it seems almost infinitesimal. At the present time there are approximately 12,000 acres of land thought to be suitable for dredging in the state, and only about 3500 acres of this could be classified as agricultural. According to figures of the California Development Board, there are 28,000,000 acres of arable land in the state, and assuming 3500 acres as the area of such land planned to be dredged, it will be seen that this represents but 1/80 of 1% of the total area of arable land. The distribution of this agricultural land is approximately as follows: Butte county, 632 acres; Yuba, 792; Sacramento, 1372; Placer, 530 (not entirely proved to be dredging land); Trinity, 80; Stanislaus, 150; total, 3556. Nearly one-half of the agricultural land to be dredged is owned by one company, the Natomas Consolidated of California. This concern has, according to the management, over $3,000,000 invested in dredges, shops, and plant, aside from the investment in land. It employs nearly 400 men in

the operation and maintenance of its dredges, and produces about $2,000,000 yearly. The company in its different operations employs a total of 1500 men and has a yearly payroll of about $1,200,000.

No Agitation Elsewhere

This agitation over the loss of land by mining seems to be confined in the United States to California. So far as I have heard, no objection has ever been raised to the operations of stripping soil from land in advance of mining operations for coal in Kansas, phosphate in Tennessee, iron in Minnesota, or iron in the north of England. While the land stripped in Minnesota has not been used for agricultural purposes, similar land is so used. In Tennessee a considerable acreage of first-class agricultural land was destroyed in mining phosphate deposits, and in Kansas good land has been destroyed in stripping for coal. Destruction of land for mining should rest on the same basis as its use for other purposes, such as building permanent structures, roads, and railroads. When it is proposed to conserve only 1/80 of 1% of all the state by restricting dredging, it may be pointed out that there are other places where conservation of land of far greater area can be accomplished without jeopardizing any great established industry. For instance, there are approximately 50,000 miles of highway in the state, and 27,000 miles of steam and electric railways, not counting those in cities and towns. A strip one foot wide taken off the right-of-way of these areas would conserve considerable more land than all the arable land affected by this anti-dredging bill. There can be no question but that land is wasted in rights-of-way, and much land is rendered permanently unsuitable for agriculture by other industries than dredging. It is an incident to industry, and if greater wealth is thereby created, there is a net gain.

Extent of Known Fields

The major portion of the dredging ground of California lies in three fields. At Oroville, Butte county; near Marysville, Yuba county; and near Folsom in Sacramento county. The limits of dredging ground in these three fields have been definitely determined. The Oroville field was the first to be developed, has proved to be the greatest in extent, and is rapidly being exhausted. In about three years most of the dredges now operating will be out of commission, and several of the companies will finish their ground in less time. In the Yuba field there are two companies operating, the Yuba Consolidated with 12 dredges, and the Marysville Dredging Co. with two. The ground is deep and it will take a number of years to work out the district. There is comparatively little good agricultural land in these holdings, and there is little or no possibility of increasing the acreage of ground to be dredged. The American field, with the exception of the Union Dredging Co.'s holdings and a few acres belonging to the Ashburton Mining Co., is controlled by the Natomas Consolidated. In addition to the 500 acres at Oroville, there are about 3500 acres belonging to the company at Natoma that is considered dredging land, and in addition to this there are about 1000 acres in river beds and old hydraulic pits which is not considered of much value, but some of which may ultimately be dredged to finish the life of the old machines. There are 33 companies in the state operating 65 dredges, but there are only 4 companies operating more than 2 dredges.

It may be of interest to note that wherever dredge mining is carried on the nearby ranches and towns have been greatly benefited. Today great activity and prosperity exist at Oroville, Marysville, Hammonton, Marigold, Folsom, Jenny Lind, and other places which were almost dormant or did not exist previous to the advent of the dredging companies. One of the greatest benefits derived from dredging operations in the state, and one which should appeal to even the most bitter antagonist of the dredging industry, is the work of the Natomas Consolidated in building extensive and expensive levees in reclaiming 60,000 acres in the Sacramento valley. This reclamation project is bringing into use approximately 40 times the number of acres of arable land that the company expects to dredge for gold. The work of reclamation will cost in excess of $5,000,000 and the money which is used to reclaim this land comes from gold-dredging. Operations such as this are of the greatest permanent benefit to the state. The loss of any small area that might have been useful for agricultural purposes is compensated for 50 times or even 100 times over by bringing into production 60,000 acres that, when fully reclaimed, will, if the company's expectations are realized, add to the wealth of the state from $20,000,000 to $25,000,000. It must also be considered that most of this land was idle and practically worthless before this work of reclamation was begun, and that it would probably have been idle for a number of years to come except for the work of the Natomas Consolidated, made possible from the profits resulting from gold-dredging.

Reclaiming Dredged Land

The advocates of the bill contend that after land has been dredged following the present method of operation in California, it is practically worthless for any economic purpose. The successful reclamation of trial areas at Natoma and Oroville, where ground that has been dredged has been planted to fruit trees, grape vines, olive and eucalyptus trees, would tend to prove the contrary.

Rock-crushing, which utilizes the coarser portions of the dredge tailing, has also become an important industry of much benefit to the state. It gives work to many men and supplies crushed rock at a cost estimated to average about 30% less than that previous to the operation of these plants. Some idea of the magnitude and the gross value of the output may be gathered from the following figures. The rock-crushing plants of the Natomas Consolidated, with improvements contemplated, will have a capacity sufficient for clearing the tailing from about 60 acres of dredged land per year. The lands are so situated as to draw most of their supply from land suitable for agricultural use after the coarser rocks are removed. In about 25 years, therefore, according to these figures, the plants can clear as many acres as the Natomas Consolidated has yet to dredge

of agricultural lands. The company estimates the product from one acre of dredged land is about 40,000 tons of marketable crushed rock and gravel. The value of this material at the plant is about $13,000. The freight charges average at least $12,000. which is wealth created and put into circulation through labor, freight, and sundry charges. Lest these figures be interpreted as showing a large profit on the operation of rock-crushing plants, it may be mentioned that the net income to the Natomas Consolidated from the rock-crushing operations is stated to be about 5% on the investment entailed; something over $1,000,000.

Comparisons of Value

For comparative purposes the following figures may be of interest: Assuming that there are 12,000 acres of land yet to be dredged in the state, and that the average depth of this land is 11 yd., there would then be an average of 53,240 cu. yd., which may be taken as 50,000 cu. yd. of material to the acre. The average operating cost of dredging in the state may be taken at 5c. per cubic yard, or $2500 per acre. In 12,000 acres there would be distributed $30,000,000 in labor and other operating costs. The average gross value of this material may be taken at 10c. per yard. Accordingly, $60,000,000 will be added to the production of the state, the greater part of which is spent within its borders.

Land that was formerly planted in vineyards and handled as such at a loss has been dredged at a profit to the owner and to the state. In one area of several hundred acres the gross amount realized from grapes averaged, over a period of several years under careful cultivation and attention, about $25.40 per acre per year. The greatest gross production per acre from this land when planted to vineyard was $32.50 per year. The net result from these operations was less than $10 per acre for any one year, and some years the property was operated at a loss. Such of this land as had been dredged has averaged $2930 per acre. If it is assumed that this amount was placed at interest, the yearly return from such investment would be about $150 per year. While these figures cannot be applied to all vineyards, in the case in point the gold produced from dredging may be regarded as added to the permanent wealth of the state while the crops from the vineyard can hardly be regarded in any such light.

New Zealand Practice

It is held by some who are possessed of incomplete knowledge of the operation of a gold-dredge, that, by the use of dredges of a different type than those now employed in the California field, the tailing can be more evenly distributed and the ground destroyed at the front end of the dredge may be reclaimed as the tailing is deposited at the stern. The dredge would thus have the effect of deep plowing and aerating the soil. These ideas are based upon accounts of the operation of the small dredges in Victoria and New Zealand where re-soiling operations have been employed for several years. Some dredges of the design first used in California left the ground behind the dredge in a condition more pleasing to the eye than the 'unsightly piles of gravel' that follow the modern dredge. It is also contended and believed that the tailing from the old type dredge left the ground in a better condition for reclaiming than the tailing from the modern boat. There is, however, some question about this, as there were great quantities of boulders and coarse gravel on the top of the tailing, and in this state none of the land handled by these dredges has ever been replanted.

Shallow Versus Deep Ground

It is true that Victorian and New Zealand dredges operating under the present restrictions in those countries do leave the land in better shape for reclamation than the California boats. This is due to the resoiling or sluicing arrangements that have of necessity been added to those machines. While these arrangements have given a degree of satisfaction in the countries named, it must be considered that the different character of the dredging ground in California would prevent the economic use of such arrangements except in a very few places. The modern California dredge has been developed following the studies and experiments of operators for a number of years, and it would be impracticable if not impossible to handle the deep ground being worked without the tailing stacker as now used. The operations of the dredges in Victoria or New Zealand are confined to shallow ground; those in California, in places are dredging ground 70 ft. deep. At some places there is a bank 20 or 25 ft. high in front of the boat. It is obvious, or should be, that in digging ground of this depth, with a high bank in front of the dredge, it would be practically impossible to dispose of the tailing without the high stacking arrangement in the rear of the boat. Experienced operators contend that it is not feasible to level the tailing from this deep ground while operating. To do so and deposit the fine soil on top of the leveled coarse tailing would add such a cost to the operation of the boat that few dredges handling deep ground having a low gold content would continue in operation. For instance, the records taken from the operations of three large dredges for the year ending 1912 show a net recovery over bare operating costs of 3.25c., 1.38c., and 3.7c. per cubic yard, respectively. These figures make no allowance for depreciation of plant or amortization of capital, and it is obvious that had any additional charges incidental to leveling and reclaiming the land been necessary, the operations would have resulted in loss.

The flume type of dredge, which distributes the tailing fairly evenly behind the dredge, has a long sluice or flume paved with riffles by which the gold is saved. Experience has demonstrated that while these arrangements permit saving a considerable portion of the gold content of material from ground which is free from much clay and which contains coarse gold, the percentage of recovery is small when dredging ground where the gold is light and flaky. One of the steps in the development of the modern dredge has been the gradual and constant increase of the area of the gold-saving tables and the even distribution of the material being washed. This has been made necessary by the dredging of ground of lower gold content and on account of the character

of the gold to be saved. If this material was carried with the heavy rush of water that runs through the sluices of the flume dredge, a large percentage of the gold content would be lost.

Double-Lift Dredges Unprofitable

The old Continental dredge, which was one of the first successful boats operated in California, was first designed as a double-lift machine; that is, the fine material from the buckets was passed to sump or water-tight compartment built in the hull of the dredge, the coarse material being dumped over the side of the boat. The fine material was raised by

EUCALYPTUS TREES GROWN ON DREDE TAILING.

means of a suction pump to a straight sluice supported by an auxiliary scow extending about 70 ft. behind the dredge. While these operations left the tailing more evenly distributed than the modern boats, the dredge operated at a loss until it was changed to one of the present type. Among the principal changes made was the change of the gold-saving devices from straight sluices to riffle table areas, to enable clean washing and even distribution of the material and the recovery of fine gold that it was impossible to save with the former arrangements.

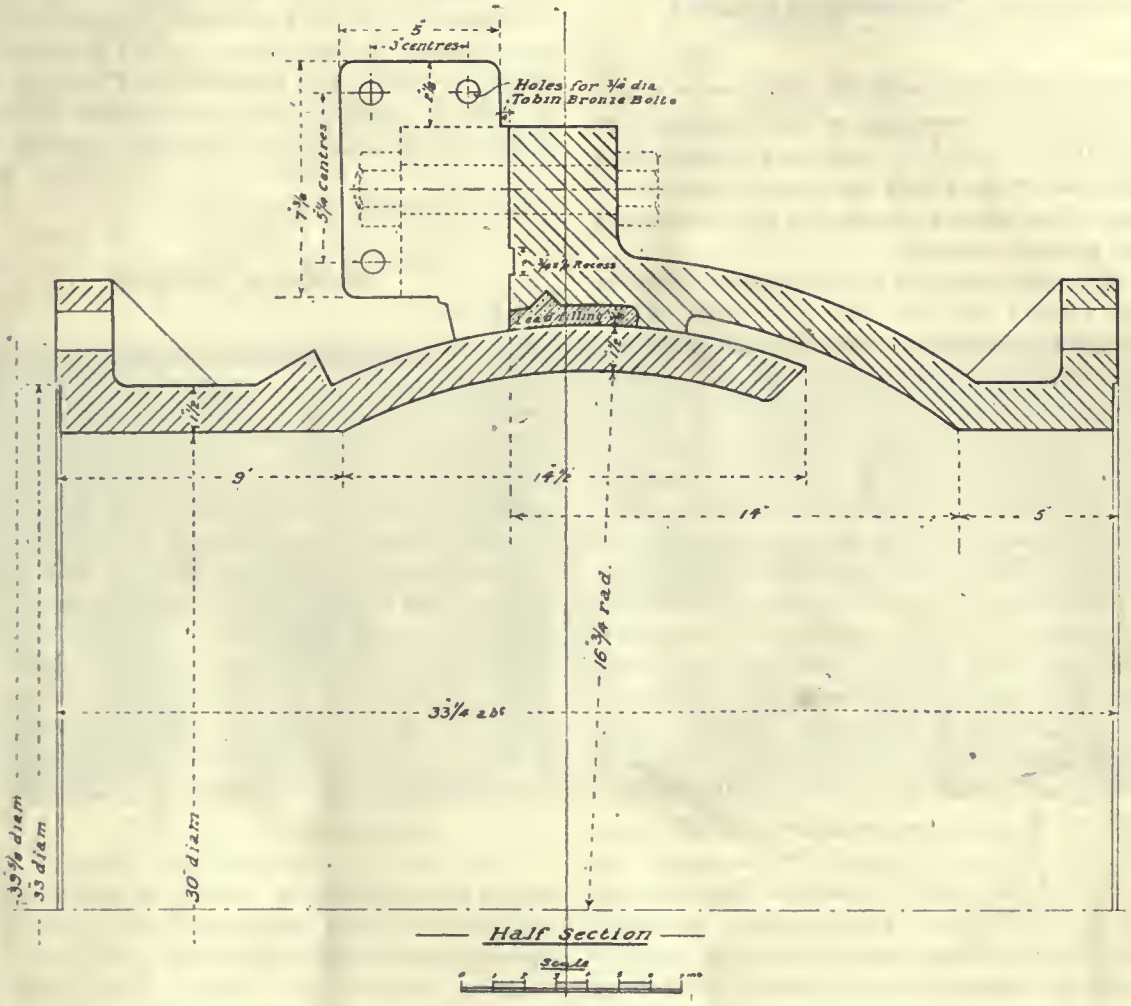
Little Valuable Ground Permanently Lost

Most of the land that has been dredged in the state was originally unsuitable for either horticultural or agricultural purposes. A considerable portion of the dredging land was previously mined by methods in use prior to the development of gold-dredges, and the condition of a considerable portion of this land was such as to make it useless for any other purpose. Open or partly caved shafts and pits, old dumps, and heaps of stones were everywhere, and practically the only vegetation was a few scrubby trees. The acreage of orchards and vineyards already dredged that had been formerly planted would probably not total much over 2000; most of this was around Oroville. The loss resulting from destroying these orchards and vineyards, some of which had already been attacked by the phylloxera and would of neeessity have been destroyed, cannot be considered great. Though there are exceptional cases, it may be said that few of these orchards and vineyards returned much of a profit to their owners prior to dredging. The removal of the tailing for use in the rock-crushing plants is a step toward the ultimate reclamation of that land. After the larger stones have been removed from the ground at Natoma, experiments have been made in planting olive and eucalyptus trees without any further treatment than the addition of a shovelful of loam around the roots of the trees as they are put in place. While only a few acres have been planted in this way, enough has been done to demonstrate the feasibility of the plan and to give ample evidence of the fertility of the ground dredged. Experiments in planting trees and grape vines in the dredge tailing have been made at Oroville by James H. Leggett, and while much of the success of these latter experiments was due to the abundance of clay present—a condition common to that locality that added greatly to the fertility of the tailing—the results show that the ground after dredging is not so worthless as was at first supposed. The result of these experiments have already been described and illustrated in the *Mining and Scientific Press* of October 26, 1912.

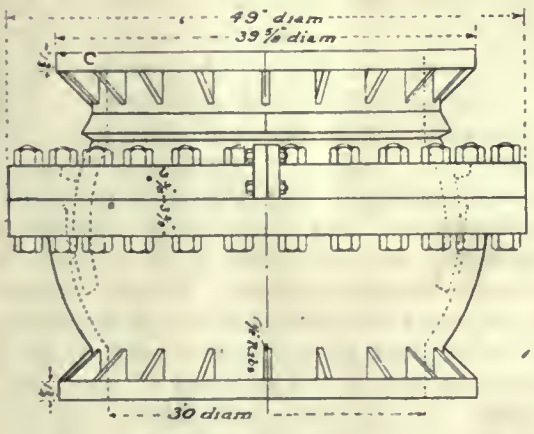
Foreclosure proceedings in the matter of the mortgage on the properties of the Peruvian Mining, Smelting & Refining Co., by A. G. Irigoyen, of Lima, acting under power of attorney for the Old Colony Trust Co., trustees for the bondholders, have recently been concluded. The Commission to revise the old Code of Civil Procedure made its report only a few months ago, and as a consequence an act was passed bringing this new code into force from July 28, 1912. Due to this new code, the proceedings in this case were carried through in less than three months, which constitutes a record in the judicial history of South American republics for an affair of such magnitude. Under the old code of procedure, such a foreclosure would have taken quite six months (more probably a year), and thus the advance which Peru has made in the matter of making it possible for a creditor to secure an expeditious collection of his debt is both praiseworthy and noteworthy. Under the old code of procedure, experts who were to value the property were appointed, one by each party, and in case of disagreement a third was named by the two already chosen. Disputes and delay under this system were common. Under the new code, the experts are appointed by the judge himself, and their report, upon being accepted by the judge, is final, and not open to appeal of any sort.

A Flexible-Joint Siphon

*In the South Island of New Zealand the Government has constructed ditches, for many years, for the supply and sale of water for hydraulic mining. On April 12, 1912, the Kumara district received an impetus by the opening of an extension of the ditch system, which consists of an inverted flexible-joint siphon of 30-in. cast-iron pipe, 10,626 ft. in length, across the valley of the Taramakau river. This conduit delivers 36 cu. ft. of water per second into a distributing ditch, which traverses the higher terraces above the gravel claims, and with its storage reservoir will be able to supply 50 cu. ft. per second for 12 hr. daily, throughout the whole year, for the development of the extensive deposits still unworked in the Westbrook Maori Point, and Hayes Terrace sections. As a power scheme, this conduit has valuable possibilities, as from it about 2600 hp. can be developed at the Government power reserve on the south bank of the river. The cost of this water scheme extension was $96,000, and the accompanying cuts give details of the pipe. The plans were accompanied in the report by three good photographs showing the pipe across the valley, across the full width of the river, and a section of the river and pipe illustrating how it was laid down. Unlike many pipes which cross rivers, this one was laid arch shaped, the top of the arch being against the flow of the river, this bringing all joints into compression and so lessening leaks; whereas, when a pipe is laid straight across the flow, all bolts in joints are in shear and leaks are made more possible. The pipe is anchored by means of piles driven at intervals on either side.



METHOD OF PACKING THE JOINT.



FLEXIBLE JOINT, ASSEMBLED.

*Abstract from annual report of New Zealand Department of Mines for 1911.

Mineral exports from Broken Hill during the first 11 months of 1912 were valued at $19,900,000; and dividends amounted to $8,920,000, to which the Broken Hill South contributed $1,410,000; Sulphide Corporation, $1,400,000; Broken Hill Proprietary, $1,300,000; North, $1,250,000; Zinc Corporation, $850,000; Amalgamated Zinc, $650,000, the two latter from treatment of tailing by flotation.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Treatment of Concentrate at Goldfield

The Editor:

Sir—I read with interest J. W. Hutchinson's article, 'Treatment of Concentrate at the Goldfield Consolidated Mill,' in which he explains at considerable length the theory on which his roasting practice is based and offers various reasons for the satisfactory roast and product secured.

From the composition of the concentrate roasted, it is quite evident that the large percentage of free silica is chiefly responsible for the good roasting. With the presence of free silica a fine subdivision of ore or concentrate particles in roasting is especially favorable to oxidation. It has been long recognized that oxygen (gas) condenses on the surface of finely divided silica (quartz) and certain other oxides and metals at a high temperature, and that these 'contact' substances act as carriers and transmitters of oxygen. Notable examples of these are platinum sponge and ferric oxide, Fe_2O_3. Plattner, in his work on 'Röstproeesse', published more than half a century ago, mentions quartz as a 'contact' mineral and explains its important action in roasting; and the contact proeess of sulphuric acid manufacture is based on this peculiar physical phenomenon. The finely divided silica in the Goldfield concentrate acts in this manner. Furthermore, the quartz prevents the sulphide particles from melting, as, when present in such large quantity, it acts as a diluent forming an infusible mixture. It also acts chemically, decomposing the sulphides. That silica decomposes metallic sulphides and sulphates is a well recognized fact in metallurgy, and its important rôle played in roasting processes is well known. Siliceous ores with a large percentage of free silica are frequently added to sulphides to bring about their decomposition, as well as to prevent their fusion. The rapid rate of decomposition of pyrite in presence of free silica is well illustrated in pyrite smelting, where the oxidation by means of the air-blast is purposely carried on so fast that the ore is smelted, which without free silica could not be accomplished successfully. If the Goldfield concentrate were a sulphide with practically no free silica present, it would be difficult to prevent fusion of the slimed sulphide particles and to secure a sweet roast.

The difficulty of controlling temperatures in roasting and preventing fusion of sulphides has led to the practice of mixing diluents with the charge, and the addition of finely crushed limestone to concentrates is now common practice in copper and lead ore roasting. The heat required for the decomposition of the calcium carbonate $CaCO_3 = CaO \leftrightarrows CO_2$ is furnished by that generated by the oxidation of the sulphides; this causes a lowering of the roasting temperature with the desired result. As the roasting proceeds the calcium carbonate, converted into the sulphate and oxide, keeps the sulphide particles apart and furthers their oxidation. In addition to this favorable action, the admixture of lime with the calcines was greatly responsible for the large increase in the smelting capacity of the copper reverberatory furnaces.

In conclusion, I would say that the silica acts in the following ways in the roasting of the Goldfield concentrate: (1) As a powerful reaction compound, decomposing the sulphides; (2) as a contact substance, or carrier and transmitter of oxygen; (3) as an efficient diluent, preventing fusion of sulphide particles and consequent incomplete roasting.

HERBERT HAAS.

San Francisco, February 1.

Regulating Dredging

The Editor:

Sir—Your timely editorial, 'Regulating Dredging,' which appeared in the issue of February 8, held great interest for me; and if the words contained therein, "any person * * * intending to mine soil for gold," mean literally what they say, this law as proposed will, I am sure, hold considerable interest for every piece of placer ground in the state.

Does this law contemplate that the only means of mining "soil for gold" is by the dredging process? Or may it merely mean that of all the processes for mining soil for gold, only the dredging process shall be placed under the Water Commission? Where no injury to others is done, has the private ownership of land in this state no stronger position than to allow a stranger to the title to name the use to which it may or may not be put?

Considering the relatively few acres of alluvial soil in this state rich enough to be mined for gold: compared with the vast acreage of tillable soil now under cultivation, containing no gold; not to mention the absolutely new areas of agricultural land now monthly being literally 'created' by reclamation, in tracts of from 10,000 to 60,000 acres, does not the "declaration that cultivation of the soil is an ordinary use, necessary for future subsistence, livelihood, and prosperity of the people, and that the use of the soil for dredging purposes is an extraordinary and uncommon use" lose much of its assumed force? Under the wording of the law, as you quote it, it would seem that every 'placer mine' in California must close down (under liability to a fine of $5000) until the status of its soil shall have been legally passed upon by the Water Commission. It may be that I am unduly excited, or too obtuse to understand a matter really of no concern to me, but as the owner in fee of 1200 acres of deep alluvial soil (much of it unquestionably tillable) containing gold, which I am mining by hydraulic process in this state, I write to ask just how far reaching it is intended this proposed law shall be. Just what is it our legislature is intending to regulate? Let's have some light on the matter.

INQUIRER.

Oakland, California, February 14.

[The proposed law is serious enough in terms and is, we believe, entirely unnecessary. The matter is discussed fully in another column.—EDITOR.]

Stimulants and Altitude

The Editor:

Sir—A recent editorial in one of the mining story books on 'Engineers as Financiers' makes incidental reference to the use and misuse of whisky and soda. As it says—it is not true that drinking whisky and soda is injurious, only drinking to excess injures one. Precisely the same thing is true of two other curious human habits. The simile brought to mind a Bolivian condition.

It is a cold and difficult place in which to live and the Government makes it more difficult by exacting very stiff revenues from the alcohol business. Much German and French corn alcohol is consumed by Aimará and Quichua Indian men, women, and children, it really being a necessity due to the cold, the altitude, and the high cost of all foodstuff.

The railways and mine operators are sure that the temperate consumption of 40° alcohol made of corn is a very dangerous occupation—but it does not kill. O. Kempf does not agree. He says a few years will see the Indians vanish.

These same Indians have a habit similar to chewing tobacco. They masticate a cud of the cocoa leaf with a tiny piece of quicklime. The latter seems to be a necessary part of the chew, else the cocaine effect is not experienced. It is a fact that the children do not use the leaf so much, but after a while they "acquire the habit, by no means injurious when followed temperately." It is much cleaner than tobacco and stimulates more than, without exciting like whisky (and soda). The pleasures of cocaine are only given up when they can be replaced by those of 40° corn alcohol. There is not the least doubt that the excessive user of cocoa is annoying to his employer. It is customary to wear a heavy boot, but even with this it is difficult to concentrate a workman's attention, short of three or four hard kicks. It is said to require a long residence to attain the degree of *savoir faire* which an experienced man exhibits in administering these kicks calmly, naturally—smilingly. This is an art difficult to acquire.

The child is supposed not to require the stimulant and rarely begins its use before having reached the age when he takes a wife and starts a family—sometime after twelve. His parents do not advise his adoption of the habit though a father well knows that, "a stimulant is required after a boy becomes a man."

It is this stimulant in Bolivia (like other stimulants elsewhere) which enables the Bolivian Indian to work at high pressure (or altitude, if you prefer) and makes him the peer of his equal anywhere.

MARK R. LAMB.

Santiago, September 13, 1912.

Taxation of Mining Claims

The Editor:

Sir—In the matter of Mr. Joseph's letter and your invitation to say things on the above subject, I submit the following.

The early legislators of Nevada being seized and possessed with a desire (in those days amounting to a passion) to encourage and stimulate mining in all parts of their wonderful state, enacted laws exempting mines from taxation. The result was the absolute reverse of what those good men expected: mining was not encouraged, but speculation and mine owning was encouraged and developed in an astonishing way. It cost nothing to hold mining claims. If they were worth anything, and the owners cared to patent them they could be held without cost. They could also be held by indifferent or pretended assessment work when not patented. To illustrate: many years ago, I met a prospector in Winnemucca who had just come in for a grubstake and wanted help to develop a rich silver lode that he had found. To prove its richness he exhibited well worn pocket specimens. On being asked who owns the claims in the district, he said, "I own one side of the mountain, and Whiskey Dick owns the other." I do not know the object of Nevada's present law to which Mr. Joseph objects, but I do know that the way to encourage mining in Nevada or in any other state is to tax the mines and exempt the improvements. This plan is so simple that I fear your editor in charge of political economy cannot be induced to relate it to the multiplication table or to chemical reactions, yet I must insist that the plan is governed by as unvarying a law as either, and in no other way can mining be really encouraged or miners and mine owners be justly treated by a state.

Stockton, February 19. G. McM. Ross.

AIMARA INDIANS IN BOLIVIA. CRUSHING, WASHING, AND CLEANING ORE BY HAND.

Special Correspondence

LONDON

GREAT COBAR, REPORT BY HERZIG.—MEXICO MINES OF EL ORO REMOVES HEADQUARTERS TO FRANCE.

A few weeks ago I gave some particulars of the Great Cobar copper mine in New South Wales, and showed that the mine had now turned the corner and commenced to make profits, though not to pay dividends. Since then, the profits have once more decreased, let us hope only temporarily. For the quarter ended December 31 last, the profit was only £23,071, or just one-third of the figure for the previous quarter. This 'profit' is by no means the real profit, for debenture interest, London expenses, and depreciation have not been charged. A London paper which voices the views of an Anglo-Australian financial firm, continues its bitter attacks on the mine, the directorate, and the management, and is jubilant over the present setback; but it is inadvisable to reproduce its analysis of the position. Let me turn, instead, to a more cheerful item of news, namely, the publication of a report on the mine by Charles S. Herzig. A few months ago, alarming reports had been circulated with regard to the loss of the lode, but subsequently this was proved to be due to an error in driving the level. Mr. Herzig was commissioned by a group of shareholders to go to the mine and make an examination. His report has been bought by the board and issued to the shareholders and the public. His view of things is highly encouraging, and he states that the property is not only of immediate merit, but of great potential value; geologic reasons indicate that its life will be a long one and that it should become a consistent dividend-payer. The subject of the future of the Great Cobar is of such great importance that I quote as follows, Mr. Herzig's account of developments at depth:

"The future outlook for these properties is one of great promise, for we have enormous orebodies which have been consistent producers for a number of years, in which developments at the lowest points show results of a highly favorable character. For instance, in the Cobar mine itself, at the twelfth level around the plat, one of the largest areas so far opened in the mine has been exposed, having an assay value considerably above the average of the mine. The thirteenth or lowest level is opening equally well. The northern orebody has unquestionably taken a more easterly dip than heretofore, so that the additional development which is now being carried out should, if indications prove anything, show a greatly increased tonnage in these levels. Apparently it is increasing in size from the tenth level down. The shaft has proved ore for 60 ft. below the thirteenth level, so that the bottom of the mine is still good. Developments in other directions are giving equally favorable results. The Cobar Chesney mine has a consistent run of valuable ore for about 700 ft., and at the lowest level so far opened up, the seventh, ore of better grade has been found than anywhere else in the mine. In one section high-grade gold ore has been found, and at the other end of the level better copper ore than the mine's average. The cross-cut on the eighth level is now being extended to the orebody. A shoot of ore hitherto untouched below the No. 2 level has been cut on the seventh level, and shows profitable ore for a width of 11 ft. This development is a highly important one. The Cobar gold mine is a deposit of a different class, and the future cannot be forecast with the same degree of certainty as with the other two properties. The only other gold mine in the district has proved value to a greater depth than the Cobar Gold, and to that extent the outlook may be considered hopeful."

The Mexico Mines of El Oro, Ltd., is in future to domicile its management in France, though the registered office will continue to be in London, and the company will continue to be an English one. The object of this new move is to avoid income tax. Seeing that the large majority of shares are held in France and other Continental countries, it is only natural that the directors should desire to prevent these shareholders from paying English income tax on a Mexican venture. The majority of the members of the board are Frenchmen, and the meetings of the directors have been held in Paris for some time. This decision has been based on the interpretation of the law in the celebrated De Beers case. Shareholders in that company are to be found chiefly on the continent of Europe, and though the company is registered under the laws of the Cape of Good Hope, there is also an office in England, where it was alleged the actual direction of affairs was centred. The argument was that wherever the mine and wherever the registered home of the company, the location of the actual management decided the domicile of the company. With income tax at 1s. 2d. in the pound, foreign investors are not keen on an English domicile for their companies. The transferrence of the centre of management of the Mexico Mines of El Oro from London to Paris is a decidedly interesting move.

CLIFTON, ARIZONA

NEW PLANT FOR ARIZONA COPPER.—MINIMUM WAGE LAW.

Construction work upon the new smelting and concentrating plant of the Arizona Copper Co. is making good progress. The concentration plant at Morenci, which now handles the ore from the Humboldt, Clay, Longfellow, and Yavapai mines, is being doubled in size in order to handle an increased tonnage from those mines and also 1000 to 1500 tons per day from the Coronado mine at Metcalf, which will be connected with the concentrator by an electric haulage system. At the Coronado the ore will be delivered through chutes to ore pockets above the adit or 1100-ft. level, whence it will be drawn into 10-ton cars; trains of 20 cars each will be hauled by electric locomotives through the ridge to the 250-ft. level of the No. 6 shaft, where the ore will be dumped into skip pockets and hoisted to the mill-bins.

The concentrator, which was originally designed by C. D. Clark and L. H. D. Forbes, has since been enlarged to a capacity of 1700 tons per day and is now being rebuilt under the direction of David Cole, to a capacity of 3000 to 4000 tons per day. The bin capacity has been increased and a primary crushing plant has been built, consisting of McCully breaker, round trommels, and 54 by 24-in. rolls. The Hancock jigs which have been in use are being replaced by Woodbury jigs, made of concrete, as these are able to handle the unsized product, which now goes to the Hancock jigs, and make a cleaner concentrate for direct smelting. The Huntington mills are being replaced by 8-ft. Hardinge mills, of which 9 have been ordered. These will be longer than the ordinary design, being 36 in. long at the cylindrical part instead of 22 in., as this has been found to give increased grinding capacity without an equal increase of power and weight of pebbles. These mills are being manufactured by the Allis-Chalmers Co., which, together with the Power & Mining Machinery Co., has furnished most of the equipment. The present Wilfley tables and vanners will be retained, but more refined methods of the classification of the fine material are expected to yield a better extraction.

At the new smelting plant, which is being constructed on the San Francisco river, about two miles below Clifton, and a mile from the Shannon smelter, the roasting plant consisting of eight 21-ft. Herreshoff furnaces, is practically completed, together with its accompanying dust chambers. The main chimney is also finished and work on the reverberatory plant is well advanced; 10 waste-heat boilers are already in place, and the brickwork on three reverberatory furnaces is well advanced. The power-house is rapidly being put in shape, and it is hoped to have it in operation by July; the smelting plant as a whole will probably be blown in before the end of the year. A full crew is at work under the supervision of E. Hanton Jones; Norman Carmichael is general manager. L. D. Ricketts is consulting engineer for the company. David Cole has designed the new concentrator, and Repath & McGregor the smelting plant.

Mining men throughout Arizona are vitally concerned in the proposed minimum-wage law which has been introduced in the first legislature, now in session. This provides that in all hazardous occupations, among which mining and smelting are classed, the minimum wage for eight hours of work shall be $4. It is not at all probable that the bill will secure passage, as its provisions are so unreasonable, the class of miners now available in the Clifton district receiving $2.25 per shift; but if it should be enacted, the results will scarcely be what its proponents expect. If the mining companies are compelled by law to increase wages to such an extent, they will naturally bring in more skilled men from other mining districts, who are able to do $4 worth of work per shift, and the condition of the present mining population, instead of being bettered, will be rendered worse. Possibly this is what the sponsors of the law desire, as it will be remembered that the Kinney bill, which failed of passage a year ago, provided that men should not be allowed to engage in hazardous occupations unless they were able to read and write the English language. It is quite probable that the legislators have something else in mind than the welfare of the Mexicans who perform a large part of the labor in mining and smelting throughout Arizona.

HOUGHTON, MICHIGAN

MINE-RESCUE WORK.—COMPENSATION LAW.

In the Lake Superior mining regions, to quote a mine superintendent, "a Red Cross craze is on." A United States mine-rescue car has been obtained through the Bureau of Mines and will be stationed at Ironwood, Michigan, to serve the iron ranges of Michigan and Minnesota and the copper country of Michigan. The larger mining companies are training first-aid crews at all their mines, in order that the employees shall know how to care for a man with broken bones, overcome by gas, or injured by electrical accidents. Both surface and underground crews are trained. The underground crew is selected from men familiar with the mine, such as timbermen and trackmen. Also, crews are trained in the use of the oxygen helmet and pulmotor, and such apparatus is maintained in some central locality. The Cleveland-Cliffs Iron Co. has held exhibitions and competitive contests at Ishpeming, at which crews from its different mines took part, and has awarded prizes to the teams judged best. This company intends to train a new first-aid crew at each mine every year, so that in time nearly all the employees will be competent. The direct cause of the interest in mine-rescue work was the mine fire in the Hartford mine of the Republic Iron & Steel Co. in Negaunee, in the spring of 1911, when seven men were killed.

Another reform which the mining companies have succeeded in bringing about is the Michigan State Compensation Law, which went into effect September 1, 1912. This law is optional with employers and employees, but the terms are such that it is to the interest of both to agree to come under its terms. Under the old laws, when a man was injured in a mine and though he deserved damage payments, he went to a lawyer and started suit against the mining company. Usually he lost the suit, at considerable expense to himself and the company. In case he won, the lawyer took from 50 to 100% of the money awarded. In some cases where the injured man and his lawyer succeeded in working up a strong feeling against the mining company, the sum awarded the plaintiff was out of all proportion to his injury. Under the new Compensation Act, an injured man or his heirs can collect a stipulated sum or series of payments from the company without going to law, and without any long delay intervening. A certain amount is named for each accident that might arise, so much for death, so much for injury incapacitating a man for work, so much for broken finger, loss of eye, etc. The payments stipulated are in all cases fair, and in some surprisingly large.

Thus, in place of the lawyers securing the bulk of the money spent for accident compensation, the injured man and his family receive it.

BOSTON

GRANBY FINANCES.—GIROUX CONTEST POSSIBLE.

Stockholders have confirmed the action of the directors of the Granby Consolidated, authorizing an issue of $5,000,000 6% convertible bonds. An increase in capital stock from $15,000,000 to $20,000,000 is authorized. The Granby bonds have been underwritten by Speyer & Co., of New Work, at 96, 1% being commission and 3% bonus. The Granby president says the Hidden Creek ore assays in copper about double that of the original Phoenix mine. An interesting feature of the meeting was the announcement that Granby has other acquisitions under consideration.

Rumors keep reaching Boston of dissatisfaction over the management of the Giroux Consolidated at Ely under Thomas F. Cole. It is said that the development policy does not have the sanction of a large group of stockholders and that they contemplate soliciting proxies with the view of bringing about a change of management. Some of these stockholders believe that the control of the property does not lie with Mr. Cole and his associates, and that a fight for control might be successful. It is said that the output of Giroux for February exceeded all previous records, running above 1200 tons per day, and that the ores are showing some increase in value, assaying about 2.3% copper. The caving system is to be started in the underground workings of the Morris mine, experts from Michigan having gone there recently to take charge of this work. The Coppermines company, controlled by the Gunn-Thompson interests, has been under steady development ever since the strike was settled, but is not yet shipping. It is believed in Boston that eventually there will be a merger of the two. Interests here connected with the Smokey Development Co. deny the probability of that company becoming a party to the merger, pointing out that it is yet a prospect, but has been fully financed for some time to come and is without any incentive to sell at present.

JOHANNESBURG, TRANSVAAL

RANDFONTEIN MEETING.—INCREASED ORE RESERVE.—IMPROVED CONDITIONS WARRANT EXPECTATION OF STEADY WORK.

The feature of the week has been the meeting of the Randfontein Central Mines, which, until last month, for several months past figured as the largest gold producer on the Rand. The magnitude of the operations carried on may be gathered from the fact that in 1912 a total of 733,780 oz. of fine gold was produced, of a value of £3,074,476, a total closely approaching a month's output for the whole of the Rand. Even then this property has been far from working at full pressure during the year. The huge mill of 600 stamps and four others of 100 stamps each represents a milling equipment of 1000 stamps. If allowance be made for the tube-mills as auxiliaries, the milling capacity perhaps will come close to being equivalent to 1500 stamps. This huge equipment has caused some trouble during the year to keep it employed to three-fourths of its capacity owing to want of rock and labor, but labor is now getting more plentiful, the smaller mills have been thoroughly overhauled, and the year has started with far better prospects than was the case twelve months ago. It is officially stated now that all the stamps are expected to be dropped in three months' time, a feat which accomplished, ought to enable the property to again take up the position as the largest gold producer of the world. It has been apparent during the year that it was impossible to keep the huge Central mill fed with rock by the mines in the immediate neighborhood, and ore had to be brought from the southern end even to keep a limited number of stamps at work, but the prospects of the huge mill getting into full swing are more encouraging, and less is now heard about the mill proving itself a 'white elephant.' The best feature of the report for last year was the announcement that the ore reserves had increased nearly a million tons during the year, bringing the total to 7,600,000 tons, of which 6,350,781 tons assayed on the average 6.8 dwt. per ton. It is estimated that when the whole of the ore-

reduction plant is at work some 3,100,000 tons yer year will be crushed, so that practically there are two years of ore in front of the mill. As things go on the Rand, this may not be considered an excessive reserve, but the position has materially improved since the huge mill was started about two years ago. To have gained an additional million tons of development ore during the year appears a notable achievement and would have appeared more so had it been developed in some of the old mines, but it must not be forgotten that several additional outcropping reefs have been discovered during the year which have readily lent themselves to development. It is claimed for the Randfontein property, with its extensive area and numerous payable reefs, that its resources are unequaled by any other mining property on the Rand. There is, no doubt a great deal of truth in this statement, but the geological conditions surrounding the Randfontein property are not such that two or even three years' supply of payable ore in sight should justify the erection of such a huge mill as that at Randfontein. A fall in the grade in the mines in the northern section of the property gave considerable trouble during the year, and it is to be noted that while the profitable ore reserves averaged 7.29 dwt. in 1911, the average had fallen in 1912 to 6.8 pennyweights.

JOPLIN, MISSOURI

DECLINE IN PRICES CAUSES SHUT-DOWN OF MINES.—MINING SHORT CREEK GRAVELS.—CALAMINE AT DUENWEG.

The average production of 5500 to 6500 tons of zincblende per week has been cut to about 3500 tons in the Missouri-Kansas-Oklahoma district, due to the closing of many large mines following the decline in the prices of both zinc metal and zinc ore, the former having dropped to $6.10 at the beginning of March, while the price of zincblende now ranges from $40 to $48 per ton, assay basis of 60% metallic zinc, with choicer grades bringing as high as $51. The greatest number of mines to close are in the sheet-ground district of Webb City and Carterville, where the cost of operation is high and the recovery small. Many of these mines cannot produce concentrate at a profit at the prices now prevailing. Several meetings of the largest operators have been held within the past two weeks, and these meetings resulted in coöperation in the matter of curtailing the output.

Two companies are conducting interesting mining operations at West Galena, Kansas. They are Woods & Anthony, holding a lease on a large portion of the 320-acre tract of Bonanza Mining Co.'s land, and Ryan Brothers, operating on a lease of the Empire District Electric Co.'s property. Both are milling the gravel and sediment taken from the bed of Short creek, the course of the stream having been diverted so that the old channel is now dry. The stream heads at the old Pumpkin Head mine, one mile west of Joplin, and flows through the heavy producing zinc and lead districts of Ellisville, Cave Springs, and Galena. In these, and especially in Galena, mining operations have been conducted for many years, and the mine waters pouring into Short creek have carried zinc and lead sediment until the entire creek bed, to its mouth four miles west of Galena where it empties into Spring river, has become mineralized. The Galena mines have been working steadily for more than 25 years, and not only has a heavy volume of fine material been carried down-stream in the mine-waters, but in times of floods entire heaps of concentrate have been swept away and have helped enrich the lower portion of the creek bed. Woods & Anthony have a lease on the creek about two miles from the point where it empties into Spring river, while Ryan Brothers have a lease at the mouth of the creek. Both companies have erected sludge mills and use scrapers and mules to drag the mineral-bearing sediment to their plants. The creek bed is from 10 to 50 ft. wide and is richly mineralized to a depth of 3 to 5 ft. The mill recovery is from 15 to 20%, the greatest percentage of recovery being zincblende, although some lead is also won.

One of the greatest handicaps in shaft sinking in this district—the necessity of draining the ground continuously as the sinking progresses—was overcome in a novel but decidedly satisfactory manner at the Minor Heir-Sunrise mine, on a lease of the J. W. Allen land at Spring City, Missouri. First a 6-in. drill-hole was sunk to the level of the old workings at a depth of 185 ft., and a small drift was extended to connect the old drifts with the hole. The new shaft was sunk on the drill-hole, care being taken to keep the hole clear of débris, and thus it acted as a drain through which the water seeped to the lower ground, from which point it was pumped out. Ordinarily the task of seating and removing the pump in shaft sinking, which is a tedious and expensive operation, greatly delays the work. The Minor Heir-Sunrise new shaft is 7 by 8 ft. in the clear and was sunk in seven weeks, three shifts per day doing the work. The shaft is 700 ft. from the mill and is connected by a long tramway, 82 ft. in height at the highest point.

Calamine mining in the Duenweg, Missouri, camp is more active than it has been in years. On the Henry Weymann land east of the camp, on the McGee Mining Co.'s properties to the east and northeast of the camp, and at the old Central States mines, south of the camp, prospecting has been in progress, and some exceptionally good finds have been made recently. The ore occurs at shallow levels, seldom being found in this district at a greater depth than 100 ft. It will average about 43% metallic zinc, sometimes running as high as 50%. It is sold on a 40% basis and a premium of $1 per ton is paid for each percentage above that. The prevailing price at present for 40% ore is from $26 to $28 per ton, while choicer grades bring as high as $38. The cost of mining the ore and getting it ready for the smelter is small, and hand jigs are frequently used.

NEW YORK

COPPER DULL.—GUGGENHEIM MEETING.—HOMESTAKE AFFAIRS. HAGGIN AND MILLS.—GENERAL DEVELOPMENT COMPANY.

The copper situation remains weak, with the larger sellers maintaining a price of 15c. The depressing factors are the commercial standstill in Europe and the apparent possibility that Mexico will finally manage to embroil herself in tronble with the United States. The general atmosphere in New York remains very largely pessimistic. Some profess to believe that when the incoming administration shall

COPPER-CASTING MACHINE AT NEVADA CONSOLIDATED WITH OIL-FIRED RECEIVER MADE FROM OLD CONVERTER.

have been settled in office there will be a quick revulsion of sentiment. In the meantime, however, stocks, especially the coppers, are off and weak.

The quarterly meeting of the various Guggenheim companies left results mixed. The spectacular achievements of Chino during the past year had rather led to the anticipation of an initial dividend at this time. Ray Consolidated had also been expected to join the list of dividend payers, and it was something of a shock that the stockholders received an explanation instead of a dividend. The board's action is stated to be wholly due to the unsatisfactory copper market; that the management does not consider the necessity for dividends so pressing as to justify borrowing the money against unsold copper. The regular quarterly dividends were declared by the Utah Copper Co. and the Nevada Consolidated, the former paying 75c. per

share, the latter 37½c. It seems impossible to discover the real status of affairs as between legal authorities at Washington and the A. S. & R. Co. It is repeatedly heard that a rigid investigation is being made and that vigorous action will follow, but confirmation cannot be obtained from any authoritative government official.

Carrying out the plan recently announced to increase the capital stock of the Homestake Mining Co., the directors have declared a cash dividend of 65c. per share and a stock dividend of 15%, both payable March 25. Arrangement has been made to mail to shareholders fractional scrip to avoid issuing fractional shares, and the Columbia-Knickerbocker Trust Co., of New York City, will buy all fractional scrip offered on a basis of $100 per share, or will sell such fractional scrip as needed by any holder to make up a full share, at the same price. James B. Haggin has been very active during recent weeks with the affairs of the Homestake, and his big silver-gray limousine may be seen standing in front of the Mills building both early and late. Mr. Haggin keeps business hours that might put to shame many younger men who toil in his vicinity. The Mills building, of New York City, despite the fact that it was not many years ago pointed out as one of the sights of the financial district, is rapidly coming to be classed as a bit of old New York, and it holds or has held not a few tenants about whose names there clings a vast deal of reminiscence. D. O. Mills, lately deceased, was long a notable figure in San Francisco as well as in New York, and in mining circles was probably best known for his operations in the Coeur d'Alene, particularly in the Bunker Hill & Sullivan. Some of Mr. Haggin's old-time associates made their business homes in the Mills building for many years; the Hearst estate still has its offices there, as also has the firm of Lounsbery & Co., both of the latter having been interested with Mr. Haggin in the Homestake and in the old American Mining Co., which was taken over by the El Oro Mining & Railway Co., Ltd., of El Oro, Mexico. Another notable who until his recent death had for many years maintained an office in the Mills building, was H. McKay Twombly, who was known as the 'sulphur king.'

The General Development Co. has just increased its capital stock from $2,600,000 to $3,000,000 to provide means to absorb the Silver Mines Exploration Co. The latter was organized some five years ago by Adolph Lewisohn and his associates to take up the work of handling mining properties in Canada. It was through this organization that the development of Kerr Lake and of the Wettlaufer-Lorraine was carried on. The latter named company has just passed its regular quarterly dividend and the market in the issue has been consequently one of the soft spots.

BRITISH COLUMBIA

DIVIDENDS AND DEVELOPMENT MARK PROGRESS.

The year opened with two dividends paid in January by metalliferous mining companies operating in the province, and one declared payable on March 1. Those paid were by the Standard Silver-Lead Mining Co., with mine and concentrating mill near Silverton, Slocan lake, of $50,000, being this company's regular monthly dividend at the rate of 2½% on its issued capital of $2,000,000; and by the British Columbia Copper Co., with copper mines and smelting works in Boundary district, of $88,756, being a quarterly distribution of 15c. per share. The dividend payable on March 1 is that of the Granby Consolidated M. S. & P. Co., at the rate of 1½%, approximately $225,000.

East Kootenay.—The Consolidated Mining & Smelting Co. during January shipped about 3600 tons of lead ore from the Sullivan Group mine to its smelting works at Trail. Much exploratory work having been done in new ground last year, an enlarged production of ore is looked for in 1913. Operations at the company's St. Eugene mine are now on a much smaller scale than in past years, but there is still a small ore-production being maintained.

At the several collieries in southeast Kootenay coal-mining is generally active, though occasionally the output is unfavorably affected by a shortage of railway cars. One colliery, that of the Corbin Coal & Coke Co., of Spokane, Washington, with coal mines situated some 14 miles south of McGillivray, a station on the C. P. R. Co.'s Crowsnest railway, is preparing to mine coal open-cast, having cleared off the surface débris from a considerable area so as to allow of the big deposit of coal, occurring almost at the surface and proved to be fully 300 ft. wide, being worked as an open quarry. It is proposed to use a steam-shovel to take the coal direct from the face and load into railway cars.

West Kootenay.—Deep snow has interfered somewhat with mining operations in Ainsworth and Slocan divisions, though mines situated near one or other of the lakes have not had similar transportation difficulties to those in the midst of the mountains. The Bluebell, near Kootenay lake, and the Standard and Van-Roi, near Slocan lake, have kept up their respective outputs with little or no diminution. The Rambler-Cariboo and Ruth have also made shipments, though on a smaller scale. It is expected that the former of these two will this year produce much more ore than in earlier years, for it now has much improved transportation facilities, an aerial tramway having been constructed from the mine down to the concentrating mill recently completed alongside a newly finished branch railway line. Near Sandon, deep level development is being continued on the Slocan Star and Payne mines, but snowslides and accompanying winter difficulties have made it necessary to practically suspend work for the time at several mines in the vicinity of Cody. The Lucky Jim mine, situated on the divide between Slocan and Ainsworth divisions, and the Retallack & Co. and Utica mines, on the Ainsworth side of that divide, are among the operative mines of this part of West Kootenay district.

In Nelson division, the British Columbia Copper Co. is continuing development of the Eureka copper mine, under option of purchase, and is shipping copper ore from the Queen Victoria mine, purchased last November, to its smelting works at Greenwood. The Kootenay Gold Mines, Ltd., is endeavoring to obtain additional capital for the purpose of doing needed development, so as to keep its 20-stamp mill regularly running. The Consolidated company's Molly Gibson silver-lead mine is one of the shippers of this division. In Ymir camp development is being continued at the Wilcox and Dundee mines. Near Salmo, the Emerald and H. B. are shipping lead ore, gold ore is being crushed at the respective stamp-mills of the Motherlode and Queen in Sheep Creek camp, and the Second Relief in Erie camp, while the Arlington, also at Erie, is being worked under lease.

Boundary and Similkameen.—The big copper mines of Boundary district are maintaining their normal output of ore. The largest producers were the mines at Phoenix of the Granby company, the British Columbia Copper Co.'s Motherlode coming next, and the New Dominion Copper Co.'s Rawhide mine being third; several small mines added to the total production for January. The B. C. Copper Co.'s new general manager, Oscar Lachmund, has been in local charge several weeks. No information is yet available concerning the company's future operations in Similkameen district, but it is known that the Hedley Gold Mining Co., operating in Hedley camp, continues to crush 5000 to 6000 tons of gold ore per month and to make good profits.

Coast District.—The Britannia, near Vancouver city, and the Granby company's Hidden Creek mines in the vicinity of Observatory inlet, are doing the chief development in connection with metalliferous mining on the British Columbia coast. The Marble Bay mine, on Texada island, in which bornite ore has been mined down to a depth of 1000 ft., is now opening a level at about 1100 ft. vertical depth. Important developments are taking place on several coal-mining properties on Vancouver island. The Western Fuel Co., of San Francisco, has already spent $500,000 in connection with the opening, equipment, and transportation facilities of a new mine within five miles of Nanaimo. The Pacific Coast Coal Mines, Ltd., has just reached coal in a new shaft, at 610 ft. from the surface. The Canadian Collieries (Dunsmuir), Ltd., is also opening a new mine, this being in Comox district, Vancouver island.

General Mining News

ALASKA

FAIRBANKS

The Wild Rose claim, on Dome creek, produced $930 from 26 tons of ore crushed at the Spalding mill. It is proposed by the Minook Gold Dredging Co. to erect a dredge on Big Minook creek, in the Rampart district. The ground is from 10 to 30 ft. deep, and there are no boulders to hinder work. The dredge will be of the Bucyrus make, and may be in operation about the end of next summer.

ARIZONA

COCHISE COUNTY

The Calumet & Arizona company has acquired the Saginaw mine on the basis of one C. & A. share for 6¼ Saginaw shares, while the company will distribute 800 shares of C. & A. *pro rata* from stock held in the Saginaw treasury.

GILA COUNTY

(Special Correspondence.)—At the Inspiration Consolidated Copper Co.'s property all work at the millsite, on the railroad grading, and underground work at the Inspiration division of the property has been discontinued for several days on account of the severe weather that has rendered outdoor work impossible and has made it impossible to deliver fuel and other supplies at the operating centres. The Live Oak division of the property, however, has been more fortunate, having had a sufficient supply of oil and other necessaries on hand to continue work at a normal rate. The cessation of the storm on the last day of February indicates that the work will be resumed throughout the property's area within a few days. At the Old Dominion, underground work is proceeding in a manner that insures a normal output of ore for the month of February, but the unprecedented storms that prevailed during that month necessitated suspension of nearly all construction work at the mine. The Great Falls type of converters installed at the plant early in January are proving satisfactory in every respect. Because of the severe weather prevailing during the greater part of the past month, the Gibson Copper Co. has been unable to deliver fuel at its plant, and the working force at the mine has been reduced nearly one-half. The management expresses its intention to install oil burners as soon as possible. The rich ore that was traversed throughout the raise from the 800-ft. level to the 600-ft. level of the Superior & Boston, southeast of the McGaw shaft, continues on and above the 600-ft. level. As the ore dips under Quo Vadis hill, it seems certain that an extensive body of mineral will be disclosed to the southeast, and below the present ore disclosure. Beyond the installation of a reinforced concrete arch on the line of the switchback, beneath the tramway that carries supplies from the valley to the Miami mill and shafts, there has been little surface improvement at the property during February, because of the severe storms that have been prevalent during the greater part of the month. B. Britton Gottsberger, general manager, is expected to recover from two operations performed to relieve him of appendicitis. At the South Live Oak Development Co.'s property it has been impossible to begin drilling at hole No. 7 because of the severity of the weather. The results at hole No. 6 are reported by the management as wholly satisfactory.

Miami, February 28.

GREENLEE COUNTY

It is stated that the Apache Box group of 11 claims near Duncan have been taken on option by the Copper Queen Consolidated Mining Co., of Bisbee. The terms are 90 days and payment of $250,000 cash.

CALIFORNIA

BUTTE COUNTY

The boiler, hoist, and house of the Crystal Hill mine, near Magalia, were destroyed by fire on March 3. The loss is $3000, and the mine is rapidly filling with water.

ELDORADO COUNTY

The Nonpareil mine, in the Georgetown mining district, has been leased for 10 years to I. P. Allen, of the Canton bank, San Francisco. Shafts have been sunk to prove the width of the old river channel, which is 250 ft. wide. This is 50 ft. more than the old Gold Channel mine.

NEVADA COUNTY

(Special Correspondence.)—The North Star Mines Co. disbursed $300,000 in dividends during 1912, making a total of $3,786,989 paid to stockholders since organization. The par value of issued stock is $2,500,000; consequently, the company has paid in excess of $1,250,000 over the original valuation. The property is the deepest incline mine in California and the leading gold producer of the state. Besides actively developing its main holdings, the company is vigorously exploring and developing the Champion mine and other claims. Sacramento people are actively developing the Montana mine, in the Willow valley district. A cross-cut is being extended to the vein and some excellent ore has been recently extracted from the upper workings. The Norton shaft is being raised to connect with the Lecompton. Considerable prospecting and development continues in the Deadman Flat region. This district has been particularly noted for rich pockets.

Grass Valley, February 24.

A few years ago the Brunswick Mining Co., upon the advice of the manager, C. H. Mallen, decided to sink a new vertical shaft 3000 ft. south of the old incline. A modern electrical equipment was erected, and the shaft was sunk 400 ft., when a heavy flow of water was encountered. It was then decided to pump through the old workings and raise to the new shaft from the long south drift on the 1250-ft. level. A Dow electric pump of 1200-gal. capacity per minute, and costing $7000, was used to cope with the water. The problem was not too easy, as a circular surface and underground survey of over a mile was necessary to get the correct starting point for the raise. This was done by E. C. Uren, of Nevada City, and F. M. Miller of Grass Valley. Work was started on April 1, 1912, and the raise was driven 474 ft., a splendid connection being made a few days ago. The shaft will be sunk a further 200 ft., when the lode will be cut. The shaft is 8 by 18 ft., and the raise 5 by 12 ft., the latter to be enlarged to the former size for three compartments. Blasting in the raise was done by electricity, by what is known as the 'delay system.' The contractors were W. C. Gans, J. R. Thompson, G. G. Johnston, J. A. Eddy, F. Kult, and W. J. Mow. The connection has improved ventilation considerably. It is proposed to erect another 20 stamps, while a 220-hp. Ingersoll-Rand air-compressor is on its way to the mine. In all, 82 men are employed.

SHASTA COUNTY

An engine is being installed at the old Quartz Hill mine, near Redding. This mine is under lease to the Mammoth Copper Co. for three years, and has a large body of siliclous ore. At the Stowell mines, under option to the Mammoth company, all machinery is ready for operation. Eight machine-drills will be employed on development.

SIERRA COUNTY

The Tightner mine at Alleghany continues to give high returns, and the last two bullion shipments to the Selby smelter were worth about $87,000, while the new ore-shoot cut in the lower adit four months ago has yielded about $250,000. Twenty-five men are employed, and the 10-stamp mill is working steadily on ore from 600-ft. depth. The Tightner company will advance the lower adit toward the Red Star claim, which it has under bond.

COLORADO

DOLORES COUNTY

The annual report of the Rico-Wellington Mining Co. states that ore production consisted of lead ore, 463 tons, worth $11,477; copper ore, 4596 tons, worth $79,657; zinc ore, 1068 tons, worth $20,389; a total value of $111,523. Total receipts, including loan from Knight Investment Co., were $155,284. Due to this company is $78,769, and the cash overdraft is $6626. Development covered 3822 ft., and

about 11,000 tons of lead-zinc ore is ready for mining. Generally, development has been of a gratifying character. A two-bucket tramway, extending 2500 ft. from the Wellington adit to the Winkfield switch on the Rio Grande Southern railroad, has been constructed. Its capacity is 50 to 60 tons in 8 hours, at a cost of 23c. per ton. A platform 25 ft. below the adit has a storage capacity of over 4000 tons. The Pro Patria mill, belonging to the Rico Mines Co., has been leased for 5 years, $30,000 is being spent on its remodeling and power-plant, and it should be soon in operation.

Eagle County

Several mining men have returned from the Brush creek new district and state that the ore is found in a shaly limestone, above which, toward the top of Horse mountain, is a red sandstone dipping east. Still higher at the top of the mountain is a white sandstone dipping northeast. About 10 ft. above the orebody a fault can be seen in the mountain. Below the orebody is found a blue limestone. H. E. Burton has made analyses of the ore, and has classified it as a 'silver vanadate,' an entirely new mineral. Samples have been sent by him to the School of Mines at Golden for further study.

Lake County (Leadville)

Several years ago it was proposed to drive a tunnel through Mosquito range, from the head of Empire gulch, but after surveys were made the project was abandoned. The work is again being discussed. The tunnel would be 3869 ft. long, and would give a depth of 900 ft. and test various properties at depth, besides draining them. It would also benefit Leadville in many ways.

San Miguel County

The Tomboy mill worked 29 days in January, and treated 11,000 tons of ore yielding $33,500, and $57,000 from 1400

CARRYING LUMBER TO THE TOMBOY MINE.

tons of concrete shipped. Working expenses were $51,000, leaving a profit of $39,500. Expenditure on the aerial tramway was $11,600.

Teller County (Cripple Creek)

The February production of the Cripple Creek district is given as follows:

Plant.	Tonnage.	Av. val.	Total.
Portland	9,500	$21.00	$ 199,500
Golden Cycle	28,500	20.00	570,000
Stratton's Independence	10,767	2.78	29,832
Wild Horse	1,000	3.60	3,600
Portland	14,200	3.16	44,872
Isabella	1,000	1.50	1,500
Gaylord	1,800	2.20	3,960
Smelters	3,610	65.00	234,650
Jo Dandy	1,465	2.00	2,930
Colburn	1,925	3.00	5,775
Total	73,767		$1,096,619

It is probable that the Gold Dollar Consolidated Mining Co. will reduce its royalties to lessees. During 1912, development in the Isabella mines covered 11,127 ft. Ore production by the company amounted to 2181 tons, worth $30,692; by lessees, 10,098 tons, worth $202,592; and from dumps, 8730 tons, worth $76,797.

In the Vindicator mine, what is known as No. 1 vein, where found on the 1400-ft. level, was poor. On the 1500-ft. level the shoot was 100 ft. long, but of low value; while on the 1600-ft. level 10 ft. of ore, worth $30 per ton, has been cut 400 ft. south of the main shaft.

The report of the United Gold Mines Co. for the year ended December 31, 1912, gives the following:

Lessees ore production, tons	16,172
Value	$136,484
Freight and treatment	62,087
Paid to lessees	57,857
Royalty	15,763
Net income for company	14,879

The production of each of the company's mines were as below:

	Tons.	Value.	Av. val.
W. P. H. group	2,458	$ 35,531.73	$14.46
Deadwood	1,350	16,963.69	12.56
Damon	1,090	10,411.21	9.55
Wild Horse	780	34,268.02	43.93
May B.	238	4,622.29	19.42
Wild Horse mill	10,256	34,686.83	3.38
Totals	16,172	$136,483.77	$ 8.44

IDAHO

Blaine County

The Danaher M. & M. Co.'s new mill, which cost about $70,000, is in full operation. It is at present treating ore from the upper dump, which contains 80,000 tons of ore. On February 24 the jigs produced 2800 lb. and the vanners 1100 lb. of concentrate in 7 hours.

Bonner County

Officials of the International Smelting & Refining Co. of Tooele, Utah, are conferring with the president of the Idaho-Continental Mining Co. in connection with the Idaho-Continental mine near Porthill.

Idaho County

At the American Eagle mine a shaft is being sunk 200 ft. below the adit level. It is of two compartments and is to be timbered with sawn lumber the whole depth. The rock is hard, and the contract will be finished by May 1.

Shoshone County

The Federal Mining & Smelting Co. has taken a two-year option on the Flynn group of mines, in the Coeur d'Alene district, for $150,000. The Frisco adit, now in 1800 ft., will be extended 2000 ft. to cut the Flynn veins at a depth of 2000 to 2500 ft. The Snowstorm Mining Co. is paying a dividend of $15,000 on April 1.

MONTANA

Cascade County

Development in the Florence mine at Neihart is encouraging. The vein has been found again south of the fault on the 300 and 500-ft. levels, and is being driven on. Ore being shipped contains 50 oz. silver per ton, and the January output gave net earnings of $6000.

Lincoln County

(Special Correspondence.)—D. H. Tandy, who owns some placer claims on the Yakt river, at what is known as Snipetown, while in this town on February 21, stated that his claims are in shape to be operated during the coming summer. He has put in a hydraulic plant, which will be used in washing out the gravel. This plant was completed last fall, just at the time when the first cold weather started. Mr. Tandy formerly published a newspaper at Hillyard, Washington.

Duncan McDonald and George McKay, who came in last week from their mining claims on Granite creek, report that they now have an excellent showing in the Porcupine claim. They have driven on the vein for 35 ft., where they have a 3-ft. vein of silver-lead ore, the samples they brought in being particularly fine.

Libby, February 24.

NEVADA

Churchill County

During January the Nevada Hills Mining Co. treated 2738 tons of ore, valued at $17 per ton, the loss in tailing being $2.02 per ton, making the yield $41,005. The net profit for the month was $12,929. Recovery by concentration was 13.3%, and by cyanidation 74.8%, making a total of 88.1%. Costs were: mining, $4.57; milling, $3.75; marketing, interest, taxes, and general, $1.87; a total of $10.19 per ton.

Clark County

The Tramp Miner Mining Co. has a property 17 miles from St. Thomas, and is shipping ore that returns 34% copper at Salt Lake. The mine is worked by adits, and has been opened to 350 ft. Near the copper ore is a large body of iron ore carrying 51% iron and 3% copper. Heavy shipments of zinc ore are being made from the Goodsprings district, the monthly totals being about 3000 tons, averaging 40% zinc and 58% lead. The Yellow Pine is shipping 70 tons of zinc concentrate daily, carrying 36% zinc, and 30 tons of lead concentrate with 60% lead and 40 oz. of silver.

Esmeralda County

The Goldfield Consolidated Mines Co. has declared a dividend of 30c. per share, amounting to $1,067,700. The Goldfield district mines and mills, numbering nineteen, are employing 833 men at present, of whom 621 are employed by the Consolidated company, 60 by the Merger company, 22 by the Jumbo Extension, and 20 by the Western Ore Purchasing Co. The sampler of the last-mentioned company at Millers, Nye county, is to be reopened, and that at Hazen, in Churchill county, will be kept in commission. The Consolidated company is sending about 100 tons of ore to smelters from the Grizzly Bear and Clermont mines.

Lyon County

Matte produced by the Mason Valley smelter has been shipped so far, but it is now intended to erect two converters with a monthly capacity of 4,000,000 lb. of copper. A blowing-engine will also be needed, and the new plant will cost about $75,000.

Nye County

The Tramp Consolidated, Bullfrog Sunset, and Denver Bullfrog Annex properties, all in the Bullfrog district, near Rhyolite, and controlled by the Sunset Mining & Development Co., have been examined and sampled during the past two months. Sampling has disclosed lodes varying from 4 to 36 ft. wide, worth from $2 to $30 per ton. An air-compressor and machine-drills are to be installed, and it is proposed to erect a cyanide plant with a capacity of 5000 tons per month.

During the week ended March 1, the Tonopah mines produced 11,677 tons of ore valued at $245,802, making a total for the current year of 98,414 tons and $2,060,684.

Storey County

In the annual report of the State Controller the mineral production of the Nevada is given, and that of the Comstock district from October 1, 1911, to September 30, 1912, is $1,268,493, the largest producers being Mexican, $414,682; Ophir, $356,241; Chollar Leasing Co., $197,942; Comstock-Phoenix, $157,144; Crown Point, $86,067; Yellow Jacket, $36,110; Con. Virginia, $7570; Belcher, $3212; and Hale & Norcross, $2417.

From the southwest drift of the Ophir 2400-ft. level, 82 tons of ore worth $48.55 per ton was taken. On the 1600-ft. level, the northeast drift from the north lateral of the Sutro tunnel is following the vein, which contains quartz of low value. The Mexican mill treated 552 tons of ore during the week ended March 1, worth $30.84 per ton, with 95% extraction. Work on the Monte Cristo and Keyes properties is being pushed ahead. The Ophir cyanide plant treated 609 tons of tailing during the week, and shipped 6 bars of bullion worth $5500.

White Pine County

The Nevada Consolidated Copper Co. produced 4,169,708 lb. of copper in January, against 6,309,228 lb. for the same month of 1912.

NEW MEXICO

Grant County

During the last quarter of 1912 the Chino mill treated an average of 4920 tons per day, containing 1.84% copper, the ratio of concentration being 15.14 tons of ore to 1 ton of concentrate, there being 29,891 tons of concentrate produced averaging 18.03% copper. The average extraction was 64.58%. Profits were $682,918, and for the whole year, $2,352,822.

Socorro County

Six mining companies in the Mogollon district are exceedingly active now in developing the gold mines. Three of these companies are producing, the Ernestine, the Socorro, and the Deadwood. Their mills are all running at full capacity. The Ernestine company is adding new equipment to operate the mines and mill, installing a new 260-hp. De la Vergne engine and a large air-compressor, and repiping the mines with large air pipes. Many more machine drills will be put in use as soon as this equipment, which has been bought in El Paso, can be placed. This is the direct result of the change of ownership and management of the Ernestine company. The new management is doing everything possible to begin developing the mines on a large scale, and preparations are being made to begin sinking the main shaft. The company will also push all the principal headings in the lower works. It has been decided to put all development on contract work, beginning February 1. E. A. Wayne, the general manager, has always favored contract work in order to make greater progress in development. The mill will be equipped to double the present output. There is a scarcity of laborers and miners in the district.

OREGON

Grant County

The Canyon Mountain Mining Co. has purchased a 10-stamp mill which used to be working at one of the properties in the Virtue Flat district. The machinery will be shipped by way of Sumpter Valley and Canyon City to the property.

SOUTH DAKOTA

Lawrence County

(Special Correspondence.)—Mine Rescue Car No. 5 of the U. S. Bureau of Mines, in charge of O. U. Bradley, has just completed a two weeks' stay in the Black Hills, instructing the miners in the use of mine-rescue apparatus and in first-aid work. One week was spent at the Homestake and the balance of the time at the Trojan. At both places the miners evinced great interest in the work and proficient crews were organized.

Beginning with January, the monthly dividends of the Homestake have been at the rate of 65c. per share. For

MILL AT HOMESTAKE MINE.

a number of years previous they had been 50c. The increased rate is in a great measure accounted for by a lowering of operating costs through the construction of a hydro-electric plant on Spearfish river. Since the company has 218,400 shares of stock outstanding, the present dividend rate calls for a monthly disbursement of $141,960, an increase of $32,760. On February 27 the company paid taxes in Lawrence county to the amount of $107,000, the largest

amount ever paid by it. The increase is partly due to the acquisition of mining ground purchased last year.

Deadwood, February 28.

UTAH

Utah County

The Pacific Gold Mining & Milling Co., at American Fork, covered 220 ft. of development and 3950 cu. ft. of stoping by hand in 1912. A west cross-cut in the lower adit cut a 6-in. vein of zinc-lead ore, and prospects are good. Ore and concentrate shipped amounted to 209 tons, containing 214,019 lb. of lead and 3614 oz. of silver, with a little gold, copper, and zinc. The average price received was $39.04 per ton.

During 1912 the Dragon Consolidated Mining Co. covered 2998 ft. in development, producing 2188 tons of ore valued at $59,056, and 6695 tons of iron ore worth $19,151. The cash balance at December 31 was $27,942. On the 800-ft. level a drift is being driven south to cut the contact and develop the country south of the shaft. Diamond-drilling covered 700 ft. in the gulch below the main shaft to cut the contact.

CANADA

Ontario

Following are results of working the City of Cobalt Mining Co.'s property during the 15 months ended December 31, 1912:

Development, feet	5,319
To date, feet	17,287
Ore shipments, tons	259
Ore milled, tons	8,921
Total contents, ounces	442,754
Ore reserves, tons	37,343
Total contents, ounces	1,269,662
Cost per ton milled	$3.224
Cost per ounce	0.122

The main shaft is 339 ft. deep, and connections were made with the 331-ft. level, and considerable work was done on No. 12 and 14 veins below that level.

The Nipissing high-grade mill treated 115 tons of ore in January, and the refinery produced 271,643 oz. of bullion. The low-grade mill is treating about 180 tons per day, the January output being 140,000 oz. Where several branch veins join the main lode, the Meyer vein is 15 ft. wide.

The low-grade mill at the Nipissing mine is treating to full capacity. During the week ended February 22, ore shipments from Cobalt were 229 tons and bullion shipments 133,710 oz. The Trethewey mine produced 620,923 oz. of silver in 1912; and ore reserves are estimated as 31,172 tons. Gross receipts were $301,086, and net profits $127,834. During January, La Rose Consolidated Mines Co. produced 217,977 oz. of bullion worth $134,724. The net profit was $76,278; dividend paid, $375,000; and surplus is $1,602,181. The Goldfields, Ltd., of Larder Lake, will add 30 stamps to its mill, and bring the capacity to 500 tons per day. Everything at the mine is electrically driven, including a 12-drill air-compressor. The mill consists of jaw-crushers, stamps, and amalgamating tables. During 1912 the Cobalt-Lake Mining Co. produced 1,123,147 oz. of silver, of which the 20-stamp mill yielded 541,570 oz. from 23,410 tons of ore, at a cost of $1.83 per ton. Total earnings were $648,409, and profits $420,100, while the surplus is $425,948. Ore reserves are estimated at 52,036 tons containing 2,135,040 oz. of silver. The Dome mine at Porcupine is now operating its plant with power from the Northern Canada Light & Power Co., whose power-station is at Waiwaten Falls, on the Mattagami river. The Dome company uses 900 kw. per day. During the six weeks ended February 11, the Hollinger mill treated 9562 tons of ore worth $240,300. Forty stamps are now at work. In the mine, 34 machine-drills are working, and 482 men in all departments. North on the 300-ft. level, the vein is being driven on and the drift is under the richer ore showing in the upper levels. The net operating profit from July 1 to December 31 was $600,664, which was appropriated by three dividends, $270,000; written off plant, $106,223; off development, $122,639; and carried forward, $101,802. Gold in precipitate, slag, and solutions amounts to $62,498.

CHILE

During the first two weeks of February, No. 1 adit of the Braden Copper Co. was advanced 42 ft. in ore averaging 1.97% copper. The converter department was shut down, and copper production was 458,000 lb. In the old mill the extraction was 69.9% of which there was saved 75.5% by the Minerals Separation process.

MEXICO

Baja California

After being shut down for two years, the San Juan mine is again in operation. Ore is to be taken by boat to Guaymas, from the mine, north of Santa Rosalia, and then railed to El Paso smelter.

Guanajuato

During 1912 the Tajo de Dolores mine produced ₱627,380 from 63,083 tons of ore, which averages 252 gm. of silver and 2.57 gm. of gold per ton. Extraction varied from 85 to 87%, and profits were $105,500. The mill contains 40 stamps, and ore reserves are given as 57,000 tons.

Jalisco

The Amparo Mining Co., of the Etzatlan district, has paid a dividend of 3%, amounting to ₱160,000. The Santo Domingo Mining Co. of the Hostotipaquillo district has been reorganized, and a 50-ton mill will be erected. W. T. Henderson is in charge of the property.

Mexico

The El Oro mill treated 20,990 tons of ore and re-treated 16,030 tons of tailing in January, yielding $181,690. Working expenses were $100,730, and development $26,760, leaving a profit of $54,200. Railway profit was $7990. The 40-stamp mill of the Mexico Mines of El Oro treated 13,350 tons of ore, worth $138,150. Working expenses were $44,170, and development, $10,900, leaving a profit of $83,080.

Sinaloa

(Special Correspondence.)—An option for ₱200,000 was recently taken on the property of the West Coast company, at Santa Cruze de Alaya, in this state, by Luis Thamalen, Enrique Peña, and J. R. Rogers. Miners have been employed and the mill is running on good ore. Experiments with cyaniding have been satisfactory, and the plant will be changed to all-sliming, and a modern cyanide plant erected. The old dump of the West Coast company, which contains about 15 oz. silver per ton, will be re-crushed and cyanided. The above named people have also taken over the old Polo Blanco mine, and a boiler and pumps are being installed to pump out the mine. J. W. Himez is developing his property at San Lorenzo. Everything is quiet in the state of Sinaloa.

Culiacan, February 24.

Sonora

Damage to the Democrata smelter by fire has been repaired, and the new furnace is again in operation. Shipments of ore are being made from the Transvaal Mining Co.'s property, near Cumpas, to Douglas. The orebodies opened contain large quantities of ore, the Cobre Rico mine having 2,500,000 tons of 2% copper ore, and the Transvaal about 3,000,000 tons of concentrating ore. In the former, development has covered 16,400 ft., including diamond-drilling, and in the latter, 2000 ft., besides 10,000 ft. of drilling. The Ultima Chanza mine has been opened by 5000 ft. of work, and 50,000 tons of ore averaging 10% copper and 5 oz. of silver is ready for mining. The company's holding covers 2225 pertenencias. At the Cerro de Plata mine the lode has been prospected for 4300 ft. to a depth of 600 ft. There are about 75,000 tons of ore worth 4% copper on the dump. A 50-ton treatment plant is to be erected by the Penn-Sonora company near Encina, on the Southern Pacific of Mexico.

PERU

Electrical haulage has replaced mule traction in the Cerro de Pasco mines. The new hydro-electric power-station at Oroya is being constructed with all speed.

Market Reports

LOCAL METAL PRICES

San Francisco, March 6.

Antimony	12—12¾c	Quicksilver (flask)	40
Electrolytic Copper	18—18¼c	Tin	53¼—54c
Pig Lead	4 60—5.55c	Spelter	8¼—8¾c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, March 5.—Copper prices are now firm responding to large European buying. Distinctly better demand for lead and speiter is evident. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Feb. 27	14.55	4.33	6.00	60
" 28	14.55	4.33	6.00	58⅞
Mar. 1	14.55	4.33	6.00	59⅛
" 2	Sunday.	No market.		
" 3	14.60	4.34	6.03	59⅝
" 4	14.65	4.34	6.05	59⅝
" 5	14.75	4.34	6.08	59⅝

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	March 6.
Camp Bird Ltd	$ 4⅞
El Oro	4½
Esperanza	7⅛
Oroville Dredging	1⅞
Santa Gertrudis	6⅜
Tomboy	6⅝

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. March 6.		Closing Prices. March 6.
Adventure	$ 3¼	Mohawk	$ 51½
Allouez	37	North Butte	28¼
Calumet & Arizona	64¾	Old Dominion	49⅝
Calumet & Hecla	465	Osceola	88
Centennial	15	Quincy	68
Copper Range	45¾	Shannon	11½
East Butte	13⅜	Superior & Boston	3⅜
Franklin	7	Tamarack	30⅛
Granby	63½	U. S. Smelting	40⅜
Greene Cananea, ctf.	8¼	Utah Con.	9¼
Isle-Royale	25½	Victoria	1¼
La Salle	4½	Winona	2¾
Mass Copper	4½	Wolverine	68½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 6.

Atlanta	$ .17	Midway	$ .49
Belmont	7.00	Montana-Tonopah	1.55
Big Four	.87	Nevada Hills	1.15
Buckhorn	.90	North Star	.21
Con. Virginia	.17	Ophir	.19
Crown Point	.22	Pittsburg Silver Peak	.60
Florence	.52	Round Mountain	.47
Goldfield Con.	2.80	Sierra Nevada	.11
Halifax	1.15	Tonopah Extension	1.75
Jim Butler	.73	Tonopah Merger	.83
Jumbo Extension	.30	Tonopah of Nevada	6.00
MacNamara	.19	Union	.09
Manhattan Consolidated	.06	West End	1.30
Mexican	.61	Yellow Jacket	.23

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. March 6.		Closing Prices. March 6.
Alaska Mexican	$12⅛	McKinley-Darragh	$ 2⅛
Alaska Treadwell	41⅜	Miami Copper	23½
Alaska United	23	Mines Co. of America	2½
Amalgamated Copper	71⅛	Nevada Con.	17½
A. S. & R. Co.	71	Nipissing	8⅞
Braden Copper	9	Ohio Copper	⅝
B. C. Copper Co.	3⅜	Ray Con.	19
Chino	40½	Tenn. Copper	37½
First National	2½	Tonopah Belmont	7
Giroux	3	Tonopah Ex.	1⅞
Goldfield Con.	2¾	Tonopah Mining	5⅜
Greene-Cananea	8½	Trinity	4½
Hollinger	16½	Tuolumne Copper	3
Inspiration	17¾	Utah Copper	54
Kerr Lake	3	West End	1⅞
La Rose	2⅞	Yukon Gold	3
Mason Valley	8¼		

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

GEORGE B. LEE is at Douglas.

T. T. READ is at Douglas, Arizona.

L. D. RICKETTS has gone to Cananea.

E. E. CARPENTER is down from Rochester.

NORMAN CARMICHAEL was at Globe recently.

CHARLES BUTTERS was in Tonopah this week.

STANLEY LANE is in Moscow on mining business.

GEORGE H. SCHIRD visited San Francisco this week.

J. W. BENNIE has returned to Clifton from Douglas.

S. H. PITKIN will be at Denver March 10 to 15 inclusive.

A. J. EVELAND has been visiting copper mines in Arizona.

LIONEL LINDSAY has left for a vacation trip through Japan.

R. E. SMITH is drilling placers near Nikolaievsk, East Siberia.

ALF WELHAVEN passed through San Francisco returning to Korea.

D. C. JACKLING will hereafter make his home in San Francisco.

WILL C. HIGGINS has been visiting San Francisco and has gone to Reno.

R. B. LAMB is now consulting engineer for the Peterson Lake Mining Company.

W. W. TAYLOR is now manager at the Kainei mine, Kinsen station, Kei Fu Tetsudo, Chosen.

C. E. BARR succeeded S. J. Kidder as mill superintendent for the Silver Peak G. M. Company.

R. B. MARTIN will sail on the *Siberia* March 29 for Manila, to assume a position with the Bureau of Science.

ROSS B. HOFFMANN is in the Odeel region on the Lower Amur, East Siberia, but is expected in London soon.

W. A. KUNKLE has resigned as superintendent at the Ajax mill and gone to Denver to engage in consulting practice.

C. T. GRISWOLD has resigned from the Carnegie Institute of Technology to join the Associated Geological Engineers.

B. BRITTON GOTTSBERGER has been in the hospital for appendicitis. Two operations were necessary, but his recovery is now assured.

J. B. HUTCHINS, who has just returned to St. Petersburg after a trip to London, is now consulting engineer to the Cabinet of the Tsar of Russia.

KARL EILERS addressed the San Francisco Engineers' Club briefly last Tuesday on the affairs of the American Institute of Mining Engineers.

J. S. WILBUR and J. F. HANCHER, who are developing a drift mine in Colombia, expect to be in San Francisco in June to purchase equipment and supplies.

FRANCIS A. THOMSON has returned to Pullman, Washington, from an inspection of the Silver Hoard mine at Ainsworth, British Columbia, for which company he is consulting engineer.

ROBERT ANDERSON has resigned from the U. S. Geological Survey to form a partnership with A. C. VEATCH, specializing in the geology of petroleum. The new firm will maintain offices in London.

HALLET R. ROBBINS, recently of Atlantic, Wyoming, has been appointed assistant professor of metallurgy at the State College of Washington, Pullman, Washington, succeeding the late R. E. SAMPSON.

CHARLES A. BANKS, general manager of the Jewel Denero and Idaho Alamo mines, leaves New York March 1 by the *Carmania* for London. He intends returning to British Columbia about the middle of April.

J. F. THORN has resigned as general superintendent for the Goldfield Consolidated Mines Co., and ALBERT BURCH has taken charge of the property. It is understood that Mr. Burch will devote but part of his time to the work.

Spelter Production in 1912

The accompanying tables summarize the spelter production of the United States in 1912 and are from figures collected by C. E. Siebenthal of the United States Geological Survey. The figures are based upon direct returns from the smelting companies. They show an increase of 8.6% in the world's production, but a growth of 18.2% in the United States production and 21.5% in United States consumption. As noted at the time, spelter was imported during part of the year. Zinc ore imports for the year amounts to 43,940 tons containing 17,567 tons of zinc. Ore exports were 23,349 tons. In the review number of the *Mining and Scientific Press*, issued January 4, Mr. Siebenthal's preliminary estimate of 338,630 tons was printed. As will be seen, this is checked with remarkable accuracy by his final figures, 338,806 tons, now printed. The total number of retorts available at the close of 1912 was 107,948, of which 25,148 was in Illinois, 29,612 in Kansas, 27,416 in Oklahoma, 5772 in Pennsylvania, 15,408 in West Virginia, 2672 in Missouri, and 1920 in Colorado. New retorts to a total of 12,216 were building, and of these 11,640 were to be in Illinois. These figures illustrate strikingly the continued movement of the zinc-smelting industry to the coalfields.

PRODUCTION OF PRIMARY SPELTER[1] IN THE UNITED STATES, 1906–1912.

APPORTIONED ACCORDING TO SOURCE OF ORE.

	1906	1907	1908	1909	1910	1911	1912
UNITED STATES:							
Arizona	64	77	152	2,862	2,594	2,336	4,092
Arkansas	1,801	1,911	2,002	135	286	385	604
California	.....	140	27	.....	.....	1,099	1,672
Colorado	32,456	26,077	24,885	20,121	23,238	42,233	60,841
Idaho	573	3,508	581	901	3,454	3,180	6,800
Illinois	282	1,446	298	675	1,551	2,884	3,952
Iowa	201	220	516	.....	40	.....	.....
Kansas	3,902	13,850	8,628	9,185	10,220	6,843	5,668
Kentucky	335	358	341	22	29	205	394
Maine	.....	1	.....	.....	.....	.....	.....
Missouri	130,348	141,824	123,655	140,676	140,652	127,540	149,557
Montana	1,415	.....	900	4,725	12,408	22,115	14,196
Nevada	1,768	1,692	398	825	1,516	1,595	6,132
New Jersey	11,206	13,573	6,926	16,035	20,217	15,128	16,941
New Mexico	555	136	134	3,961	4,911	3,778	6,882
Oklahoma	.....	719	2,235	3,008	2,297	2,247	2,041
Tennessee	124	181	341	695	925	1,000	1,935
Texas	8	16	.....	.....	.....	.....	245
Utah	2,449	1,972	282	5,960	7,221	7,004	7,756
Virginia	1,143	771	910	58	1,168	228	62
Washington	7	.....	.....	.....	.....	12	.....
Wisconsin	11,057	15,273	17,538	20,381	19,752	31,809	34,137
Total domestic	199,694	223,745	190,749	230,225	252,479	271,621	323,907
FOREIGN:							
Canada	201	545	2,425	978	3,304	1,598	4,199
Mexico	21,875	25,570	17,250	24,557	13,401	13,307	10,700
Total foreign	25,076	26,115	19,675	25,535	16,705	14,905	14,899
Grand total	224,770	249,860	210,424	255,760	269,184	286,526	338,806

APPORTIONED ACCORDING TO LOCALITY IN WHICH SMELTED.

Illinois	47,939	56,056	50,244	67,653	73,038	83,130	88,397
Kansas	129,564	134,108	99,298	103,299	105,697	98,413	101,104
Oklahoma	.....	5,035	14,864	28,782	34,760	46,315	76,925
Other States	47,267	54,661	46,018	56,026	55,689	58,668	72,380
Total	224,770	249,860	210,424	255,760	269,184	286,526	338,806

PRODUCTION OF SECONDARY ZINC IN THE UNITED STATES, 1907–1912.

Secondary spelter, redistilled	7,050	7,159	9,273	12,784	14,043	[2] 21,000
Secondary spelter, remelted	11,791	9,811	23,767	28,439	26,470	[2] 29,000
Recovered zinc in alloys, excluding old brass remelted	1,417	665	1,181	2,709	3,223	[2] 3,300

[1] Primary spelter is made directly from ore, but secondary spelter is recovered from such sources as drosses, skimmings, and old metals.
[2] Subject to final revision.

WORLD'S PRODUCTION OF SPELTER, 1906-1912.

Locality in which smelted.	1906	1907	1908	1909	1910	1911	1912
Australia	1,131	1,098	1,198	.....	560	1,904	2,531
Austria and Italy	11,883	12,522	14,063	13,931	14,666	18,602	21,050
Belgium	168,067	170,307	181,851	184,194	190,233	215,050	220,690
France and Spain	59,293	61,438	61,512	61,859	65,191	70,791	79,442
Germany	225,997	230,058	239,062	242,594	251,046	276,008	298,810
Great Britain	57,971	61,286	60,029	65,422	69,531	73,803	63,090
Holland	16,150	16,526	19,017	21,548	23,121	25,059	26,382
Poland	10,595	10,735	9,740	8,758	9,514	10,952	12,320
United States	224,770	249,860	210,424	255,760	269,184	286,526	338,806
Total	775,857	813,830	796,896	854,066	893,046	978,695	1,063,121
United States percentage of world's production	29.0	30.7	26.4	29.9	30.1	29.3	31.9

Subject to final revision.

CONSUMPTION OF PRIMARY SPELTER IN THE UNITED STATES, 1907–1912.

Supply:						
Stock, Jan. 1—						
In bonded warehouses	.....	2	9	39	31	32
At smelters	3,824	26,364	19,613	11,167	23,201	9,049
Production	249,860	210,424	255,760	269,184	286,526	338,806
Imports	1,778	881	9,454	1,960	609	11,115
Total available	255,462	237,671	284,836	282,350	310,367	359,002
Withdrawn:						
Exports, foreign, from warehouse	9	8	334	4,758	11,276	6,286
Exports, foreign, under drawback	1,555	1,234	.....	4,486	3,079	1,188
Exports, domestic	563	2,640	2,566	3,990	6,872	6,634
Stock, Dec. 31—						
In bonded warehouses	2	9	39	31	32	48
At smelters	26,364	19,613	11,167	23,201	9,049	4,474
Total withdrawn	28,493	23,504	14,106	36,466	30,308	18,388
Apparent consumption	226,969	214,167	270,730	245,884	280,059	340,372

MINING CONCESSIONS in Syria are being actively developed and the British Consul at Damascus states that a small company has been formed locally to procure mining concessions, and has five or six projects in hand, including prospecting for petroleum in the Yarmuk valley about 118 miles from Damascus by rail on the Haifa line, and also in the Ghor el Arbian vale, which is nearer, and at Kafranlye, and for iron in the district of Salt and near that town. In the vicinity of the Dead Sea it is proposed to prospect for iodine, bromine, asphalt, and bitumen. As to the coal or lignite at Erni on Mount Hermon, no mining is now going on, but a concession for the term of 99 years has been applied for.

THE most extensive and important of the Brazilian iron deposits are in the Serra do Espinhaço, bounding the valley of the river San Francisco on the east. The iron ore, oddly enough, also contains gold, and many gold mines are in the vicinity. Iron ore was first found as early as the sixteenth century. The Portuguese government attached so much importance to the discovery that special efforts were made to encourage a local industry, and officials and craftsmen were sent.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

STAMPS on the Rand total 10,006, and tube-mills 286, the average proportion being 1 tube-mill to 35 stamps.

ASBESTOS produced in California in 1912 amounted to 90 tons, worth $2700, against 125 tons, valued at $500, in 1911.

RECOVERIES of metals at the Sulphide Corporation's central mill at Broken Hill are: lead, 93.1%; silver, 92.9%; and zinc, 89.9 per cent.

THE Premier Diamond Mining Co., Ltd., has treated 54,872,296 loads of 1600 lb. each to date, which yielded 14,347,721 carats, worth $60,590,400.

BAUXITE, the ore from which metallic aluminum is derived, exists in southern California, but is not being mined. The principal American output is now from Arkansas.

ANTIMONY is found in Inyo, Kern, Merced, Riverside, and San Benito counties of California, but no actual production of ore has been mined for antimony alone since 1901.

IRON ORE production of California in 1912 was 2508 tons, valued at $1 per ton, against 1950 tons in 1911. There are large bodies of iron ore, especially in the southern part of the state, but little is mined.

HEAD-FRAMES at the nine principal mines at Kalgoorlie vary in height from 60 to 110 ft., spread at the base from 31 to 54 ft., at the crown from 10 to 14 ft., and have sheaves from 7 to 10 ft. diameter.

POWER COSTS at the Associated mine, Kalgoorlie, are 80c. per ton; mine development costs, $17.36 per foot; diamond-drilling, $3.12 per foot; mining, $2.16 per ton; treatment, $2.70 per ton; and extraction, 94.29 per cent.

CYANAMIDE is being used for agricultural purposes, and Swedish works are producing 3500 tons per month. Nitrogen compounds are made from the atmosphere in Norway, and in 1912 50,000 tons of calcium nitrate was manufactured.

DIES which have been concreted in mortar-boxes have given great satisfaction in that they are held solidly in place and the wear is more even than when they are secured in the ordinary way. It is also found easier to clean out the boxes when necessary.

FLOTATION of tailing at Broken Hill in December, at the Zinc Corporation plant, returned 5675 tons of zinc concentrate from 21,270 tons treated; and at the Amalgamated Zinc (De Bavay's) plant, 16,361 tons of 49.2% zinc concentrate from 59,299 tons of mixed tailing.

CALCIUM CARBIDE production in Europe during 1912 amounted to 200,000 tons. There are 75 companies engaged in the business, but their factories did not work to full capacity. German consumption increased by 12,000 tons, and 46,000 tons was imported from Switzerland, Norway, and Sweden.

LIQUID AIR contains two parts of oxygen to one part of nitrogen, whereas ordinary air contains approximately four parts of nitrogen to one part of oxygen. Atmospheric air liquefies at a temperature of –191°C., and is reduced to about 1/700 to 1/800 of its original volume; consequently, one gallon of liquid air will evaporate into 700 to 800 gal. (110 to 130 cu. ft.) of atmospheric air.

SHAFT-SINKING costs at Kalgoorlie vary from $47.06 to $59.22 per foot for box-timbered shafts (exclusive of cutting stations at the various levels), and from $61.88 to $80.76 per foot for frame-timbered shafts, while the average cost for mine shafts from 4 by 10 ft. to 5.5 by 13.5 ft., inside measurement, was $60.32 per foot. The latter item was made up as follows: Wages and salaries, $34.76; timber, $8.42; explosives, $3.86; stores, $2.26; power, $11.02.

WIRE ROPES for hoisting purposes in Western Australia vary in size from 2¾ to 4¼ in. diam. The government regulations state that the working load shall not exceed one-eighth of the certified breaking strain of the rope when new, and whenever after testing, as provided by regulations, it is found that the breaking strain of any rope is not 6 times at least greater than the working load, such rope shall be condemned by the inspector of mines.

OXYGEN for mine-rescue apparatus may be generated from sodium-potassium peroxide by passing an aqueous vapor and carbonic acid (both products of respiration) according to the following reactions:

$$NaKO_3 + H_2O = NaOH + KOH + O_2$$
$$NaKO_3 + CO_2 = NaKO_3 + O_2$$
$$CO_2 + NaOH + KOH = NaKCO_3 + H_2O$$

The products of respiration, CO_2 and H_2O, are absorbed, and the O is restored to the wearer of the apparatus.

LOCATIONS cannot lawfully be made or perfected to patent for purposes or uses foreign to those of mining or the development of mineral. Formerly many locations were made to hold ground containing springs, or good for grazing, power-sites, timber, etc. Under the present rigid field examination before approving the entry for patent, such 'bluff' locations cannot be patented, though they remain as locations until the interests of public policy or the protest of some one with a better right to the land causes their removal.

OXIDIZED zinc ores of Leadville were first shipped in 1910. They are found, according to *Economic Geology*, within an area of 10 square miles, in 'blue limestone,' from the 'parting quartzite' up to the 'white porphyry.' The ore-bodies are as irregular as other replacement bodies of the district. The valuable portion of the ore consists of smithsonite (carbonate of zinc), calamine (hydrated silicate of zinc), and hydrozincite (hydrated carbonate of zinc), the first predominating over the others in most cases, and the last is rarely identifiable. In connection with the search for oxidized zinc ores, a new mineral and new variety of previously classified species were discovered. The first is an oxide of manganese and zinc, and the second is an aragonite containing variable proportions of zinc, up to 10%. They have been named by G. M. Butler as wolframite and nicholsonite. The zinc ores have the following composition:

Specific gravity...2.7 to 4.0

	Per cent.		Per cent.
Zinc	17.7 to 46.4	Iron	2.2 to 17.0
Lime	0.3 to 0.9	Sulphur	0.6
Magnesia	0.7 to 2.2	Alumina	0.2 to 2.8
Silica	0.9 to 33.6	Manganese	2.0 to 11.2
		Insoluble	2.2 to 34.6

LANDS withdrawn for power-sites and reservoirs were formerly invariably closed to location, especially where locations might interfere with the purposes of the withdrawal. Though the Land Department said that a location made prior to the withdrawal would be upheld, if a valid one, that is, founded on actual discovery by the locator of a valuable deposit of mineral within the limits of the claim, and maintained in accordance with the mining laws and regulations applicable, it also said that the withdrawal of land for irrigation or reclamation projects did not withdraw it from mineral location. In general, it was considered that the miner making a location on a withdrawn area was entitled to a preferred right to make a valid location upon the removal of the withdrawal, if no greater right. Locations have been made on this principle upon Indian and military reservations, but it is a poor method to pursue, for the authorities are usually antagonized by the trespassing of the locator. However, the land-withdrawal law passed by Congress June 25, 1910, now permits mineral locations upon withdrawn areas and clearly defines the present rights.

Book Reviews

Any of the books noticed in these columns are for sale by, or can be procured from, the MINING AND SCIENTIFIC PRESS.

DE RE METALLICA. By Georgius Agricola. Translated from the first Latin edition of 1556 by Herbert C. Hoover and Lou H. Hoover, and published for the translators by *The Mining Magazine*, London, 1912. For sale by the *Mining and Scientific Press*. Price $8 post and duty paid.

This handsome vellum-bound folio of 640 pages, appropriately illustrated by reproductions of the wood-cuts used in the original edition, presents in sumptuous format the first English translation of the great classic of mining. If it were a literal translation it might be dismissed as interesting but unimportant; a fit addition to the libraries of those who value books in direct proportion to their rarity. The work, however, that Mr. and Mrs. Hoover have literally given the mining profession, is much more than a translation. It includes in sequence, a Translators' Preface; an Introduction, which is a biography of Agricola; a reproduction of the original Latin title page, and the laudatory lines of Georgius Fabricius, Agricola's learned friend; a translation of the original preface; translations of the twelve books of the original work; Appendix A, a bibliography and review of Agricola's other works; Appendix B, a resumè of the notes on mining, metallurgy, and mineralogy found in earlier works and available to Agricola at the time he wrote; Appendix C, tables of Greek, Roman, and old German weights and measures such as were currently used when Agricola wrote; and lastly a well planned and discriminating index. This mere relation of the contents will indicate in outline something of the care and work that have gone into the new volume.

Any comparison that may be made of this with earlier translations into German, such as have been heretofore available, and a record of the various attempts previously made to translate into English, will give an even better understanding of the nature of the difficulties that had to be overcome. Mr. and Mrs. Hoover are by no means the first who have proposed to translate the volume into the tongue used by those who are preëminently the mine owners and mine workers of the present day. As early as 1636, Sir John Pettus made the attempt, but apparently nothing came of it. As late as 1903 a group of men at Butte, a centre of research as well as of profitable mining, started in ambitiously, but later gave up the task. It chances that the Latin of the first chapter of Agricola's work is relatively easy; indeed that is probably the easiest chapter in the whole volume to translate. It has in it less that is technical, and deals, broadly, with the utility of mining. It was necessary in the sixteenth century to use labored argument to prove that mining was a right and proper vocation; that the "earth does not conceal metals in her depths because she does not wish that men should dig them out, but because provident and sagacious Nature has appointed for each thing its place." In the discussion of such problems there is a broad human interest; but there are relatively few puzzling problems, such as how to translate into modern English technical terms made up in the middle ages by compounding Greek and Latin words, when the Greeks and Romans did not themselves have the concepts for which the words were needed. It is an open secret that Mr. and Mrs. Hoover began the translation as light heartedly as any of their predecessors. Fortunately they did not drop the matter when subsequent chapters showed the real difficulties of the task. It is in just this difficulty of right rendering of technical words that the new volume is unique. Agricola, writing in Latin of an art that had grown up after the Latin language had been cast and the mold broken, had to make words. There having been no concept, there was naturally, in the language used, no word to express it.

The same difficulty, as to words, was faced by Quannah Parker, the great Commanche chief who introduced hogs on the plains previously sacred to cattle. His tribesmen came miles to see the new and strange creatures, and asked the chief by what name they were known. The word hog would have meant nothing to them, but through traders the Indians had come to have clear concepts of hams and bacon, so Quannah Parker told them that the new animals were hams and bacon. At this, one of the old men turned away in disgust, remarking: "Injun no like 'em. Too heap much salty." Agricola had to find terms for new ideas, and in former translations there has been little left but the salt.

Mr. Hoover, with his first-hand knowledge of mining and his thorough scholarship, has been able to make Agricola's terms intelligible without unduly reading into them ideas that have originated since. To do this required wide reading in earlier and contemporary writings. It was necessary to get the point of view before the work could be successfully attempted. It is not surprising therefore to know that preparation of this book has taken all the spare time of the two translators, with much assistance from others, through five years.

As a concrete definite picture of mining as it was known and practised in the sixteenth century, this book is important to all engineers; as an intellectual cross-section of the Middle Ages, however, it has much wider interest. Reading it, in the light of the copious and scholarly footnotes found in this translation, gives us real knowledge of how our predecessors thought and felt about one of the great basal industries and one of the great domains of human knowledge. Just as a sojourn in the interior of even modernized Japan enables us to orient our knowledge of feudalism, this book affords a convenient and fascinating approach to the Middle Ages. Modern men are more interested in business and social life than in wars and royal successions, the two things that medaeval writers thought most worthy of presentation on the pages of history. Agricola painted his own times well, and Mr. and Mrs. Hoover have restored the masterpiece with rare skill.

All mining engineers know something of George Bauer, to use the real name of the author of 'De Re Metallica,' but we venture to say that few have appreciated the greatness of this our professional ancestor. A writer, student, and court physician he was, but also a Burgomaster, a diplomat, a trusted public servant, and an associate of the great men of his times. It is especially interesting to find that Bauer, a loyal and devoted Catholic, retained the confidence and esteem of his Prince and Protestant associates in Meissen through the long and bitter wars that grew out of the religious difficulties of the times. Holding sturdily to his old faith, he was the recognized intellectual peer of the greatest among his contemporaries, and when bitterness too commonly had supplanted friendships, Melanchthon, Camerarius, Fabricius, Erasmus, and others, were his close associates.

Our author was a man of affairs who contributed his part to the making of his times. He was also a lifelong student, and he wrote a number of books besides the one on which his fame chiefly rests. One of them in particular, 'Ortu et Causis,' Mr. Hoover considers valuable and significant. In it he gave in detail his views of the genesis of ore deposits summarized in Book III of the 'De Re Metallica.' We printed, October 5, elaborate comment on this chapter, prepared by Mr. and Mrs. Hoover and presenting the seventeenth century theory of ore deposition. As so often happens in careful analysis of old works, there were the germs of surprisingly modern doctrine in what Agricola wrote, not only about ore deposits, but about metallurgy and mining. This, and the bearing of much of what he said is made clear by the comment of the translators, and it is in this comment which will prove of most interest and value to Mr. Hoover's professional contemporaries. It is difficult to give an adequate conception of the wealth of material that is compressed in these footnotes and of the difficulties that had to be met in preparing them. Not only libraries but museums were ransacked. Analyses and assays were made of precious fragments to determine just how much of metallurgy was practised when the vases and coins were made. Such study was only possible where modern technical knowledge and deep scholarship were both available. It was in the truest sense a labor of love, and aside from the value of the work itself,

the profession will be stimulated and benefited by the example of this work undertaken to "strengthen the traditions of one of the most important and least recognized of the world's professions." For our part, we take great pleasure in our modest connection with the enterprise through the work of our affiliated publication. H. F. B.

THE STOCK EXCHANGE FROM WITHIN. By William C. Van Antwerp. Pp. 459, ill., index. Doubleday, Page & Co., New York, 1913.

Securities in America alone aggregate the enormous total of $43,000,000,000, and it will not be disputed that where 2,000,000 people own one-third of the nation's wealth, they are entitled, just as the farmer is, to a perfectly constructed price-making machinery which will enable them to invest their savings, or sell their holdings. In the why and wherefore of the Stock Exchange, the author makes these remarks; while he quotes from W. Lexis, of Gottingen, a well known economist, as follows: "The existence of a broad, continuous market is an economic necessity in the modern scheme of widespread investment of capital. Even though the market-place is largely filled with speculators, it is plain that the greater the number of trades in securities, the greater will be the facility for buying and selling any quantity of securities. The stock market is a powerful aid in floating new issues of public securities * * * it renders a useful service in giving a continuous guide to the success or failure of industrial undertakings * * * private investors receive in this way a continuous market opinion on the conditions of the corporations in which they are shareholders." Many persons question the necessity of the Stock Exchange, but if the matter be studied, its functions will soon become apparent. The Exchange, without doubt, leads to a lot of abuses, of which the writer is fully aware, and wild speculation will always occur, while the investor looks for a steady return on his securities, irrespective of large sums to be made from booming, which, at its best, lasts but a short time. In Stock Exchange deals we have 'bears' and 'bulls,' whose functions are well appreciated, but the practice of 'short selling,' that is, selling what one does not possess, is not so well understood, and this is fully explained. It has been often questioned as not being the square thing, but the writer thinks otherwise. At any rate, money is made in this manner. The relation between banks and the Stock Exchange is a close one, the former had holdings amounting to $4,450,822,522, deposited by 10,009,804 people at October 30, 1912; and some outlet is necessary for such sums for investment. This is afforded by the Stock Exchange. Discussing panics, and that of 1907, it is stated that every business depression in the United States has been discounted in our security markets from six months to two years before. From August 1905 to August 1907, New York City bank loans secured by Stock Exchange collateral declined from $385,652,014 to $251,867,158, a corrective force of $133,784,856. The Exchange is a barometer of future business conditions, and men turn to it for first aid at such times. The New York and London stock exchanges, and the Paris bourse are compared in an interesting way, and in the matter of settlements the first named has a good system. New York lists 1583 and London 9000 securities; while the total holdings of these exchanges are valued at $26,243,291,803, over £10,200,000,000, and over 155,000,000,000 francs. The 'Money Trust' investigation, which has recently brought out interesting details of the financial world, will be better understood on reading this interesting volume. An appendix contains a report of the Hughes Commission, and Stock Exchange laws; while an excellent index enables the reader to search for details of financial discussion. M. V. B.

ELEMENTS OF HEAT-POWER ENGINEERING. By C. F. Hirshfeld and Wm. N. Barnard. 792 pp., index. John Wiley & Sons, New York. For sale by the *Mining and Scientific Press*, San Francisco. Price $5.

The authors have done excellent work in including under one cover not only the elementary thermodynamic theory of gases and their cycles, but also the consideration of the sources of heat, its utilization in the various types of prime-movers and auxiliaries to which it is applicable, together with a discussion of the fundamental theory, the ideal and actual performance of the apparatus under working conditions. The text has been prepared primarily for advanced students in engineering who have had previous training in physics, chemistry, analytical and applied mechanics, and empirical machine design. The arrangement of the text is excellent, the various subdivisions under which the subject has been considered being treated in their logical sequence. No attempt has been made to expound new theories, emphasis being placed instead on fundamental laws and accepted theories. The derivations as well as the formulæ themselves are given in full; an essential to a thorough understanding of any subject which is frequently overlooked by writers on scientific subjects. The steam-engine and its performance is discussed at length, from the simplest forms of slide-valve reciprocating engines to the highest types of steam turbines. Boilers, economizers, and other steam-utilization auxiliaries, as well as the various kinds of fuel in use, are treated at length. Consideration given to internal-combustion engines is no less thorough. In this case, as in that of steam-engines, all types are considered, from the single-cylinder 4-cycle gasoline-engine to the oil and suction gas-producer and Diesel types. Water purification, complete power-plants, compressed air, and refrigeration are all subjects of chapters; in fact, the impression given by this book as a whole is that a big subject has been treated comprehensively and at the same time is condensed within a comparatively small compass. Engineers engaged in the practice of this branch of the profession will appreciate its value as a book of reference, while students will find their studies greatly simplified through a careful perusal of its pages. C. T. H.

THE MINING MANUAL AND MINING YEAR BOOK, 1913. By Walter R. Skinner. Pp. 1354, index. W. R. Skinner, London, E. C. For sale by the *Mining and Scientific Press*. Price $5.25.

The union of the 'Mining Manual,' established in 1887, and the 'Mining Year Book,' founded in 1901, has been effected, and the combined work is now published under the above title. This is a good plan, as the publication of two similar volumes on the mining industry was quite unnecessary, and caused a good deal of comment at such waste of divided labor. The book is now classified into two sections, namely, 'African' and 'Miscellaneous,' and many mines whose shares are not dealt in on the London Stock Exchange are included in the latter section. A work of this nature has so often been reviewed, its valuable information so well known and well received, that little further can be said about it. It is creditable that such a large volume, covering the operations of so many companies, can be published so early in the year, and containing results as far as possible up to the end of 1912. Mr. Skinner, in the preface, covers a short review of work at the different mining fields, not forgetting the sensation in the Nigerian tin section, which was given in detail in *The Mining Magazine* during the past year. A directory of mining directors covers 216 pages; of mining secretaries, 49 pages; of mining and consulting engineers and managers, 36 pages; glossary of mining terms, 8 pages; while the index refers to no less than 5350 companies.

BUILDING STONES AND CLAY PRODUCTS; A HANDBOOK FOR ARCHITECTS. By Heinrich Ries. Pp. 415, ill., index. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price $3.

There is an extensive literature of building stones and clay products, but as most of it consists of government reports or chapters in such reports, it is not readily accessible. The best general summary of the subject has been Merrill's well known volume. The handbook prepared by Mr. Ries is at once more comprehensive, in that it covers clay products as well as stone, and less detailed. The material used has been well chosen and is excellently presented. Bringing into one modest-sized volume so much that the architect needs, leaves no further excuse for mistakes that have been all too common.

Recent Publications

GEOLOGY OF SANGAMON COUNTY. By A. R. Crook. 24 pp.; Ill. Illinois State Journal Co., Springfield, 1912.

ANNUAL REPORT OF THE STATE INSPECTOR OF MINES, NEVADA, 1912. By Edward Ryan. P. 79. Ill. Carson City, 1913.

MINERAL PRODUCTION FOR 1911. By E. S. Boalich. Bulletin No. 64. P. 46. California State Mining Bureau, San Francisco, 1912.

REPORT OF THE GOVERNOR OF ALASKA TO THE SECRETARY OF THE INTERIOR, 1912. By Walter E. Clark. P. 74. Map. Washington, 1912.

GLASS SANDS OF OKLAHOMA. By Frank Buttram. Bulletin No. 10. P. 91. Ill., maps. Oklahoma Geological Survey, Norman, 1913.

TRAINING WITH MINE-RESCUE BREATHING APPARATUS. By James W. Paul. Technical Paper 29. P. 16. Bureau of Mines, Washington, 1912.

MINE-RESCUE WORK IN CANADA. By W. J. Dick. P. 50. Ill., chart, plans, index. Commission of Conservation, Committee on Minerals, Ottawa, 1912.

COMMERCIAL MARBLES OF WESTERN VERMONT. By T. Nelson Dale. Bulletin 521. P. 170. Ill., maps, charts, index. U. S. Geol. Survey, Washington, 1912.

ANNUAL REPORT OF SAN FRANCISCO CHAMBER OF COMMERCE. By M. H. Robbins, Jr. Inaugural address by William T. Sesnon. P. 20. San Francisco, January 1913.

ELECTRON THEORY OF MAGNETISM. By Elmer H. Williams. Bulletin No. 62, Vol. 10. P. 66. Charts. University of Illinois Engineering Experiment Station, Urbana, 1912.

COSTS OF PRODUCING POWER IN IOWA WITH IOWA COALS. By H. W. Wagner. P. 35. Charts. Bulletin No. 29, Engineering Experiment Station of Iowa State College of Agriculture and Mechanical Arts. Ames, December 1912.

CONTRIBUTIONS TO ECONOMIC GEOLOGY, 1910. (Short papers and preliminary reports.) Part II, MINERAL FUELS. By Marius R. Campbell and others. Bull. 471. P. 663. Maps, charts, index. U. S. Geol. Survey, Washington, 1912.

THE TANANA MAGAZINE. 'Quartz' edition of *Fairbanks Daily Times*. P. 76. Ill. Fairbanks, Alaska, 1912. An interesting little publication dealing with the lode mines of the district, where there are now 16 stamp-mills in operation.

PHYSIOGRAPHY AND STRUCTURE OF THE WESTERN EL PASO RANGE, AND THE SOUTHERN SIERRA NEVADA. By Charles Laurence Baker. Bulletin of the Department of Geology, Vol. 7, No. 6. P. 25. Ill. University of California, Berkeley, December 1912.

COAL DEPOSITS OF MISSOURI. By Henry Hinds. Bureau Geology and Mines, XI. N. S. P. 503. Ill., index, maps. Prepared in coöperation with the U. S. Geological Survey. An excellent general summary, bringing up to date the knowledge of important Middle West fields.

UNDERGROUND WATER RESOURCES OF IOWA. By W. H. Norton, W. S. Hendrixson, H. E. Simpson, O. E. Meinzer, and others. Prepared in coöperation with the Iowa Geological Survey. Water-Supply Paper 293. P. 994. Maps, plans, index. U. S. Geol. Survey, Washington, 1912.

GEOLOGY OF KALGOORLIE, WESTERN AUSTRALIA. By C. O. G. Larcombe. P. 312. Ill., maps, plans. Vol. V, No. II, 1910. *Proceedings* of the Australian Institute of Mining Engineers. Melbourne, Victoria, 1911. This is a most important and valuable contribution to the geology of this well known field, and is the result of over three years observation by the author, who is instructor of mining and geology at the local School of Mines. Previous to the examination of the field by Mr. Larcombe, it was studied by H. P. Woodward, T. A. Rickard, A. Gibb-Maitland, E. F. Pittman, E. S. Simpson, C. S. Göczel, W. M. Frecheville, and J. M. Maclaren. Besides the geology of Kalgoorlie, that of Western Australia generally is reviewed, and the country adjacent to the former centre. The plans and micro-photographs are especially good and interesting.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING CLAIMS—AWARD ON CONDEMNATION

Grantees of a portion of the surface of a mining claim from the original locator are entitled to a proportionate share of award of damages to the claim-owner, in a condemnation suit for a railroad right-of-way. The issuance of a patent to the locator subsequent to the grant aforesaid does not affect the grantees' rights because the patent relates back to the original location.

Las Vegas & T. R. Co. *v.* Summerfield (Nevada), 129 Pacific, 303. (Jan. 4, 1913.)

OIL LEASE—RIGHT TO CANCEL DENIED

Where a vendor sold some oil lands to a vendee on an instalment contract, reserving a vendor's lien to secure the unpaid part of the purchase price, and reserving also one-half the oil and gas, and thereafter the vendee executed an oil and gas lease on a royalty basis to third parties, the vendor, in the event of foreclosing his lien against the vendee and buying in the land at the foreclosure sale, must take title subject to the third party lease, where, by his conduct in not making the lessee a party to the foreclosure suit and requesting a receiver to sequester the rents he has impliedly at least ratified the lease.

Batten *v.* Hope Natural Gas Co. (West Virgina), 79 Southeastern, 889. December 17, 1912.

OIL AND GAS LEASE—FORFEITURE

An oil and gas lease required the lessee to commence operations within four months and pursue with diligence until completed, and that the lease should immediately upon the non-completion of said well be null and void. The lessee went into possession under the lease, sank one well, abandoned it, sank another well, abandoned it, and moved the drilling machinery away. No oil or gas was discovered in either well and no further prospecting was done until gas was discovered on adjacent land some time afterward, when the lessee set up a claim of right under the lease. Held that the lease was forfeited for non-completion of a well, it being the manifest intention of the parties that 'completion' of a well meant the discovery of oil or gas in commercial quantities.

Shannon *v.* Long (Alabama), 60 Southern, 273, November 19, 1912.

OIL PLACER—SUIT ON ADVERSE CLAIM

In a suit on an adverse claim filed in the course of patent proceedings, on an oil placer, it was held: (1) that where a discovery was sought to be made by drilling a well on the boundary line between two claims and it subsequently appeared that the boundary line had been erroneously established so that the well was not on the true boundary but outside of the claim in question, such a discovery cannot support a location of that claim; discovery must be within the claim limits; (2) while a discovery should properly precede the acts of location, it may follow, instead of precede such acts and will be held good as to all who have not acquired intervening rights; (3) mere indications of oil, however strong, are insufficient to constitute a discovery such as will support an original location, especially as the substance claimed to be oil by the applicant for patent was shown by the adverse claimant to be nothing more than shale grease; (4) an original and amended certificate of location must be construed together, and although neither certificate standing alone might be sufficient to support the location, both should be taken together, in the absence of intervening rights; (5) plaintiff's failure to prove the citizenship of the original locators does not entitle defendant to relief, the recorded certificate being of itself *prima facie* evidence that they were citizens, and no evidence having been introduced by defendant to the contrary.

Dean *v.* Omaha-Wyoming Oil Co. (Wyoming), 128 Pacific, 881. (Jan. 7, 1913.)

A New Lufkin Rule

Everyone having use for a rule graduated down to sixty-fourths of an inch, knows the difficulty of obtaining accurate measurements in laying out work, knows how impossible it is to get the reading instantly, knows of the eye-strain attendant upon reading such graduations repeatedly —all caused by the fineness of the lines and the closeness of the lines one to another necessary to get 64 lines in an inch. Under the eye the lines have a tendency to 'run together.' Also, because the lines are so close together, it is impossible to number each one, and therefore, after arriving at the measurement it is necessary to refer back to the last figure and count the divisions. It is evident that if the same measurement could be arrived at with the same degree of accuracy with a rule graduated down not finer than 16 lines to the inch these difficulties would be overcome. Both of these are solved in one way in the 'Alien' improved scale, an article just put on the market by the Lufkin Rule Co. The Allen scale is a patented article, and embodies a new idea in the marking of a machinist's scale.

As any even number of 64ths has an equivalent in 32nds, and possibly in 16ths, one side of this rule is graduated in 32nds and 16ths, and this takes care of all of the even 64ths. The other side of the rule embodies the new idea. It takes care of all the odd 64ths. The first graduation mark on one edge of this side is 1/64 in. from the end of the rule, and is numbered 1; the next mark on that edge is 5/64 in. from end of rule and is numbered 5; the next 9, the next 13, and so on up to the first inch mark, and thence being repeated in each inch. Here there is a jump each time of 4/64ths, and between 1/64th and 5/64ths would come one odd 64th, that is, the 3/64-in. mark; between 5 and 9, the 7/64-in. mark, etc. All of these odd 64ths appear on the other edge of this side of the rule; that is, the first graduation mark there is 3/64 in. from the end of rule, and is numbered 3; the next is 7/64 in., and is numbered 7. In this way all the odd 64ths are here given, and yet there are only 16 lines to the inch. This makes it possible to number each graduation mark, and by marking each second graduation mark slightly longer than the one before it and after it, the figures can be put on in two rows, and this allows room to make them large enough to be easily read. The rule is ¾ in. wide and furnished in the two thicknesses commonly known as the tempered and semi-flexible. It is made in various lengths. The greatest demand is expected to be for the 6-in. length. The Lufkin Rule Co. manufactures rules and measuring tapes of every description, being the largest manufacturer in its line. Its factories are at Saginaw, Michigan, and Windsor, Canada; branch offices and warehouses at New York City, and London, England.

Transformers for Outdoor Installation

For many years small lighting transformers of comparatively low potential have been installed out of doors, and they have satisfactorily withstood the service. No effort was made to develop a type of high-tension power transformers for outdoor service, owing to the demands for power being confined to centres of population where the power stations and substations were situated. Recently, however, owing to the fact that it is often desirable to tap a high-tension line where the load is not sufficiently great to justify building a sub-station, high-tension transformers of all capacities and for any commercial voltage have been designed for outdoor service.

Power transformers, 100 to 500 kva., for distributing potentials, 2300 to 6000 volts, and all transformers above 6000 volts and up to 500 kva., as built by the General Electric Co., employ a different type of construction than the distributing transformers used in city distribution. In these transformers, the straight two-legged core type construction is employed. The core consists of two vertical legs connected together at the top and bottom by yokes, thus forming a rectangle. Cylindrical coils and insulation cylinders are placed concentrically over the two vertical legs of the core, the high-voltage winding being outside the low-voltage winding, and separated therefrom by oil-ducts, and the above mentioned insulating cylinders. Power transformers for all voltages may be self-cooled or water-cooled.

In self-cooled transformers, the heat arising from the losses in the transformer is dissipated into the surrounding air, by providing a tank with sufficient external radiating surface to limit the temperature inside the transformer to a safe value. The tanks for these transformers are made from sheets of steel, corrugated under great pressure and electrically welded together. A base and rim are cast directly to the corrugations, the joint between them being an actual weld. This forms a rigid one-piece tank which, when supplied with a suitable cover and gasket, is readily adapted for outdoor operation. The main difficulty, however, in designing high-voltage transformers for outdoor use, is encountered in bringing the leads out of the tank. In transformers below 17,500 volts this is easily accomplished by bringing them out through porcelain bushings set in, or underneath, the rim around the top of the tank.

For potentials above 17,500 volts, this method is unsafe, so the leads are brought straight out through openings in the cover, and protected from the weather by a porcelain covering, built up of several petticoats. In water-cooled transformers, the heat generated by the losses in the transformer is artificially extracted from the oil by circulating cold water through a seamless coil of pipe placed in the upper part of the tank and submerged in oil. The expensive corrugated tanks for radiating the heat are, therefore, unnecessary, as a plain steel plate tank is provided. Transformers in these tanks are suitable for outdoor operation when equipped with porcelain petticoat leads brought out through metal bushing holders. Transformers having a capacity greater than 500 kva. are built of the shell type, that is, the core surrounds the windings, which is in direct contrast to the core type, where the windings surround the core.

Self-cooled shell type transformers are not built in capacities much above 3000 kva., because of the large and expensive tank construction necessary to obtain radiating surface. The extra radiating surface necessary for self-cooled transformers above 750 kva. is obtained by compounding the corrugations, that is, two plain corrugated sheets are welded together to form one large corrugation. This tank has about 65% more radiating surface than the plain corrugated tank. Another type of tank for large capacity self-cooled transformers is known as the 'tubular' or 'pipe' tank. This consists of a boiler plate tank having the ends of a double row of vertical steel tubes welded into it at the top and bottom, this providing a natural circulation for the hot oil from the top to the bottom of the tank through these external pipes, where the heat is quickly dissipated. These tanks are very efficient.

The majority of transformers above 1000 or 1500 kva. are water-cooled. The tanks for water-cooled transformers are made from heavy boiler plate, being round for single-phase transformers, and elliptical for three-phase units. They are perfectly plain and smooth, having no corrugations or pipes, which are unnecessary in this type of transformer. All these various tanks are designed for outdoor use when furnished with a suitable cover, gasket, and leads. Three large water-cooled transformers, 2750 kva. each, have recently been designed for outdoor operation on a 110,000-volt circuit. These are in successful operation at the present time. Some 1000 kva. self-cooled transformers, in tubular tanks, are also in successful operation cut down on a 110,000-volt circuit.

At the annual meeting of the Manufacturers' Bureau of Indiana, Melville W. Mix was unanimously reëlected president for the fourth time. Mr. Mix is president of the Dodge Manufacturing Co., extensive manufacturers of power-transmission machinery, Mishawaka, Indiana, and well known in the industrial world. The Manufacturers' Bureau includes several hundred Indiana manufacturers.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Courtenay De Kalb. C. W. Purington.
J. R. Finlay. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

PUMPING coal sounds anomalous, but Mr. R. G. Hall tells on another page how he applied centrifugal pumps to moving fine coal into and out of water storage. His success goes a long way toward solving the problem of storage of fine coal; a problem that is severe in the Middle West and again on the Pacific Coast.

CONCENTRATION is but a form of sorting in which machinery and water are substituted for the trained eye and hand of the worker. It is natural that each should have its field of maximum efficiency, and just where to draw the line is often a real problem. Mr. R. S. Handy tells this week how a decision was reached at one plant, and the method is applicable elsewhere. Written for our readers, Mr. Handy's paper was one of the interesting series read before the recent meeting of the Spokane local section of the American Institute of Mining Engineers.

ONE blast-furnace of a group of three built by the Penhsihu Colliery & Mining Company, in southeastern Manchuria, was recently blown in. The company was formed several years ago with joint Japanese and Chinese capital, to work promising coal and iron mines a short distance southeast of Mukden, and the coal mines have been in successful operation for some time. Iron ore of high quality has been developed in considerable supply, and it is planned to make an annual output of 120,000 tons of pig. The work is of especial interest since it is the first of the kind to be started by private enterprise throughout the whole of China.

DYNAMITE is a good servant, but demands careful treatment. Destruction of the steamer loading at Baltimore, of Nobel's works at Glasgow, and of the storehouse of the Utah Copper Company at Bingham, all within a week, focuses attention on one danger ever present in our industries. In all these cases there is no reason to believe the destruction was malicious. In that of dredge No. 1 of the Yukon Gold Company, blown up February 24, while the motive is obscure, the explosion can hardly be accepted as accidental. Officers of the company are entirely unable to account for the motives back of the act. There had been no labor troubles or other disagreements that might offer an incentive, and the company is not unpopular locally. Canadian officials are active in the search for the perpetrators of the crime and their efficiency is so well known as to lead to every expectation that the dynamiter will be arrested and punished. We often wish

detection was as certain on our side of the boundary. We are glad to know that relatively little damage resulted from the explosion and that No. 1 will be ready for operations this spring with the rest of the fleet.

SISKIYOU county lies on the northern border of California. It is as large as a number of European states, and much of it is unsettled. Roughly, one-third lies in the National Forests, another third belongs to the railroad and is not open to prospectors, and only the remaining third is private or public land open to use without restriction. The county has been fortunate in its settlers and has an unique record in several particulars. For example, it not only has no debt, a sufficiently unusual detail to excite comment, but has a surplus in its treasury. Incidentally, the area is one of rich gold veins and important copper deposits are being developed. The county levies a tax, which yields about $7500 per year, to create a fund for purchase and display of the best specimens of gold and other minerals found in its mines, and in this way it is endeavoring to attract additional citizens by presenting concrete evidence of the wealth to be won. This work is in the hands of a citizens' committee consisting of Messrs. C. L. Proebstal, R. E. DeWitt, L. A. Lash, and Fred Wadsworth, and it is producing results. One who has enjoyed camping in the mountains and valleys of Siskiyou can wish no emigrant a kindlier fate than that he find a home among them.

Mining Bills at Sacramento

Mining men in California should study the bills relating to the industry now before the legislature at Sacramento. The Mines and Mining Committee of the Assembly will hold a public hearing Monday afternoon, March 17, to consider the Finnegan bill for a mine inspection service. This is one of three directed to the same end, that has been introduced. The Birdsall bill, Senate 254, proposes to abolish the State Mining Bureau and substitute a mine inspection service. Aside from any question as to the wisdom of this policy, it is poorly drawn, contains numerous mischievous provisions and should be defeated. The Campbell bill, Senate 930, is much better, and, in our judgment, the best of the three. We are already on record as favoring the passage of a mine inspection law. We believe that a competent inspector would prove a useful adjunct to mining in the state, and that the operators make a mistake in offering no constructive criticism to the bills that come up from year to year. In outline, the Campbell bill is excellent, and it could well be made the basis of a highly useful law. In numerous other bills there are proposals of vital interest to miners. The Stuckenbruck Assembly bill 461, proposes to extend to mining companies the right to condemn and purchase land for storage of tailing; the Caminetti Senate bill No. 1607, requires telephone systems in mines; the Campbell Senate bill No. 931 and several others, provides for an eight-hour day in mines, mills, and smelters; the Finnegan Assembly bill No. 1306, provides for a water spray with all machine drills, and otherwise regulates ventilation; the Stuckenbruck Assembly bill No. 703, proposes a poorly chosen board to regulate smelter-fume matters, and numerous other proposals for legislation have been made. A little would be useful, but most of it may fairly be classed as freak legislation.

'Blue Sky' Legislation and Investors

That a fool and his money are soon parted is a truism discovered many years ago. It is also one likely to be received as axiomatic for many generations to come. It is too much to hope that society can protect from financial loss those who are incompetent or too lazy to use ordinary precautions to protect themselves. It is distinctly worth while, however, to throw every safeguard around the savings of the average man. It is to these accumulations from the many that industry must look for capital for expansion. The very rich, of whom so much is written, are usually rich less in what they actually own than in the funds they control. The case of Edwin Hawley is to the point. The dominator of numerous important railways, hailed at one time as the probable successor of E. H. Harriman, and at the time of his death engaged in building up an independent railway system that would have extended from Newport News to Minneapolis, his estate was only about five million dollars. The great railway and industrial enterprises of the world are today supported by the savings of wage-earners and professional men, and the most serious sign of the times, industrially, is the growing disposition of the average man to spend rather than to save. If business is to expand in any country, there must be a stream of investment running counter to the outflow of money in wages and salaries. Lately the tendency has been strong both in the United States and Europe, for each to spend his surplus in luxury and pleasure rather than to return it to industry with a view to increasing his margin of safety. We believe this to be due to widespread belief that the old machinery for investment of savings did not yield a fair return to the one who did the saving. The decreased purchasing power of money at once increased the difficulty of saving, and lessened the return that could be expected from reinvestment. At the same time the growth in the very large fortunes decreased the apparent value of a modest competence. Many a man of family has reasoned that even if he should save as much as $100,000, his standing and position in the community would be little improved, the safe income he could leave his family would be but $5000, and therefore why not travel, buy an automobile, and give his family pleasure while he might? The individual instance is unimportant, but the cumulative effect of this reasoning is enormous.

In the past wage-earners and salaried employees have put their money into savings banks, insurance, building and loan companies, and land. The last is becoming too expensive for all men to buy, and, first in the cities, we are becoming a nation of tenants. Building and loan associations, being occasionally dishonestly and often poorly managed, have lost favor. One or two notorious failures contrib-

uted greatly to nearly killing what once seemed likely to be a most helpful form of coöperative saving and investment. The insurance scandals, followed by later investigations of stock exchanges and banks, have done much to discredit the older forms of investment with the wage-earner. It was made abundantly clear that the course of money from the savings bank or insurance company back to the channels of trade, while it gave unquestioned security, was one which clipped the profits of the man whose money, in the end, was invested. The mechanism of trade and industry being exposed to view, has caused the average man to feel, justly or unjustly, that others have had the major profit from the sacrifice he made in saving. As a result of all this, the tendency to cut across lots, a disposition always strong in Americans, has been greatly strengthened. Money for new enterprises is now largely found by sale of bonds, and these are 'peddled out' rather than disposed of through stock exchanges. Speaking in general terms, the latter have been abandoned to professional speculators, to their own great disgust.

No country can afford to cease reinvesting. Increasing population demands increased facilities for trade and commerce. New wants demand new factories, and growing trade demands more abundant and better means of transportation. Magnificent as has been the development of railroads in the United States, it is well recognized that any quick or large expansion of industry would find the country as unprepared as in 1905, when freight blockades and car shortage became national calamities. The very life of the nation demands the keeping clear of the channels for reinvestment. It is this, we believe, rather than any sentimental desire to upset the natural law regarding foolish ones and hoarded gold, that gives importance to the demand for 'blue sky' legislation. A largely new, and fairly satisfactory, method of reinvestment has been found in this sale of stocks and bonds direct to the people; it is of first importance that such securities represent something more than the promoter's cheerful optimism typified by the blue of the sky, and that the newfound confidence of the investor be not abused.

Kansas, which has often led in social legislation, has enacted a law requiring in effect that, prior to sale within its borders of any stocks or bonds, the selling agency must have a certificate from the State Bank Commissioner. To obtain such certificate, it was necessary to make a complete and frank statement as to the resources of the company concerned, and the Commissioner was empowered to refuse the right to sell unless he was convinced that there was a reasonable hope of success of the enterprise. Such a measure is clearly one that may be of great benefit or great harm, and, while the principle of enforced publicity is one that we fully endorse, it is certainly a serious matter when it is proposed to enact the Kansas statute practically without change and after only briefest trial, in twenty-nine other states. This is not making profitable use of experience. Incidentally, it does not seem to be generally known that the Kansas commissioner, who seems to have enforced the law with admirable judgment, has himself recommended its extensive amendment to clear the way for the legitimate work of established dealers in investment securities. Other states do well to profit by Kansas' experience, but they should be careful to get full profit.

The need for 'blue sky' legislation lies in the greed and incapacity of a common class of promoters, and in the limitations of the common legal basis for recovery of damages from purchase of 'fake' stocks. Speaking in broad terms, in order to make such recovery it is necessary to show: (1) that false statements were made; (2) that such statements were known to be false by the one making them; (3) that they were believed by the purchaser; (4) that he acted upon that belief to his detriment. When to these requirements is added the difficulties inherent in the matter of responsibility of agents, and the technicalities of court procedure, it will be clear that the average small investor has no practical redress when he is induced to buy a worthless security. To preserve his confidence and to preserve this all-important habit of reinvestment, the field for the hopelessly crooked or hopelessly visionary seller of misnamed 'securities' must be restricted. In the method of doing it, however, lies danger. An opinion not based upon investigation is valueless, and if any state officer is to pass a valuable opinion upon all securities offered for sale, he must have large funds for investigation. Also, anything savoring of state endorsement of an enterprise is a sure road to disaster. We believe that full and complete publicity, with adequate records made easily and cheaply available to any intending investor, reinforced by some suitable means of enforcing penalties for misrepresentation, afford an adequate means of meeting the situation. The large majority of new enterprises fail because they are ill advised, poorly managed, or overloaded with promoters' profits. Speaking especially of the 'cheap' mining stocks peddled about, they may in most cases be shown to be hopeless from a sound investment point of view by a plain analysis of a truthful statement of properties, rights, and promoters' shares. It does not seem improper to require such a truthful statement prior to allowing public sale of securities, and with such statement easily available and plainly set forth, it would not be hard to sift the good from the bad. Good management can only be secured by active participation in an enterprise by competent stockholders and directors. The state can not assure this. Perhaps it can not altogether prevent the use of loaded dice, but it should be possible to furnish X-ray photographs that would show the skeleton of any business organization, and it is proper to impose severe penalties on the making of false statements in connection with any such public record as here contemplated, and to refuse permission to sell, to any who can not give a simple clear statement of assets, liabilities, and participation. What constitutes simplicity and clearness in such a statement may be left to the discretion of an executive officer. He will make mistakes and there will be injustice and possibly graft, but in the end relative rather than absolute justice in this as in other things is all that we may hope to attain.

Storage of Coal Under Water

By R. G. Hall

The frequent and prolonged strikes and suspensions of operations in the central coalfields have presented to the industries dependent thereon very serious problems. Not only has the cost of factory operation been materially increased during these times of suspension, but for those industries where the cost of fuel is a considerable item, as in the zinc smelting industry, the whole margin of profit is likely to be entirely wiped out. Those who use the larger sizes of coal have partly solved the problem by storing the required amounts of fuel in piles. By this method, however, the depreciation in quality of the coal, as well as the rehandling and carrying charges, have been so serious as to make the ultimate cost of the coal, based on the heat units recovered, a very heavy charge. Besides, the storage of screenings finer than 1¼-in. in piles exposed to the weather is practically impossible, as the smaller sizes of coal in this field suffer heavy depreciation in quality, and unless carried in very low piles, or protected in some manner will almost surely fire spontaneously. It has long been known, however, that the depreciation of coal when stored under water is slight, and the problem for those burning screenings has been met in this way by a number of concerns in Illinois and elsewhere.

While acting for a zinc smelting concern operating in Illinois, burning several hundred tons of screenings daily, I was obliged to give close study to this problem, and a solution was finally worked out which has now been in practical operation for a number of years.

Providing a Pit

The construction of a pit capable of containing up to one hundred thousand tons of coal, as well as the water necessary to submerge the same fully, was a problem which at first indicated a capital expenditure out of all proportion to the advantages to be gained. In addition to this the cost of unloading the coal from cars into the pit, and its recovery therefrom, together with the necessary switching of the cars, figured up to a total altogether too high considering the small margins available in the zinc smelting business. Much studying and experimenting, however, gave a solution which for capital expenditure and operating cost would seem to be favorable, when the tonnages handled are considered.

A pit of approximately the required capacity was found at an abandoned brick yard in the outskirts of town. This pit was irregularly elliptical in shape, about 450 ft. long and 250 broad, while the depth was 45 ft. On account of the drainage conditions of the surroundings the pit is always filled with water within about five feet of the top. The banks below this level, that is below the loam, consist of comparatively hard shale. Hence the sides, which are quite steep, and the bottom, are ideal for reservoir purposes. It was at first considered that it would be desirable to cover these sides and bottom with a skin of concrete, but thorough examination after pumping out the water convinced me that the cheapest, and probably the best, bottom at that time was coal screenings, which at that season cost about 45c. per ton delivered at the pit. Accordingly no other bottom was put in, and the results have amply justified the experiment.

Pumping Coal

Owing to the tonnages to be handled, and the small margin allowable, it was absolutely necessary that the labor and power costs should be low. Experiments showed conclusively that the coal could be handled entirely by water through centrifugal pumps, but it was some time before the proper type of pump was secured. Working in conjunction with the engineer for the builder, I was at last able to design a pump which would handle the maximum quantity of coal with the minimum of water. The pump is not necessarily the most economical of power for the material and distance handled, but during the handling of 50,000 tons of coal, and although at times it has carried material as much as 50% solids, and will maintain an average of at least 30%, it only choked once. That was brought about deliberately in testing.

The plant is equipped with a railroad track along the longest side, with a total capacity of 30 cars. At the point where the railroad comes closest to the side of the pond the track is carried on a low trestle over an unloading chute. This chute is sufficiently wide to accommodate one coal car, and only so much below the trestle as to allow about one foot clearance under the track stringers. The bottom slopes toward the pond about 10%, and the outlet into the pond is constricted to about 4 ft. wide. At the side remote from the pond (the high end of the chute) is a 10-in. pipe having 6 holes of 4 in. each, cut in the side. This pipe is attached to a common 10-in. centrifugal pump delivering about 3500 gal. per minute. The suction of this pump is back in the pond, properly protected from an influx of coal. The cars used are of the standard Chicago & Alton drop-bottom type. These cars drop their loads in four sections, two on each side. Two men operate the plant, as the pumps run without attention from them. The plant is equipped with a heavy car-puller capable of moving 10 or more loaded cars.

Method of Unloading

When the loaded car is placed on the trestle the men open the drops, section by section, which takes about two minutes. This throws about 90% of the whole car load into the chute. This causes the water to back up in the chute until the accumulation is sufficient to move the whole mass of material. On account of the narrowing of the mouth of the chute, the velocity attained is at times sufficient to carry the greater portion of the material at least half way out into the pond. When the bulk of the material has moved out, the operators then close a valve

CARS OF COAL ARE DUMPED THROUGH THE TRESTLE SHOWN IN THE UPPER PICTURE AND FLUSHED INTO THE POND, BEING DISTRIBUTED TO ANY POINT BY MEANS OF THE DELIVERY PIPE SHOWN IN THE MIDDLE, AND LOADED OUT BY MEANS OF THE ELEVATOR SHOWN IN THE LOWER PICTURE.

in the pipe to the chute, and this throws the whole stream directly into the car itself. A few moments of the stream properly directed into the sides and ends is sufficient to clear the car absolutely, and the next car is placed. The whole operation, from the time one car is ready to unload until the next is ready, averages 10 minutes. The actual operation requires much less, but delays are frequent, owing to bad order drops on the cars. The actual unloading capacity of the plant is limited by the trackage and the ability to get the cars switched often enough. Owing to the limitations of space, only about 15 cars can be handled without re-switching. As it is possible to get service twice daily, there is no difficulty in unloading 30 cars, or 1500 tons, in a day. This is done at a labor cost of $4 and a power cost of $10 to $20. When the coal around the mouth of the chute accumulates so that its removal becomes necessary, it its thrown out to the remoter parts of the pond by means of the coal pump itself. These two pumps are operated by electric motors, supplied with current from the local utility company. As the power demand is intermittent, the price charged for the actual consumption is high, averaging about 5c. per kilowatt-hour.

Re-loading the Coal

Adjacent to the unloading chute is the re-loading machinery. The part on the bank consists simply of a hopper excavated and lined with plank; in the hopper is placed the boot of the re-loading elevator; the sides of the hopper slope directly into the elevator. The arrangement is such that the coal and water are pumped directly into the elevator boot, and the water is forced to travel slowly around the hopper before finding its way back into the pond. The elevator consists of long-pitch steel chain, provided with continuous buckets especially designed for this work. At the present speed it has a capacity of 5 tons per minute, but will admit of a large increase over this capacity.

The coal pump is placed on a barge 15 by 40 ft., and is belted to a 50-hp. motor. This motor has been found to be unnecessarily large. Both the suction and discharge pipes are light spiral-riveted. As this material is so much lighter to handle, the shortness of life will be more than compensated by the ease of operation. The discharge pipe is carried on pontoons made from common oil barrels, which have proved to be both cheap and convenient. One operator on the barge is sufficient, and he finds no difficulty in moving around as the ground is worked out. For the most part, when the pump is drawing from the bottom of the pond and in a good stock of coal, the material will be drawn from a long distance, so that as much as 50 cars of coal will be loaded without a new setting of the barge. As the stock gets low, more frequent moves become necessary.

Settling Is Simple

Contrary to my own expectations, it proved to be a simple matter to settle the coal from the water. I had supposed that an elaborate settling system would be necessary, but the hopper proved ample for the purpose. It is true that the finer dust is washed away, but for the purpose for which this coal is used the dust is of doubtful value.

Tests of the coal for depreciation showed no appreciable change in heating value from freshly mined coal. Laboratory tests indicate a slight appreciation, which I believe to be due to the disintegration and to a large extent the removal of the fire clay as well as the dust of the coal; but this slight increase in heat units (if such really exists) is more than made up by the shrinkage in weight.

With reference to the total costs of the operation, it appears that the money to be made by the storage of the coal for market purposes is small. This project, however, was undertaken as an insurance measure, to guard against strikes, and to provide some means of equalizing the prices of coal at different seasons in the local Illinois field. As such it has been an unqualified success. The cost of equipment of such a pit of approximately 80,000 to 100,000 tons, is about $10,000, exclusive of the pit itself. In this case the pond and sufficient ground for tracks cost $5000. Conditions permitting this low cost were peculiar, and probably could not again be duplicated.

Cost of Storage

The cost of Illinois screenings during the time at which they are most plentiful averages about 55c. per ton, and our experience is that the shrinkage of total tonnage during the two operations of switching in, unloading, reloading, and switching out again will be about 10%. The switching or stoppage charge in this case is $3 per car. Taking into account all charges against the coal, the final costs may be stated as follows:

	Per ton.
Cost of coal	$0.550
Interest and amortization on plant	0.020
Labor cost	0.015
Power cost	0.035
Supplies, maintenance, and insurance	0.015
Interest on cost of coal	0.025
Depreciation of coal	0.055
Switching or stoppage charge	0.060
Total cost of coal	$0.775

This takes no account of watchman's services, which under proper conditions would not be necessary, and also assumes that the coal remains in the pit only during one season.

It is to be noted that this method of handling is based entirely on the use of screenings. Experiments have shown, however, that with properly designed apparatus and machines, equally as good results may be obtained in the handling of material not coarser than 6-in. screen. Where it is necessary to use cars with tight bottoms, there has been worked out another method of unloading which costs no more for labor and power than above given, and has the advantage over dumping with cradle that the first cost and complications of plant are much less.

The Elmore vacuum plant at the Sulitjelma mine in Norway produced 856 tons of copper concentrate during January.

Dry v. Wet Crushing at Kalgoorlie

By M. W. von Bernewitz

According to the last annual report of the Hainault Gold Mine, Ltd., owing to change in the character of the ore being mined treatment by the stamp-mill and cyanide plant is now unsatisfactory, and a dry-crushing plant may be necessary if the mine develops satisfactorily. The time seems opportune to review the treatment problem at Kalgoorlie. It is with some diffidence that I do this, although after eight years' general observation one should be in a position to do so easily. There are so many points to study and compare that the discussion may easily be inconclusive. Having watched the treatment of the ores by the dry-crushing method most of this time, I may be accused of being biased in its favor; I have also studied the wet-crushing process, and the general remarks of those in charge have been forgotten.

In general, the ores are of a gray to greenish color, of a schistose structure, and they show an increase in hardness and silica content with depth. They contain pyrite and tellurides of gold and silver, but no minerals harmful to treatment. There is little free gold, it being mainly in the pyrite. The most important constituents have an average of SiO_2, 63%; Al_2O_3, 4%; $CaCO_3$, 12%; $MgCO_3$, 6%; FeO, 7%; and S, 3½ per cent.

First Attempts

When treatment of the Kalgoorlie sulphide ores was started, the ore was not understood, as nothing like it had been treated in Australia before. In 1899-1901 several large plants were erected, and, while results were low, yet they were the means of spurring metallurgists to further trials. Gradually the present satisfactory methods were evolved. In the dry process, the effect of roasting was not thoroughly understood, and the ore in the leaching vats had to be cut out by picks and bars. Then the analyses revealed the changes in lime and magnesia during roasting. In the wet mills, losses through the gold in tellurides not being dissolved, and trouble through the pyrite not being properly saved, also upset results.

After the early failures in treatment, two schools of treatment grew up. The Associated, Associated Northern, Boulder, Kalgurli, Perseverance, and South Kalgurli now treat by dry crushing; the Hainault, Horse-Shoe, Ivanhoe, Lake View & Star, and Oroya Links by wet crushing. Machinery is as effective as can be, labor is well paid and intelligent, supplies of fuel and water are of the first order, economy is pushed into every department, and the plants are kept at work full time.

In the dry plants, if the roasting be good, there is little fear in subsequent operations, and there is only one product, and an easy one at that. It soon was found that tellurides were not soluble in ordinary cyanide solutions, but bromo-cyanide proved to be effective. It is used in wet mills where either concentrate, sand, and slime, or concentrate and all slime is produced. This necessitates three or at least two subsequent processes, and close supervision. Bromo is still used at the Horse-Shoe, Ivanhoe, and Lake View. The Oroya Links is not using it much now. Great care is necessary in its use, yet it has helped to materially increase the extraction in the wet mills.

Comparisons of Cost

The dry process is a trifle higher in cost than the wet process, but the residue from the former is lower than the latter. The comparison may be stated as follows: (1) dry process cost $2.50 plus the residue (average extraction 93% on $8.26 ore, equals 70c.) equals a total of $3.20 per ton; (2) wet process cost $2.24 plus residue (average extraction 88% on $6.84 ore, equals 69c.) equals a total of $3.20 per ton. These figures are the best obtainable, as all cost systems are not similar, and extractions are not always published. It is admitted generally that the dry work is superior to the wet. During the month of May last, the tonnage treated dry divided into the total yield gave the above average figure. In the same month, wet tonnage and output gave the average quoted.

On the one hand there is a residue from the dry plants which will not pay for re-treatment; but from the wet mills a residue of $1 or over can be re-treated by vacuum-filtration at a cost of 50c. per ton; and if the loss in treatment be 20c., the profit would be 30c., which is worth saving. A few of the dumps contain more than $1 per ton, but I speak of results of present practice. The Oroya Links published figures giving the value of its residue lately as 42c. Against the first cost plus residue of $3.20 in the wet mills, must be placed cost plus residue plus re-treatment in the wet process, or $3.20 plus 50c. equals $3.70 per ton. This shows an advantage of 50c. in favor of the dry process.

Dust Losses

Millmen maintain that a deal of gold is lost in dry crushing and roasting. From ball-mills and dust-houses about 0.5% of the ore may be lost, and in roasting in a modern furnace not more than the same amount. Dust losses are difficult and costly to determine, but estimating all dust to average in value with the original ore, one per cent of 2400 tons dry treatment daily of $8.26 ore equals 8c. per ton lost. Experiments have proved that there is no actual volatilization of the gold in roasting telluride ores. The average loss in weight in crushing and roasting ore at Kalgoorlie is 10%: made up of dust, 1%; moisture, 1%; sulphur, 2.5%; and CO_2 from carbonates, 5.5%. In roasting concentrate, the loss is only about 0.05%, and as this product averages some $50 per ton, the loss on 7000 tons treated monthly would be 3c., or 0.25c. per ton on 2730 tons treated wet daily.

The only amalgam in a dry plant is in the pans.

while in the other process amalgam is collected from boxes, plates, pans, in battery, and the concentrate plant. There is accordingly more supervision necessary in a wet mill, and risk of stealing is greater. The average loss of mercury is low.

Concentration has been carried to a fine point at Kalgoorlie, but none the less very fine mineral and telluride floats and mixes with the pulp going to leaching vats and slime plants. This fact is, to my mind, one of the reasons for difficulties in a wet plant on such ores, in spite of the use of bromocyanide.

Classifying in a dry plant consists only in separating the pulp for the pans, and any coarse discharge from the latter is returned for further grinding. In some stamp-mills, classification for tables, re-classification for tube-mills, and further classification for more tables, is necessary, and the system rapidly becomes complicated. It necessitates extensive systems of classifiers, launders, and return pumps.

The average cost of ball-milling is 50c., against say 42c. per ton for stamping. I think the former plant easier to look after than the latter. Both produce products that are equally well adapted to further treatment.

Efficiency of Roasting

This discussion would not be complete without mention of the general efficiency attained in roasting ore or concentrate. For capacity, fuel consumption, power, labor, and results, furnace work at Kalgoorlie cannot be beaten. As examples of roasting ore, the plants at the Associated, Perseverance, and Kalgurli may be mentioned, and of roasting concentrate at the Horse-Shoe.

One of the troubles at Kalgoorlie is the presence of graphite, which is found in the Associated, Associated Northern, Boulder, and Oroya mines. It does not seem to change during roasting, and causes a premature precipitation of the gold from cyanide solutions. Fortunately, the mineral does not come to the mills very often; but as to this effect, there is no doubt, and it is a nuisance hard to deal with. The Boulder is troubled with it more now than any of the other mines.

Introduction of Vacuum-Filters

Gradually the filter-press is being discarded in favor of vacuum-filters. In the past an immense sum has been spent on press plants, about 100 presses being erected, 80 of which are treating 100,000 tons monthly. The balance are out of commission, but the benefit derived from this machine at Kalgoorlie has been admittedly large. With a press washing can be carried to a degree that cannot be beaten, but the labor cost is high, and I expect that it will have to give way. The Associated Northern, Boulder, and Oroya Links filter their current mill slime by vacuum systems of their own, while others are talking about introducing the system. The lowest cost of treatment by filter-press is 24c. per ton, while 8c. should cover vacuum-filtration. Such a saving is important with ore yielding as low as $5.50 per ton.

The cheap price made for water, 36c. per 1000 gal., for sluicing away all mill residue, has simplified this work and done away with the further building of dusty dumps. Sluicing, on the whole, is cheaper than making dumps, and Kalgoorlie has much to be thankful for in connection with the great water scheme.

On the cost of erecting the two types of plants discussed, there is not much data on account of constant additions, improvements, and alterations. The Associated Northern plant, with capacity of 120 tons of sulphide ore daily, cost originally $180,000. For the same tonnage, a battery of 25 stamps would cost $125,000.

The margin between the dry and wet processes was large enough at one time, although extractions vary from 94 to 86%, respectively, and left no doubt as to which should be chosen. Now the stamp-mill work is improving slowly but surely, and the difference is small. For my part, I would build a dry-crushing and roasting plant to treat a similar ore.

Western Australian Gold Production

December returns from the leading mines are listed below:

Name.	Tonnage.	Value.	Profit.	Dividend.
Great Boulder	16,389	$248,300	$149,200	$328,100
Ivanhoe	17,266	158,400	52,800	.....
Kalgurli	10,120	102,400	45,600	.....
Yuanmi	10,260	91,200	38,800	70,000
Sons of Gwalia	13,496	107,200	22,500	81,300
Lake View & Star	14,834	94,400	18,000	60,000
Fenian	2,781	35,400	14,900	.....
Perseverance	17,171	101,300	13,800	.....
Victorious	7,000	34,500	11,500	.....
Associated	8,115	58,500	11,300	.....
Black Range	2,869	30,800	6,400	9,000
Mararoa	2,590	23,900	8,900	.....
Golden Ridge	2,894	24,600	8,600	23,200
Golden Horse-Shoe	22,892	154,600	8,500	.....
South Kalgurli	9,374	53,800	8,000	.....
Ingliston Con. Ext.	1,171	16,600	7,100	.....
Great Fingall Con.	5,652	55,000	5,700	.....
Sand Queen	941	21,100	7,500	7,500
Oroyo Links	9,820	51,200	4,400	71,800
Mountain Queen	2,682	19,300	2,700	.....
Lake View Con.	7,905	7,500	2,200	.....
Ida H.	1,324	14,300	1,700	.....
Commodore	1,050	6,900	1,400	.....
Menzies Con.	1,859	15,000	700	.....
Marvel Loch	1,300	9,000	100	.....
Burbanks Main Lode	1,824	21,300	600	12,700
Ingliston Extended	650	5,400	2,500	.....
Lady Miller	1,822	6,700	2,700	.....
Hainault	4,458	22,200	5,600	.....

Formosa, the island belonging to Japan, had in 1911, 9 gold, 1 gold and copper, 27 placer gold, 16 sulphur, and 270 coal mines; and 39 oil wells, the production being valued at, gold, $1,069,500; silver, $32,525; copper, $264,513; coal, $468,367; sulphur, $22,950; and oil, $3243. The industry employed 5047 workers, most of whom were engaged in coal-mining. Wages paid ranged from 51.5c. per day for male Japanese to 11c. for female Chinese laborers. The three productive gold mines are east of Keelung. The output of placer gold is decreasing fast. The coal from the Denryoku mine shows 54.28% fixed carbon by analysis.

Milling v. Hand Sorting of Lead Ore

By R. S. Handy

The following tests and data were compiled in April 1912, in order to demonstrate to the management of the Bunker Hill & Sullivan Mining & Concentrating Co. the inadvisability of hand sorting the mill feed, under the conditions obtaining at its plant at Kellogg, Idaho. It is to be understood that each condition of mining and milling requires its own consideration and treatment, so that nothing which follows is intended as a criticism of other plants. In order to make comparisons, the following arbitrary conditions have been assumed in this paper: Price of lead, 4½c. per pound; price of silver, 60c. per ounce; smelter contract, 90% of the lead at 90% of the price for lead, 95% of the silver at the price for silver, and freight and treatment $18 per dry ton. In order to present the conditions at the Bunker Hill plant, a brief description of the ore-crushing department of the West mill follows:

Crushing Department.—The ore is hauled from the mine by electric locomotives and dumped into a storage-bin of 1700 tons capacity, from which it is drawn through chutes into the 'rock-house' and handled as shown on the accompanying flow-sheet (Fig. 1). The coarsest pieces in the run of mine ore are about 12 in. diameter and the sizing of the whole is, roughly, 80% through and 20% on a 3-in. ring. From the storage bin the ore is conveyed over a grizzly with 1¼-in. intervals to two No. 5 bronze ball gyratory crushers and reduced to 2½-in. maximum diameter, and, with the undersize from the trommels is conveyed to three 30-mm. trommels. The undersize of the trommels is conveyed directly to the mill storage bins of 1400 tons capacity, as mill feed. The oversize is passed through 14 by 36-in. rolls, set to ¾ in., and returned to the trommels.

Capacity and Cost of Crushing.—About 1100 tons (24 hours feed for the West mill) are handled in 6½ hours, under ordinary conditions, at a cost of 2.87c. per ton, as follows:

	Per day of 8 hr.	
Labor:		
1 crusher-man	$3.50	
1 rollman	3.50	
1 conveyor-man	3.50	
2 laborers	6.00	
Repairs	1.50	Per ton, cents.
	$18.00	or 1.636
Supplies:		
Mullers		0.217
Concaves		0.080
Shafts		0.026
Gears, eccentrics, and rings		0.040
Oil and waste		0.050
Babbit metal and zinc		0.050
Roll shells and miscellaneous		0.230
Power		0.543
		2.872

As a basis for comparison, the accompanying flow-sheet (Fig. 2) is taken to represent a typical sorting plant in this district. In such a plant the run of mine ore is run over grizzlies of about 1½-in. intervals and the oversize crushed in jaw crushers to about 6-in. maximum diameter, and, with the undersize from the grizzlies, is screened on 1½-in. trommels. The oversize of the trommels is washed by a spray of water and fed to a wide picking belt, where the waste and first-class ore are sorted out by hand and

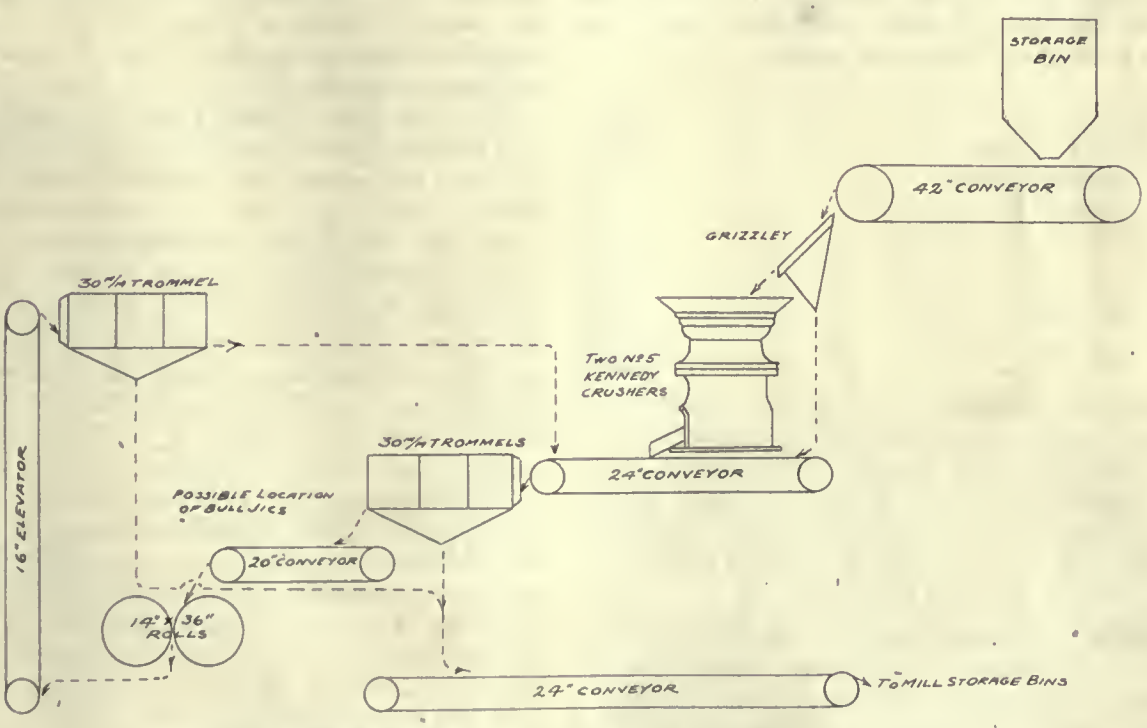


Fig. 1. Flow-sheet of 'rock-house,' Bunker Hill & Sullivan M. & C. Company.

the residue passed to the mill; or the milling ore and first-class are sorted out and the residue passed to the waste dump. The undersize of the trommels goes directly to the mill. Approximately the proportion of products are eliminated as indicated in Fig. 2 and are taken for comparison, but these figures will vary with the character and grade of the feed.

Costs of Sorting.—My observation of plants visited in this district leads me to the conclusion that each ore-sorter will pick over about 12 tons of material per shift, and that the cost per ton of ore passing over the picking belt, including the cost of crushing, conveying, and screening the whole tonnage, would not be less than 30 cents. Detailed costs per 24 hours in the plant illustrated would be:

Labor:	
24 pickers, at $3	$72.00
3 car-men, at $3.50	10.50
3 crusher-men, at $3.50	10.50
1 fireman, at $5	5.00
3 sluice-plant men, at $3.50	10.50
	$108.50
Power and supplies	10.00
Total	$118.50

Purpose of Sorting.—Hand sorting is employed in this district for one or both of two purposes, namely, to increase the mill capacity by eliminating waste and first-class ore; or to increase the mill efficiency by sorting out for shipment ore upon which the smelters will make, or rather return, a higher economic recovery than the mill does.

Sorting to Increase Capacity.—The Bunker Hill & Sullivan milling plants have ample capacity, but assuming that it were advisable to increase this capacity, would hand sorting be the cheapest and most efficient means of accomplishing this object? To determine this point several tests were made on the run of mine ore, as shown in the accompanying tables. Table 1 shows results of a test of a one-ton sample that was hand picked to undersize and oversize of a 3-in. ring. The oversize was hand sorted into first-class mill feed and tailing, the object being to select the highest-grade ore and lowest-grade tailing possible with this size. In table 2 is shown the record of a test in which a one-ton sample was crushed by hand to 4-in. maximum diameter and washed on a 30-mm. round hole screen. The oversize was sorted by hand into three products, as above. Table 3 shows the results from tests made with the oversize of the 30-mm. trommels in the present 'rock-house' operations, treated on a two-compartment Harz jig with 25½ by 33½-in. compartments, 150 r.p.m., 2½-in. stroke. The material was fed at the rate of 100 tons per 24 hours.

A study of these tables indicates that in table 1 there is not enough material eliminated to consider In table 2, 153 tons of material was eliminated on a basis of 1100 tons of feed, and a high-grade ore and a

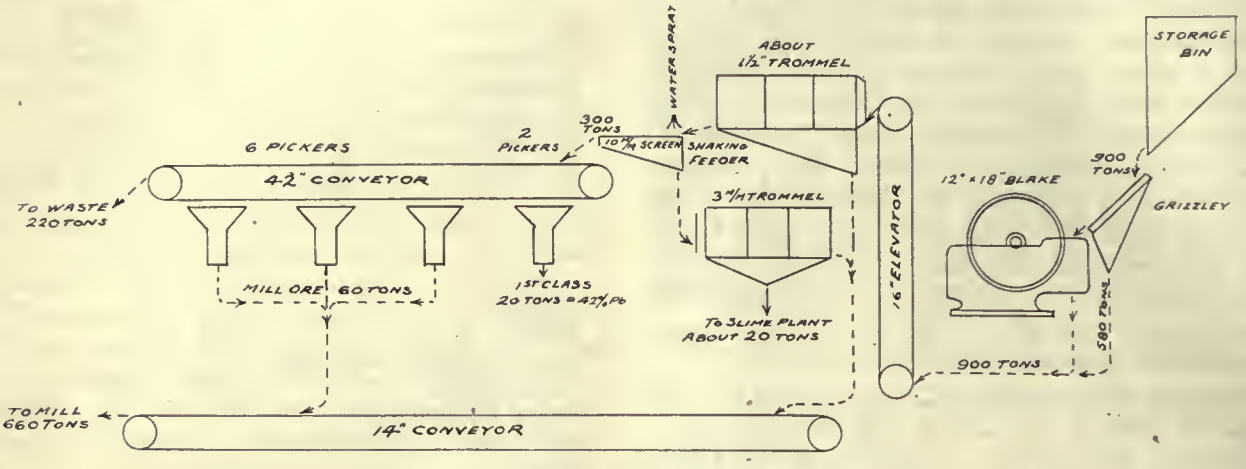


FIG. 2. FLOW-SHEET OF TYPICAL SORTING PLANT.

low-grade tailing were segregated. Considering this, at present, from a capacity standpoint, and assuming the costs of sorting as above, the cost per ton of added mill capacity would be 64½c. A jigging plant necessary to handle the 329 tons of oversize in table 3 in 6½ hours would consist of three two-compartment jigs with 36 by 48-in. compartments. These could be attended by one man and the added horse-power in a plant such as the 'rock-house' under consideration would not be over ten, so that the total cost of eliminating 44 tons of ore and 127 tons of tailing would not be over 3c. per ton of added capacity. Therefore, considering the question from a standpoint of mill capacity, it seems that the installation of bull jigs would be advisable. They could be installed below the discharge of the 30-mm. trommels without disturbing the equipment or operations.

In this connection it is interesting to note that the four jigs in the mill handling the material between 30 mm. and 15 mm. are treating 520 tons of feed per day and eliminating 320 tons of tailing assaying 0.4% Pb. They are also discharging 76 tons per day of concentrate averaging 53% Pb, and take only their proportion of the attention of the two jigmen who are attending 24 jigs.

Sorting for Economic Efficiency.—The proposal to sort for elimination from the mill feed of material that will bring higher returns by shipment to the smelters than it would from a milling operation involves several considerations, namely: (1) The losses in the mill operation on the material in question: (2) the points in the process where these losses occur: (3) the losses due to freight and treatment charges on barren material; (4) the effect that the elimination of sorted material would have on these losses.

In this connection, I have prepared three tables numbered 4, 5, and 6.

Table 4 shows the economic recovery (that is, the ratio of the full value of the feed to the net returns from the concentrates, at the prices and terms given at the beginning of the paper) from the sorting operations outlined in tables 1, 2, and 3, on a basis of 1100 tons of mill feed per day. Table 5 shows the economic recovery attained in the Bunker Hill & Sullivan West mill No. 2 on the various sizes of feed, based on 1100 tons per day of mill feed. The figures given on the jigs are only for the machines which receive original feed, and not those rehandling reground products. On the tables and vanners, however, the mixture of the original feed and re-ground material is considered, as they could not be separated. Table 6 shows results of a sizing test of the products from the gyratory crushers and rolls in the Bunker Hill & Sullivan rock-house.

Referring to table 4, A and B, it will be seen that the percentage of money recovered from the value of the material worked over is very small. It is only fair to state, however, that in actual sorting operations a much larger tonnage of concentrate (or first-class) of a lower grade, and a larger tonnage of tailing of a higher grade is eliminated than those shown in the table. In fact, I think that the conditions in C of table 4 approximate the results from actual sorting operations. It will be seen that in C, 34.6% of the value handled was recovered.

In table 5 it may be noted that in each of the operations outlined, with the exception of the vanners, there has been a greater percentage of money re-

Table No. 1
(On a basis of 1100 tons per day.)

Description.	Weight, in tons.	Per cent by weight.	Tons per day.	Assay. Pb	Assay. Ag	Contents. Lead, tons.	Contents. Ag, oz.
Total sample	1.000	100.0	1100	12.30	4.1	135.30	4510
Undersize 3-in. ring	0.812	81.2	893	11.45	3.8	102.25	3393
Oversize 3-in. ring to 12 in	0.188	18.8	207	15.95	5.7	33.01	1170
Analysis of oversize:							
First-class ore	0.008	0.8	9	62.10	25.6	5.59	230
Mill feed	0.145	14.5	159	17.20	6.0	27.35	954
Tailing	0.035	3.5	39	0.49	0.2	0.19	8

Table No. 2

Total sample	1.000	100.0	1100	9.30	3.2	102.30	3520
Underside 30 mm.	0.701	70.1	771	7.72	2.7	59.52	2081
Oversize 30 mm. to 4 in	0.299	29.9	329	13.04	4.4	42.90	1447
Analysis of oversize:							
First-class ore	0.012	1.2	13	57.50	20.1	7.47	261
Mill feed	0.160	16.0	176	19.62	6.8	34.53	1196
Tailing	0.127	12.7	140	0.54	0.2	0.75	28

Table No. 3
(On a basis of 329 tons per day.)

Oversize 30 mm. to 2½ in	0.721	100.0	329	7.35	2.6	24.18	855
Analysis of oversize:							
Concentrate	0.097	13.4	44	42.00	15.0	18.48	660
Middling	0.345	47.8	157	3.36	1.2	5.27	188
Tailing	0.279	38.8	127	1.00	0.3	1.27	38

Table No. 4

	Feed. Tons per day.	Assays: Pb, %.	Assays: Ag, oz.	Val. per ton.*	Tot. val.	Concentrates. Tons per day.	Assays: Pb, %.	Assays: Ag, oz.	Val. per ton.*	Total value.	Economic recovery.....	Assay of tailing, Pb %..
A—Oversize 3 in. in table 1	207	15.95	5.7	$17.77	$3678.00	9	62.1	25.6	$41.86	$376.74	10.2	0.49
B—Oversize 30 mm. in table 2	329	13.04	4.4	14.37	4727.70	13	57.5	20.1	35.37	459.81	9.7	0.54
C—Oversize 30 mm. in table 3	329	7.35	2.6	8.17	2687.90	44	42.0	15.0	21.17	931.48	34.6	1.00

Table No. 5

Jig feed, 15 mm. to 30 mm	520	10.68	3.7	11.83	6151.60	76	53.0	18.0	30.90	2348.40	38.2	0.40
Jig feed, 7 mm. to 15 mm	180	10.44	3.6	11.55	2079.00	24	56.0	20.0	34.23	821.50	39.5	1.00
Jig feed, 3 mm. to 7 mm	100	8.03	2.8	8.90	890.00	16	58.0	20.0	35.68	570.80	64.1	0.90
Jig feed, 20 mesh to 3 mm	100	8.03	2.8	8.90	890.00	7	75.0	26.0	51.50	360.50	40.5	1.79
Table feed, 200 to 20 mesh	160	11.50	4.0	12.75	2040.00	28	68.0	25.0	45.82	1282.90	62.8	2.12
Vanner feed, under 200 mesh	180	9.49	3.3	10.52	1893.60	25	47.0	17.0	25.96	649.00	34.2	5.40

*Pb, $4.50; Ag, $0.60.

Table No. 6

Screen sizes.	Product from gyratory crushers, per cent.	Product from 14 by 36-in. rolls, per cent.
On 36 mm.	31.3	..
" 18 mm.	47.1	72.8
" 12 mm.	5.0	10.2
" 7 mm.	7.2	7.4
" 5 mm.	3.1	3.3
" 3 mm.	1.3	1.1
" 10 mesh	0.4	0.3
" 20 "	1.5	0.8
" 40 "	1.0	0.7
" 60 "	0.4	0.5
" 80 "	0.2	0.3
" 100 "	0.2	0.3
" 150 "	0.2	0.2
" 200 "	0.1	0.2
Through 200 "	0.6	2.0
	99.6	100.1

covered than under the most favorable conditions of hand sorting. In fact, it might be said that as long as the material remains crystalline, the finer it becomes, the greater the profit per unit value of feed is returned from concentrating it.

In consideration of the question as to whether the extra crushing necessary to reduce the oversize of the 30-mm. trommels to undersize of 30 mm. produces an appreciable amount of vanner feed, upon which a lower recovery is attained than from the sorting operation, table 6 is useful in showing that the minus 200-mesh material produced in the crushers and rolls is practically negligible.

Conclusions

1. The additional cost of crushing the oversize of 30 mm. through 30 mm. is hardly appreciable.

2. Jigging the undersize of 30 mm. is cheaper and more efficient as a means of eliminating tailing than is hand sorting or jigging the oversize.

3. Therefore, the mill capacity should be increased by adding to the regular mill equipment, if possible.

4. Where sorting of the oversize must be done, jigging is cheaper and as efficient as hand sorting.

5. Economic recovery from sorting the oversize is much lower than from crushing, sizing, and concentrating it.

Structural Materials in California

Development of structural materials of California has received but scant attention as compared with that of gold, oil, and copper, and is capable of great expansion. A great deal has been written about building material of this state, and an exhibit of such products has been permanently set up at the State Mining Bureau, San Francisco, under the supervision of W. W. Thayer, where those interested may see that it is no longer necessary to go out of the state of California for the best. In 1912, the value of structural materials produced was approximately $21,000,000, or about 20% of the total output of all minerals. Details of estimated production in 1912 of certain materials are as follows:

Asbestos	$ 3,000
Cement	10,500,000
Brick	2,750,000
Clay-pottery	275,000
Granite	400,000
Gypsum	125,000
Infusorial earth	25,000
Lime	450,000
Limestone	550,000
Magnesite	80,000
Marble	75,000
Sandstone	125,000

A Permanent Exhibit

In the Mining Bureau exhibit the floor in the hall at the entrance is laid with magnesite, in two colors, and blocked off to imitate 8 by 8-in. tile. This material was furnished and laid by the Chemolith Manufacturing Co., of Los Angeles. The main arch at entrance is constructed of architectural terra-cotta in colors, and was furnished and erected by Gladding-McBean Co., Steiger Terra Cotta & Pottery Works, N. Clark & Son, and Carnegie Brick & Pottery Co., all of San Francisco. A panel in this arch, designed by Domingo Mora, makes this particular portion of the exhibit an interesting one. The inside of this archway includes round columns and square pilasters with pediment constructed of white and red sandstone, furnished and erected by the Ione Sandstone Co., Sacramento. The second main archway at the entrance to the mineral museum consists of polished granite columns and pilasters with pediment, furnished and erected by the Raymond Granite Co., San Francisco, and the California Granite Co., Rocklin.

In the centre of the exhibit is a large fountain, which is electrically lighted, and will be in operation during the hours that the museum is open to the public. This fountain was designed and placed in this exhibit to illustrate the possibilities of California cement in this class of work. It was furnished by the Henry Cowell Lime & Cement Co., and the sculpture work was executed by O. S. Sarsi Co., both of San Francisco. The floor in the central portion of the exhibit around the fountain is laid with composition flooring to imitate tile, and was furnished and laid by the Carrelin Asbestos Flooring Co., San Francisco.

Marble Work

The marble tile floor that has been laid in the vestibule and marble panels in the floor of main exhibit room, also three marble panel sections of side walls, were furnished and erected by the Columbia Marble Co., San Francisco. Another section of marble panel work was furnished and erected by the Banning Marble Co., Los Angeles. This marble is quarried on Santa Cataline island. The marble work of panels over fireplaces, and wall panels on the west wall of the exhibit, was furnished and erected by the Warren Marble Co., San Francisco. The wainscoting on the north and south walls of the exhibit is constructed of ornamental and sand-lime brick, furnished and placed by the Golden Gate Brick Co., the Furlow Pressed Brick Co., and the Los Angeles Pressed Brick Co., Los Angeles; the Stockton Fire & Enamel Brick Co., Stockton; and the United Materials Co., San Francisco.

Two large open fireplaces have been erected in this exhibit: one constructed of 6 by 6-in. mat-glazed tile, with white tile fire-box, furnished and erected by the Pacific Tile & Terra Cotta Works, Los Angeles, and the other of 6 by 6-in. rough-glazed tile, furnished by Gladding-McBean Co., San Francisco.

The balustrade separating the main exhibit room from the hallway is constructed of sandstone, furnished and erected by the Colusa Sandstone Co., San Francisco. Two polished granite newel posts and two polished granite pilasters were furnished by the Academy Granite Co., Fresno. Polished granite pilasters were also furnished by the following firms: Placer Granite Co., Rocklin; North California Mining Co., Oroville; McGilvray Stone Co., San Francisco; Bly Bros. Stone Co., Los Angeles; Riverside Granite Co., Los Angeles; and A. O. Wickman, Rocklin.

Electric Power Installation at El Tigre

By James W. Malcolmson

*The Tigre Mining Company of Mexico, owned by the Lucky Tiger Combination Gold Mining Co., of Kansas City, decided early in 1910 to enlarge its mill, which consisted of a concentrator milling 3000 tons of ore per month. The enlarged plant was designed to crush and concentrate 6000 tons of ore per month and to cyanide 7500 tons monthly. The extra tonnage cyanided was to be obtained from tailing which was stored below the old mill. Power was supplied to the old mill from four boilers, a 150-hp. Corliss engine using producer gas made from charcoal. The total power required, including 60 hp. used for machine drills in the mine, was approximately 275. Cordwood cost $4.32 per cord, 8 by 4 by 3 ft. and charcoal $15 per ton. The fuel supply in the surrounding country was approaching exhaustion; over 150 mules and 90 men were engaged in cutting and transporting this fuel, and in the unsettled political conditions in Sonora were such that it would be practically impossible to keep an organization of this kind together. The price of fuel was steadily rising and at times it became almost impossible to get sufficient fuel to operate.

Power Estimates

It was estimated that the enlarged plant, together with the mine, would require 750 hp. as follows:

	Hp.
Old mill, which was left unchanged	180
New concentrator	90
Cyanide plant	380
Mine and other requirement	100
Total	750

In a study of the best manner to obtain power, the following alternative propositions were considered:

1. To continue using the local fuel supply and by building tramways and cheapening transportation generally, reaching a larger area of country. Power to be generated by means of wood-burning gas-producers and gas-engine plant.

2. To build a steam power plant at Yzahal, the nearest railroad point, 30 miles away, and transmit electric power to the mine, using Texas or California oil as fuel at $1.70 per barrel, on the assumption that the Mexican government would remove the import duties.

3. To build a dam on the Bavispe river, 10 miles from the mine and a hydro-electric plant and transmission line.

4. To erect a power plant at Douglas, Arizona, and transmit electric power 65 miles to the mine.

An investigation of the available timber showed that it consisted of 80% white pine and 20% scrub oak. The supply was limited, and much of the pine would be required during the next ten years for mine timbering and general construction work. It is estimated that 13,500 cords of wood, 8 by 4 by 3 ft. would be required, per annum, to produce 750 hp. in a well designed gas-engine plant as follows:

	White dry oak.	Dry pine.	Total.
Hp-hr. per year	1,600,000	4,800,000	6,400,000
Consumption per hp-hr., lb.	3.31	3.0	.....
Total lb. per year	5,280,000	14,400,000	19,680,000
Total cords per year	2,000	10,900	13,500

Estimating these 13,500 cords at $3.25 gold per cord, equals a total of $43,875 per annum. Adding coke used in the bottom of the producers, 1½% of the weight of the wood consumed, equal to 150 tons per annum at $20 per ton, equals per annum $3000, gives a total fuel cost of $46,875.

A Steam Plant

A well designed steam plant at Yzabal with electric power transmission to El Tigre, would consume 1½ lb. of Texas fuel oil per horse-power delivered to the motors. Taking 750 hp. for 356 days equals approximately:

6,400,000 hp-hr. at 1½ lb.	9,600,000 lb. oil
311 lb. oil per barrel equals	30,870 bbl. oil
$1.70 per bbl. at Yzabal gives total fuel cost per year in gold	$52,480
Excess cost over gas fuel at the mine	$5,605

This difference would be wiped out by an increase of $0.50 gold per cord in the cost of 13,500 cords per year. In fact, before the new power plant was in operation the price of cord wood had increased $1 per cord and the cost, under any circumstances, would have steadily risen. Even with wood at $3.25 per cord the estimated saving was more than offset by the greater expense for labor, repairs, and supplies with gas engines. In a plant of this size the expense of gas power would be nearly twice as much for repairs and supplies as for the corresponding items in a steam-power transmission plant. The cash expenditures per annum would be greater at El Tigre than with a steam-electric plant at Yzabal even if there were no increase in the cost of wood.

Gas-Engine Plant

Regarding first cost, it was estimated that gas-engine power would be unsatisfactory unless the plant had one spare engine to allow for periodical cleaning of each engine in turn. It was estimated that a suitable plant of gas-producers, gas-engines, and dynamos could be erected only at El Tigre, 30 miles from the railroad for $150,000 gold, taking the European cost of engines. Engines made in the United States would cost more.

The first cost of a suitable steam plant at Yzabal with electric power transmission to El Tigre was estimated at $213,400, including economizers, as below:

Power-plant at Yzabal erected complete	$133,000
Economizers (not considered essential)	17,000
Transmission line to El Tigre, 30 miles, 30,000 volts	30,000
Step-up and step-down transformers	14,000
Margin on a preliminary estimate, 10%	19,400
Total estimated cost	$213,400

The estimated cost per horse-power delivered per year using 750 hp. was $105.

*Read before the New York meeting of the A. I. M. E. and printed in *Western Engineering*.

Compared with power transmitted from a steam plant at Yzabal, gas-engine power at El Tigre would be less reliable and more troublesome, and the proposal to erect a local power plant at the mine was, therefore, definitely rejected. After an expert examination of a proposed dam on the Bavispe river, this was also abandoned. The river is usually 150 ft. wide and 2 ft. deep, but at times it is 200 ft. wide and 24 ft. deep. During very dry seasons the river is not over 6 in. deep. If a dam and power plant were built, involving enormous cost and many miles distant, a duplicate steam plant would also be necessary, and the total estimated cost proved to be out of all proportion, when compared with the other projects.

Power from Douglas

Before finally deciding to build the Yzabal, which is 45 miles south of Douglas, an investigation was made as to the possibility of securing power from that town. In Douglas, the power plant of the Copper Queen Consolidated Mining Co. develops approximately 8000 hp. for the requirements of its smelter. An arrangement was made whereby the Copper Queen company agreed to install steam turbo-generators in its plant and supply electric power to the Tigre Mining company. The installation was to be paid for by the Tigre company, and the power sold on a sliding scale varying with the amount taken and the cost of fuel oil in Douglas. In August 1912 this amounted to 0.96c. per kilowatt-hour at Douglas. The installation of an exhaust steam-turbine plant at Douglas presented several advantages, although the cost of the machinery, together with the 65-mile transmission line to the mine, was considerably in excess of the Yzabal project with a 30-mile transmission. The principal advantage, which led to a final decision to adopt the Douglas plan, was the cost of power.

Cost of Transmitted Power

Taking 750 hp., it was estimated that a plant at Yzabal would cost per year $79,000, or $105 per horse-power delivered at El Tigre per year. Power from Douglas delivered at the mine, it was estimated, would cost slightly over $70 per horse-power per year, or from $54,000 to $57,000 per year, depending on whether one or two turbines were required. In other words, the Douglas project showed a saving on cost of power of $25,000 per year, and it was decided in July 1910 to adopt the Douglas plan and build a line to the mine. In June 1911 power was delivered over the line to El Tigre, the revolution in Mexico causing some delay in prosecuting the work.

The plant at the works of the Copper Queen Consolidated Mining Co. at Douglas consists of two 750-kw. exhaust steam turbo-generators which will work with a 50% underload or overload without any very serious loss of efficiency. The Tigre Mining Co. received power at the buss bars at a tension of 2200 volts. This is stepped up to 44,000 volts by means of three General Electric transformers. At the mine the current is stepped down to 440 volts and distributed to the various circuits in the plant.

The transmission is unusual on account of the small quantity of power being transmitted such a long distance. The current is 44,000-volt, 60-cycle, 3-phase, transmitted over a single line of wooden poles carrying 3 conductors of No. 4 B. & S. gauge, medium, hard drawn copper wire with telephone wires below. The poles are 200 ft. apart; at the crossing of the Bavispe river the span is 1600 ft. The cost of the line from the low-tension side of its step-up transformer station at Douglas to the low-tension side of its step-down transformer station at El Tigre was $161,121. Not including the transformer stations at each end, their cost was very closely equal to $2000 per mile. The line, including the transformer stations, was built by Sanderson & Porter, of New York. The total cost of the exhaust steam turbo-generator plant, including the steam piping, etc., was $71,894, the machinery being placed by the Copper Queen Consolidated Mining Co. During the past year 6000 tons of ore has been concentrated monthly and 7500 tons cyanided at the Tigre mill; an average of 616 hp. is distributed at the El Tigre switchboard. The delivered cost is $86 per horse-power per year; the cost at Douglas being 0.95c. per kilowatt-hour.

Ladder Ways

Coincident with the so-called 'Red Cross craze' on the Lake Superior iron ranges, by which the miners are learning first aid to the injured and rescue work, there is a strong movement to lessen accidents by safeguarding all dangerous places. It is pointed out in Minnesota that 10% of all the industrial accidents in the state are due to falls. Under this head the ladder-road in shafts and raises is a fruitful source of falls in underground mining. The Oliver Iron Mining Co. has accomplished a great deal in the safeguarding of ladders. The following are the newer regulations.

The opening of the ladder way on surface shall be protected by a closed door to prevent stumbling into the hole. The ladders shall extend four feet above the door so that one may get on them without crawling into the hole to do so. All ladders shall be at least four inches from the side of the shaft, to allow a good hand and foot hold. The landings are normally twelve feet apart, though under exceptional conditions they may run from 10 to 25 feet. The man-hole from a landing to the ladder below is always directly beneath the ladder which is placed at an angle across the hole, so that it forms an absolute protection against falling more than the length of one ladder. The significance of this system may only be appreciated by one who has stood by a ladder road and heard some agile young miner shoot down, his feet glancing from rung to rung with a sound on the steel like a steady rat-a-tat on a hollow tree.

The Briseis Tin & General Mining Co. is best known for its connection with tin mining in Tasmania, but it also owns the Wallace gold placers in Victoria. From the latter $13,500 was won by working 115,600 cu. yd. last November. The same month the company produced 45 tons of black tin from its Tasmanian properties.

New Method of Zinc Precipitation

JOHANNESBURG CORRESPONDENCE

In a paper just read by John S. MacArthur before the Chemical and Metallurgical Society of South Africa, the use of zinc wafers in preference to any other form for precipitation purposes was recommended. It was pointed out that all attempts to displace zinc by the use of charcoal or electricity had failed, and as an effective chemical agent, filiform zinc had shown itself hard to beat, although C. W. Merrill had successfully introduced the use of zinc dust.

Physical Structure Important

Probably the high chemical activity of the zinc thread had much to do with its success, for if it is examined under a lens it will be seen that while one side is polished by the cutting tool, the other side has a velvety pile exposing a large surface to the auriferous solution, which accounts for the prompt responsive action of this form of zinc. The velvety pile seems to encourage the liberation of free hydrogen accompanying the precipitation of gold. The disadvantages of filiform zinc are due to its structure and mechanical considerations involved in its use and in dealing with the bullion precipitate. Then again, zinc thread is weak and its fibrous structure is destroyed by the cutting tool, the velvety surface being only an indication of the thread having been strained beyond the breaking point of the original fibre. The solution soon penetrates the pile of velvet, and the spongy zinc thread collapses into a dirty mush before its full chemical work is accomplished. Thus it is that bullion precipitates generally contain at least 50% of disintegrated zinc needing elaborate methods of refining, which, being complicated by the dusty nature of the precipitate, call for stringent precautions against loss. There is another disadvantage attached to the use of zinc shaving, and that is the difficulty of packing it with perfect regularity, some parts being tight and others comparatively loose, resulting in the solution selecting the easiest path where the possibilities of contact and precipitation are least. This is contrary to what we wish, as it results in only a small proportion of the solution passing through the tight part where the possibilities are, of course, greatest for the consumption of zinc chemically, and the disintegration is just about the same, whether the precipitation is active or sluggish.

Zinc Cut Into Wafers

Mr. MacArthur had aimed to overcome these drawbacks by using zinc sheet cut into wafers of convenient size, one to two inches long by one-quarter to one-half inch wide. Oblong wafers pack better and are more conveniently handled than when square. The wafers are made by cutting ordinary sheet zinc of a convenient gauge, say No. 11, into 1½-in. strips in a bookbinder's guillotine and then cutting these strips crosswise so as to produce wafers approximately 1½ in. long by ¼ in. wide. When these wafers fall into the cell of the zinc box they arrange themselves irregularly, more or less overlapping in slate fashion. The corners of each wafer are somewhat distorted by the guillotine, which prevents any sticking, providing at the same time channels for the uniform passage of the auriferous cyanide solution, ensuring an equal opportunity of precipitation in all parts of the mass.

The resistance to the flow of the solution is much greater with wafers than with filiform zinc, making it necessary for the extractor boxes to have at least twice the usual fall, while the cells and the boxes may be made with only half the usual depth. This method of precipitation was introduced at the Caveira mine in Portugal, in 1907, where the ore contains about 2.5 gm. of gold and 120 gm. of silver per ton. With coarse-crushing the average extraction is about 80% of the gold and 75% of the silver. The cyanide plant was equipped with the usual clean-up plant, but as the bullion precipitate only contained 3% of zinc and 12% of other foreign matter it was found that no acid treatment was necessary. Careful observations show that in use the zinc wafers become thinner and thinner until at the end of three weeks or so they disappear altogether without the structural strength being impaired or leaving distinguishable débris. This new method of treatment has proved itself economical in the consumption of zinc, has greatly simplified the clean-up, and thus saved time and temper.

Experiments at Caveira

The use of this kind of zinc has been described by Messrs. Lloyd and Rand in connection with a rotary extractor, in 1909. The operations at the Caveira mine some two years earlier showed that a revolving extractor-box was unnecessary in using zinc wafers, and as the method has been tried both in Italy and Mexico with equally good results, its success is now proved. It may be said that at the Caveira mine in Portugal the precipitation is facilitated by the presence of a large amount of silver with the gold, but in Italy the mine produces only a low-grade gold ore without silver, and as the wafers do their work well there also, it may be assumed that they will answer anywhere. The cost of installing the guillotine, the only special appliance needed, is only £10 or so, a much less sum than that required for a zinc turning lathe of equal capacity.

Broken Hill mines in 1912 produced the following:

	Tons.	Value.
Silver-lead concentrate	279,915	$13,000,000
Zinc concentrate	433,054	6,500,000
Silver-lead ore	29,605	430,000
Silver-lead slime	4,503	32,000
Total value		$19,962,000

Excepting in silver-lead slime, the products showed an increase over 1911, while the value for that year was $14,880,000. Dividends paid in 1912 totaled $8,600,000.

Charters Towers, Queensland, produced $2,094,400 from 136,430 tons of ore in 1912. Dividends amounted to $175,200, and assessments $172,800.

Hydraulic Mining in British Columbia

The most important mining work done in Quesnel Division in 1912 was that of the Quesnelle Hydraulic Gold Mining Co., which commenced preliminary hydraulicking operations in August 1911, and after a run of nearly three months stopped work on November 7, cold weather having suddenly set in. No clean-up was made, so no gold recovery was reported for that year. The then newly completed water-supply system was found quite satisfactory. Water is brought from Swift river, a distance of 25 miles. Besides the long ditch-line, there are three inverted siphons. The flow of water has been as much as 60,000,000 gal. (about 4000 miners' inches) in 24 hours.

The wear of the diorite blocks or boulders with which the sluiceway was lined in 1911 having proved excessive, and maintenance cost proportionately high, before the 1912 hydraulicking season opened the sluice was paved with high-carbon steel rolled plates, containing from 0.80 to 1.20% carbon, and of dimensions of ½ in. thick and 58 in. square. At the end of that season it was ascertained that these high-carbon steel plates gave even greater efficiency than had been expected, both in regard to duty obtained and the absence of any appreciable amount of wear. From the rate of wear—or, rather, lack of it—the conclusion is that they will stand at least 20,000,000 cu. yd. of gravel being passed over them before they will be worn out. The season's experience with these plates was in striking contrast to that of the previous year with ordinary wooden blocks which lasted only a few days, while diorite boulders wore as much as 8 inches in three weeks. No trouble was experienced from sand packing under the plates, which so evenly distributed the gravel over the full width of the sluiceway that there was no tendency to wear in the centre of the plates, such as was experienced with steel rails. The plates may be used for gold saving by separating them for about 2 in. and allowing each succeeding plate to be lower in level, about ½ in., to avoid excessive impact of the boulders moving from one plate to another. This arrangement was found much superior to placing the plates end to end, which latter plan naturally would be used so as to provide a continuous smooth surface. As plates so nearly 5 ft. square provide for a riffle only every 5 ft., it is considered advantageous to place rails at the head of the sluice for such a length as to ensure the recovery of the gold. The rails used here were of rolled manganese steel, but it was seen that, although their wear was much superior to that of ordinary steel, their life will be only a small fraction of that of the plates, so their use cannot be recommended except for gold-saving purposes.

The cost of operating this season (including all actual mining expenses, but no interest or amortization charges) was stated to have been reduced to 2c. per cu. yd. of the material handled. This was just one-half of the previous season's cost, which great reduction was due almost entirely to the use of the steel plates, for it allowed of the working force being reduced in number from 40 to 22 men for mining 9000 cu. yd. of gravel per day. It is believed that in next season's operations a further reduction will be made to even lower than this low cost. As a result of last season's operations, the position of the main pay-channel of the ancient river system on which work is being done was ascertained. This system has been definitely traced for approximately three miles, and it is about one mile in width. The season's work, through the amount of gold recovered, determined the situation of the main part of the channel, so that it is thought there need be no question as to the proper place for the construction of the main sluiceway next season.—British Columbia Bureau of Mines *Bull.* No. 1, 1913.

Malay Tin Production, 1911

The following table, showing the quantity in tons and the value of tin and tin ore produced in the Federated Malay States during 1910 and 1911, the weight of tin being calculated at 70% of the ore, is taken from a recent consular report.

	1910.		1911.	
States.	Tons.	Value.	Tons.	Value.
Perak	25,080	$18,540,708	26,033	$23,348,107
Selangor	14,297	10,577,417	13,760	12,339,477
Negri Sembilan..	2,065	1,524,958	1,739	1,562,062
Pahang	2,421	1,795,405	2,617	2,345,825
Total	43,863	$32,438,488	44,149	$39,595,471

These figures show a slight increase in quantity over 1910 and a substantial increase in value. The average price per picul (133⅓ lb.) for 1910 was $44.03, as compared with $53.34 for 1911. Production in Perak and Pahang increased 3.8% and 8.1%, respectively, and in Selangor and Negri Sembilan decreased 3.75% and 15.76%, respectively. In 1897 practically the same quantity of tin was exported at an average price of $20.45 per picul, as compared with $53.34 for 1911. With the exception of a sudden drop in February and a decline in September, the market was fairly steady, with a tendency to rise. The average price was $2.44 higher than any previous record, and there was little or no evidence of local speculation. The total labor force employed in the tin mines was 196,427, an increase of 26,066 over 1910, distributed as follows: Open-cuts, 150,439; underground, 15,107; hydraulic and *lampan*, 30,881. Laborers employed on the tribute systems numbered 107,993, as follows: Chinese, 189,010; Indian, 4626; Malay, 2577; other, 214. The total horse-power of steam, hydraulic, and electrical plant employed in tin-mining was 20,623 (as against an estimated 18,515 in 1910), distributed as follows:

State.	Steam	Steam-electro	Hydraulic	Hydro-electric	Suction gas	Oil engines	Total .....
Perak	4593	1663	5669	1500	1363	335	15,123
Selangor	3282	....	343	....	....	...	3,625
Negri Sembilan.	233	....	331	....	200	...	764
Pahang	718	....	136	....	....	257	1,111
Total	8826	1663	6479	1500	1563	592	20,623

Gold Bricks by Parcel Post

Not long ago we published an innocent little paragraph urging wider use of the parcel post and calling attention to the opportunities it afforded for re-establishment of the fine old custom of country subscribers presenting the editor now and then with fruit and other products of the farm. It was a good custom. Many an editor, if we may believe printed records—though as to that there is admitted difference of opinion—was saved from near starvation and, by the same token, many a farmer achieved contemporary if evanescent fame. As a boy, we always wished we were in the editorial chair during watermelon season. Development of the modern newspaper, with its large circulation, has brought many changes, and none are more marked than the obscuration of the personal relations between editor and reader. Joking aside, we regret to see this, and we hope that the bonds, if somewhat intangible, are still strong as between readers of the *Mining and Scientific Press* and its editorial staff. That there is such a thread of human interest tying us together, is indicated by the following letter received from G. M. Taylor, manager for the Portland Mining Company, and incited by the paragraph aforementioned.

"We do not deal in fruit and chickens, but make the goods that buy both, and the boys are remembering you by parcel post. We are surprised that such a well known Editor, of such a popular magazine should be overlooked by his country subscribers, and also that the Editor in calling attention to the oversight should express himself as content with fruit and chicken. We consider from the dignity of the profession your journal so ably represents, that you are entitled to 'High-Grade' or gold bricks, and as we deal in the latter exclusively, the mill boys are today trying out the parcel post with a $30,000 gold brick, which they ask you to accept with their

compliments." We present herewith a picture of the brick, which, with the letter, naturally aroused visions of wealth. The brick, on arrival, proved to be of suspicious lightness, and we have been unable to cash it in, even at usual discounts for high-grade. Neither the Mint nor the so-called Smelter Trust has shown any desire to purchase, though the value, as shown above, is plainly marked on the brick. We are forced to conclude that indeed "all is not gold that glitters." However, when one is gold-bricked, it is a pleasure at least to know that the job has been done so artistically.

Copper Producers' Association Report

The Copper Producers' Association statement, March 8, shows a decrease during the preceding month in accumulation in this country of 896,134 lb. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, February 1, 1913	123,198,332
Production of marketable copper in the United States from all domestic and foreign sources during February	130,948,881
Deliveries for consumption, February	59,676,402
Deliveries for export, February	72,168,623
Stock of marketable copper of all kinds on hand and at all points in the United States March 1	122,302,198

The changes in surplus in the last year have been as follows, in pounds:

	Increase.	Decrease.
February, 1912	.....	3,301,944
March	.....	572,431
April	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....
October	13,679,380	.....
November	9,419,095	.....
December	19,148,523	.....
January, 1913	17,885,770	.....
February	.....	896,134

The Cost of Copper

Interesting comparisons between the cost of producing copper in Michigan and in the West were recently made by James MacNaughton, general manager for the Calumet & Hecla Mining Co., on the occasion of a dinner given, as related by our Houghton correspondent, and were published in the *Boston News Bureau*. Mr. MacNaughton divides copper producers into four groups: The Michigan group, consisting of the copper mines in the upper peninsula of Michigan; the Montana group, consisting of the copper mines in and about Butte; the porphyry group, consisting of the porphyry mines of Utah, Nevada, and Arizona; and the southwestern sulphide group, consisting of the sulphide mines of Arizona and Mexico. Continuing, he says:

The most recent statistics available are those for the year 1911 and even they are not quite complete, but the figures I will quote cover a product of approximately 1,000,000,000 lb. of copper for the four groups mentioned, out of a total of about 1,400,000,000 lb. produced and imported into the United States for that year. Comparing the yield per ton of rock or ore treated, we find that the Michigan group gives an average of 20¼ lb. per ton; the Montana group, 61¾ lb.; the porphyry group, about 22 lb.; and the southwestern sulphides, 74½ pounds.

It would be extremely difficult to make a comparison of the amount of work expended in mining

and milling the average ton of rock or ore in each of these groups, but it would seem that on account of the great depth and the narrowness of the lodes the Michigan district would afford the most difficult mining; Montana would undoubtedly come next, with the southwestern sulphides third, and the porphyry mines last or the easiest to mine by reason of their large surface deposits permitting in most instances the use of steam-shovels, and the shallowness of deposits worked underground.

During the year 1911 the total average cost per ton treated in each of these groups was as follows: Michigan group, $1.86; Montana group, $7.84; porphyry group, $2.22; southwestern sulphide group, $8. It should be borne in mind, however, that in the Montana, porphyry, and southwestern sulphide ores quite large amounts of the precious metals are recovered, which is credited to the cost of producing a pound of copper; whereas the value of precious metals recovered from mines in the Michigan group is almost negligible. In the Montana group, for instance, the precious metals for the year 1911 amounted to 3.26c. per pound of copper produced; in the porphyry group the precious-metal value was 2.18c. per pound of copper produced, and in the southwestern sulphide group, 1.17c. Applying these credits, the following comparison of the net cost of producing a pound of copper may be made: Michigan, 9.19c.; Montana, 9.44c.; porphyry, 7.98c.; southwestern sulphide, 9.03c. From this it can be seen that if it were not for the precious-metal values in the other groups, the Michigan group would be the lowest cost producers; or, in other words, if the comparison is made on the basis of copper alone and no credit is given for the precious metals recovered, the results would be as follows: Michigan group, 9.19c.; Montana group, 12.70c.; porphyry group, 10.16c.; southwestern sulphide group, 10.25c. The average net cost of producing this pound of copper is 8.96c. Michigan, Montana, and the southwestern sulphide averages are slightly in excess of this figure, which indicates that the real competition in copper production is furnished by the porphyry mines.

It has been argued that the costs published by some of the porphyry mines are not wholly correct, inasmuch as certain charges, such as 'stripping account,' have been deferred, and that the published costs are lower than they should be. It is not to be presumed, however, that the intelligent men in charge of these properties are either fooling themselves or attempting to fool the public, and for the purposes of this discussion, at least, their figures should be given due consideration.

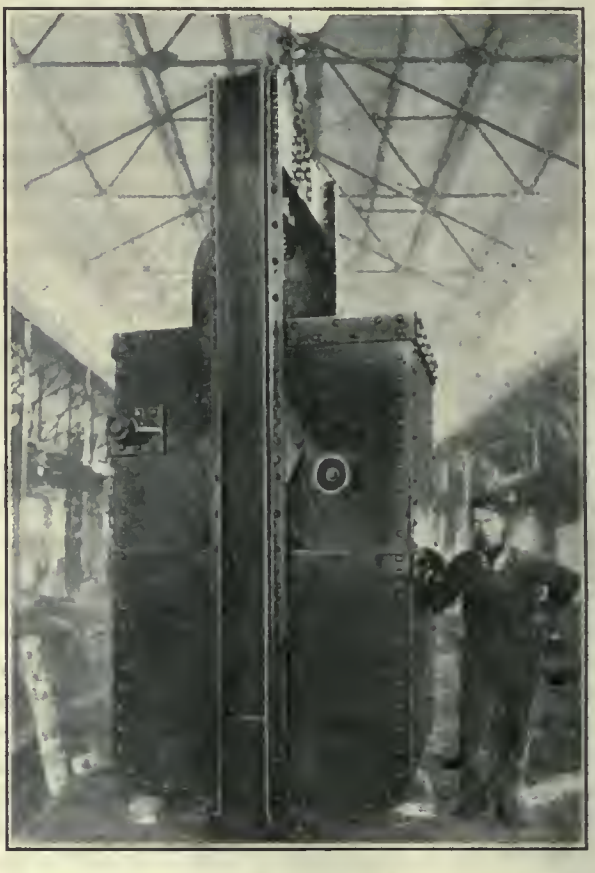
Australasian Gold Yield in 1912

According to the *Australian Mining Standard*, the gold yield of Australia and New Zealand was as follows, in fine ounces:

	1911	1912.
New South Wales	181,121	165,295
Queensland	381,845	346,390
Tasmania	31,100	40,264
Victoria	503,541	480,131
Western Australia	1,370,816	1,282,651
New Zealand	427,707	316,667

A Big Skip

The accompanying photograph shows the 140-cu. ft. skip recently made for the Hancock Consolidated Mining Co. by the Lake Shore Engine Works at Marquette, Michigan. Hancock's big vertical shaft, sunk to strike the Quincy lode at depth, has been



a matter of considerable interest in copper-mining circles. The skip's approximate size and construction are apparent from the picture.

Testing Cyanide Solutions

A good test of cyanide solutions, devised by Mr. Dowsett of the Brakpan mill, Johannesburg, to determine whether precipitation on zinc dust or shavings is good, is as follows: 1000 c.c. of cyanide solution is poured into a wide-necked bottle, to this is added three drops of saturated solution of lead acetate, and the mixture is then shaken. Add 0.75 gm. of zinc dust and shake again. Add 20 c.c. of saturated solution and shake for 30 seconds. Pour into an evaporating dish and allow dust to settle. Pour off solution, put dish on a spirit lamp, and dissolve zinc dust with about 10 c.c. of aqua regia; boil this until the bulk is reduced to a volume of about 4 c.c. Allow the chloride of lead to settle, and then pour the solution into a test tube. Cool the solution in the tube, and add two drops of a solution of tin chloride. If gold is present to the extent of 0.02 dwt. per ton of the original cyanide solution, a very slight coloration will be perceived in the liquid; 0.03 shows a slight yellow; 0.04 slight pinkish yellow; 0.06 strong pink; 0.08 the purple of Cassius. The great advantage of a test of this nature lies in the fact that the shiftsman can make it in a few minutes.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Secretarial Ethics

The Editor:

Sir—Enclosed please find a copy of a letter to me from Charles F. Rand, president of the American Institute of Mining Engineers, which is a conclusive reply to the direct and inferred criticisms, so far as they refer to me, appearing in the editorial notice in your issues of January 25 and February 8, 1913. I respectfully request, as a matter of justice, that you will publish this present communication and the letter from Mr. Rand in an early issue of your paper.

JOSEPH STRUTHERS.

New York City, March 5.

Dr. Joseph Struthers:

Sir—Your letters of February 21 and 24 have been received, together with copies of the *Metallurgical and Chemical Engineering* of September 1912, the *Mining and Scientific Press* of January 25 and February 8, 1913, and the *Engineering and Mining Journal* of February 8, 1913, in which latter the suggestion is made that you demand an investigation: with the request on your part that the criticisms appearing in these publications as far as they relate to you should be considered by the Board of Directors or the Executive Committee of the Institute. Your letters and the accompanying newspapers have been carefully considered by the Executive Committee.

We are very glad to state that no charges of any kind against you are in existence before the Board. Your accounts as assistant treasurer have been audited annually by a firm of certified public accountants and always found correct. As to the excursions which are specifically referred to by the *Mining and Scientific Press*, you are entitled to the statement which we very gladly make, that you did not originate the system by which such excursions were conducted. The system had prevailed for many years, and before you became connected with the administrative work of the Institute.

With regard to the reference in the *Mining and Scientific Press* to the New Haven and Spokane meetings, we now find that there was no Institute excursion connected with the New Haven meeting, and understand that you had no financial relation beyond the receipt of salary and expenses to the excursion connected with the Spokane meeting. Both of these meetings were held while you were assistant secretary and before you became secretary of the Institute. A committee of the Board and Council has already inquired into the conduct of the excursion to Japan which was under your charge, and exonerated you, as shown in a report which has already been published.

As to the letter of Messrs. Corning and Stone, published in *Metallurgical and Chemical Engineering* last September, we appreciate the position taken by Dr. Raymond and at the urgency of your friends, to abstain from any newspaper controversy which might be harmful to the Institute. At the same time we are pleased to say, concerning the general charge which might be construed to include you, that you have not received an excessive salary and that you have not been inefficient in the office work.

The Executive Committee consists of Charles F. Rand, Benjamin B. Thayer, A. R. Ledoux, Joseph W. Richards, and James F. Kemp.

Yours very truly,

CHARLES F. RAND,
President, Amer. Inst. Min. Engineers.

New York, March 5.

[We take pleasure in publishing the above. The reference to excursions to "New Haven and Spokane" was taken from the report of the Committee of Five, a printed document distributed by the Institute while Mr. Struthers was secretary. The report on the Japan excursion has already been printed in full with our comment. There has never been any charge that Mr. Struthers was the originator of the system of which complaint was made, merely that he was a beneficiary. We are sincerely glad to know that in case of the Spokane excursion he had no financial interest. It is always a pleasure to find circumstances capable of a pleasant interpretation rather than the reverse.—EDITOR.]

The Intermittent System of Cyanidation

The Editor:

Sir—An article under this title appearing in your issue of February 8 will stand a little analysis. In it L. P. Hillis describes a lift-pipe for Pachuca agitators which has been patented and in use for some time. It probably has all the good points that he claims for it. Possibly by using the form of lift-pipe described, thickening before agitation could be avoided, but whether sufficient saving in cost of plant and operation would result to justify the installation of increased agitator capacity which would be necessitated by settling and decanting in Pachucas, is decidedly questionable. Further, Mr. Hillis has not calculated the number of washes which would be required to reduce the value of the solution in his agitators to a point where the agitator charge could be discharged to waste. Assuming the following conditions: A recovery of $10 per ton of ore, battery solution $1 per ton, milling solution ratio 6 to 1, recovery in milling 40%, thickening in agitator from 6 to 1 to 3 to 1, agitation to recover 60% remaining in the ore, thickening to 2 to 1 in agitator, and diluting to 3 to 1 with barren solution *ten times*, there would still be $0.14 dissolved gold per ton dry in the charge. Mr. Hillis naively claims for a plant designed according to the description in his article, "simplicity, cheapness of installation, economy of power and labor, low maintenance cost, flexibility of operation." I don't question the simplicity. The article under discussion was evidently to once and for all settle the question of intermittent *v.* continuous agitation in favor of the former. Its author directs his broadside at the

Pachuca agitator while ignoring flat-bottomed agitators entirely. It will not be long before Pachucas are a thing of the past, and one of the salient features of the flat-bottomed agitator is its adaptability to continuous agitation. By regulating the height of discharge, any desired concentration of coarse and quick settling particles can be secured. In any agitator containing a known tonnage of quick settling particles and having a known feed per hour of same, the hours of agitation of quick settling particles is determined by dividing tonnage by feed. By regulating height of discharge in a flat-bottomed agitator the former can be controlled, allowing time of agitation to be nicely adjusted. There remains, of course, the fact that some quick settling particles will escape untreated from the first agitator, but assuming four or more agitators and applying the law of probability and chance, it can be readily determined that all particles with the same settling rate will be to all intents and purposes equally treated. Regulation of time of agitation upon the basis of settling qualities can be readily obtained in any flat-bottomed agitator, especially the Dorr agitator, with its central lift. The saving in labor of continuous over intermittent agitation cannot be questioned by anyone who has used both, and properly designed continuous agitation plants allow a number of nice adjustments impossible in using the charge system.

NOEL CUNNINGHAM.

Timmins, Ontario, February 17.

Taxation of Mining Claims

The Editor:

Sir—In answer to the article on the taxation of mining claims appearing in the *Mining and Scientific Press* of February 15, I suggest that if M. H. Joseph will visit some of the best camps in Nevada and note the many valuable properties that have been lying idle for the past twenty years or more as a result of litigation, poor management, or being held by some rich corporations or individuals who are absent, and who in all probability will never work them again, thereby keeping the state from its revenue and others from working them, he will form other opinions in regard to the new law. In the seven years that I have prospected in Nevada I have visited many of the old camps and have noted the stagnation of the mining industry due to absent owners who hold under patent the best properties and deprive the prospector of the lands which, if turned back to the Government, would, in time be re-located and worked. The Government in the first place should not issue a patent to mineral ground, but should require the locators to do a certain amount of development work, and if the property cannot be made to produce, or upon their failure to keep up the required amount of work, the land should revert to it and be open for other prospectors. These may in the course of time discover ore that had been overlooked by the first locators.

Mineral ground is only good for what wealth it can produce, and when it fails to produce or pay a revenue it should not be held under patent to the detriment of the prospectors and the state. If the old law is allowed to continue for another generation, there will be no field for the prospectors in the West; and without the prospector, what would our mineral industry be? Who discovered all of our great mines? And who are the parties that now hold patent to the ground that has slumbered peacefully for the past twenty years?

J. E. GRIFFITH.

Atlantic City, Wyoming, February 21.

Progress in Gold-Silver Ore Treatment in 1912

The Editor:

Sir—I should like to amplify a sentence in my annual review regarding the Nissen stamp to read: "but the amount of business up to the present given by the Rand to the inventor would probably not pay his traveling expenses, and if ever the Nissen stamp is adopted by the Rand at its mills yet to be designed—*other than by the group responsible for presenting these results so frankly and freely to the industry*—it will be because of the enterprise of Rhodesia in widely adopting it." Addition of the words italicized will make my meaning more clear.

The policy of the Corner House in giving the industry so frankly and fully details of the results of the Nissen stamp stands out as all the more commendable in face of the policy of secrecy of the Mines Trials Committee on which I animadverted. May I venture to prophesy that the Corner House will be no loser by its generosity and enterprise? When the time comes for it to design new mills it will in the same way receive the benefit of the experience of the many extra-Transvaal mines that have already adopted the Nissen stamp on the City Deep results.

ALFRED JAMES.

London, February 20.

Starving New Properties

The Editor:

Sir—The *Mining and Scientific Press* often brings accounts of old abandoned mines being reopened. This naturally involves the expenditure of large amounts of money for dewatering, retimbering, and other expenses. The claim-owner with promising property, one which has produced shipping ore on the surface, but which he is unable to develop because of the necessity of sinking, wonders why it is so hard to interest capital in undeveloped property. He is inclined to blame the mining engineer for this state of affairs, because of not using his influence in directing capital to new prospects.

A fraction of the money expended on some of these old mines, mere shells in some instances, would often produce a healthy youngster of a mine that could stand on its own merits for further development. The tendency now seems to be to starve the infant in order to prolong life in old age.

F. M.

Wisdom, Montana, February 10.

[In extensive workings, there is opportunity to study a vein not afforded by a shallow prospect, but it would be a pity to lose sight of the fact that prospects must be developed or there will be no mines. —EDITOR.]

Special Correspondence

NEW YORK

MARKETS STILL WAITING.—FEBRUARY PRODUCTION.—AMALGAMATED FINANCES AND IMPROVEMENTS.—BUTTE & DULUTH LEACHING SUCCESSFUL.—PITTSBURG SILVER PEAK EARNINGS.

Wall Street's waiting attitude, which has become chronic during the past three or four years, was, for the moment, interrupted by the change of administration at Washington, but almost immediately relapsed into the previous position. The 'Street' is now waiting to see what the new administration intends to do and what, if anything, may be done that will have a market effect. The copper-metal market has been for the most part featureless, the bottom in price having apparently been reached at 14¾c., and as nearly as figures can be collated from the various selling agencies, some 125,000,000 lb. of copper has been disposed of during the past fortnight. February having been a short month, and as expected the report of the Producers' Association showing a decrease (896,000 lb.) in accumulated stocks, the copper-share market has suffered more by reason of the general dullness prevailing than the statistical position of the metal; in fact, copper shares have not moved up or down in response to metal movement. In July of 1910 the copper surplus was at the highest figure ever reported, 401,249,967 lb., and after a severe decline in the market, the average price of 34 leading copper stocks was $48.11 per share. At that time copper was selling at 12¾c. per lb. as compared with the present selling price of 15c. Recent compilations show that notwithstanding the present improvement in price and reduction in surplus, the same 34 leading copper issues today figure an average of about $42.85. Reported production of various copper properties for February is as follows: Braden Copper Co., 1,600,000 lb.; Anaconda, smelter output, 21,250,000 lb.; Chino, 4,014,735; Miami, 2,817,000; total Phelps-Dodge output, 11,230,897 lb. The Shannon Copper Co. produced 1,152,000 lb., which may be compared with 1,232,000 lb. in January and 1,300,000 in February 1912. The Shannon output is aided by precious metals contained. These amounted in February to 250 oz. gold and 8700 oz. silver.

The United Copper Securities Co. and Arthur P. Heinze, who is a brother of F. Augustus Heinze, are complainants in a $30,000,000 damage suit brought against the Amalgamated Copper Co. and its subsidiaries, including the Anaconda; the executors of the estate of Leonard Lewisohn, William Rockefeller, H. H. Rogers, Jr., John D. Ryan, and James Stillman, are individual defendants. The suit is based on some old matters of the Montana Ore Purchasing Co., which latter has just been included in the receivership of the United Copper Co. The Amalgamated Copper Co. has just sold to the National City Bank $12,500,000 two-year 5% notes, the proceeds of which will be used to take up a note of like amount issued in March 1911 to pay for the stock of the United Metals Selling Co. which was purchased at that time. B. B. Thayer, president of the Anaconda Copper Co., just recently returned from Butte, says in a recent interview: "The changes which we have been making in supplanting steam with compressed air are progressing well, and while it is too soon to figure the actual saving, I can say that as a whole the work is giving entire satisfaction. In all departments we are continually striving toward greater efficiency and lower cost." A. B. Wolvin, long identified with the Butte & Superior, is said to be jubilant over the results obtained by the leaching plant erected at the Butte & Duluth property, in which he is the principal owner. J. D. Fields, the engineer under whom the plant was constructed and who is now in charge of its work, is authority for the statement that he can produce pure copper direct from the ore at a cost of 5c. per pound. The leaching plant is to be immediately enlarged from a capacity of 250 to 1000 tons per day. A similar plant is being erected at the Builwhacker.

The feature of the outside market has been the sharp advance in Cobalt shares, though it must be said at the same time that the advance in New York was scored without any inrush of public orders. The Pittsburg Silver Peak Gold Mining Co., operating at Blair, Nevada, reports gross earnings for the year of $1,180,307, an increase of nearly $500,000 over the year preceding. The net produced from the above was $239,754; dividends paid during the year last past totaled $502,871. There was carried forward to surplus the sum of $254,706.

TORONTO, CANADA

HOLLINGER OUTPUT.—COBALT LAKE.—DRUMMOND.

The last few days have been characterized by a rapid upward movement and heavy transactions in Porcupine stocks, due to favorable official statements from the Hollinger mine. According to the report of the president and the general manager, sent out with the checks for the dividend due February 15, production during the two weeks previous exceeded considerably the weekly output before the strike. For the week ending February 4 the product was valued at $65,005, and for the week following at $59,313. Prior to the trouble the output ran in the neighborhood of 1900 tons per week, valued at about $50,000. On February 13 there were 35 stamps running, and it was anticipated that 40 would be in commission within a few days. Regarding development, the manager states that two parallel drifts, 35 ft. distant, are being run south through the low-grade body found on No. 1 vein at the 300-ft. level. The metallic content has been steadily increasing, until it now runs from $16 to $23 per ton. At the Dome the mill of 40 stamps has for the past nine months been treating 10,000 tons per month. Development at the 260-ft. level of the Golden Stairway vein has resulted so favorably that it has been decided to increase the capacity of the mill by adding at least 40 and perhaps 60 stamps. The Jupiter property is being unwatered in order that development may be resumed as soon as possible. The shaft will be put down to 500 ft. A new compressor plant and electric transformer have been ordered. At the McEnaney, rich ore, stated to run $48 per ton, has been found at the fourth level, where the vein has widened from 4 to 8 ft. On the 200-ft. level the vein is being opened up for 550 ft. in ore running upward of $30 per ton. The management has therefore decided to enlarge the 5-stamp mill recently started to 20 stamps and to build an addition for cyanide treatment. The Dome Lake is putting in a 10-stamp mill, which will shortly be in working order. Smelter returns from a shipment of 10 tons sent some time since from the Tough claims in the Swastika district show gold content to the value of $10,453 in addition to silver worth $300. Another shipment of rich ore has been sent out. The richness of the deposits in the Kirkland Lake area of the district where these claims are located is attracting much attention, and several locations have recently changed hands, including the Wright-Hargraves in which Albert Wende, of Buffalo, and associates have purchased a three-eighths interest.

The Cobalt Lake had a record year in 1912. On December 31 the company had a surplus of $425,947 as compared with $80,847 the year before. An initial dividend of 2½% was paid in January. The production was 1,123,147 oz., and the ore reserves are estimated at 2,135,040 oz. With the payment of the regular and extra dividends declared by the Buffalo amounting to 23%, that company will have returned to its shareholders an aggregate amount of $2,107,000, or more than twice its capital. The annual report of the Seneca-Superior showed net profits of $121,618 and a surplus after paying a 10% dividend of $73,980. The north vein discovered in October has been developed for 213 ft., showing an average value of 3500 oz. per ton for this distance. The ore reserves are estimated at 1,150,000 oz. The annual report of the Trethewey showed net profits of $338,640, and a surplus of $178,743. The ore reserves were estimated at 590,624 oz. Negotiations are on foot for the sale of the property to English capitalists for a price stated at $750,000. The Casey Cobalt mill of 10 stamps will be enlarged this summer by addition of 10 stamps. Active

operations have been resumed at the Wright claim, which is being worked by the Pan Silver Co. The Silver Cliff has been purchased by R. C. Wigmore, of Toronto, and is being reopened with W. H. Jeffrey as manager. Drilling has been started on the Alexandra property to pick up the Balley vein. The Drummond is taking out large quantities of milling ore from an extensive orebody on the 125-ft. level, keeping 20 stamps of the Northern Customs concentrator running at full capacity. The Penn Canadian has cut a vein of high-grade ore 5 in. wide, on the 150-ft. level, and is taking milling ore from the lower levels.

BOSTON

Market Tone Better.—Calumet & Hecla and Tamarack.—Severe Weather Limits Copper Production.

Stock market interests in Boston received Mr. Wilson's inaugural message with evident satisfaction, and there seems to have been a change for the better in sentiment since March 4. An experienced Boston financial editor said the other day in private conversation that he believed the enactment of a 'blue sky' law in Massachusetts would result in mining stocks of the better class having something closely resembling a boom, as, under the construction of the law now under consideration, mining securities would be the only kind appealing to the universal gambling passion which would be at all eligible.

The Calumet & Hecla management is trying hard to bring the average recovery of the Tamarack conglomerate rock up to that of the district, 1%, or 20 lb. per ton. It is now a trifle better than 19 lb., and the management hopes in the next two months, since the ore in No. 3 shaft is showing a slight betterment at greater depth, to make up the difference. The decline of 3c. per pound in copper placed Tamarack in the doubtful column again. Last year, when copper sold up as high as 18c. per pound, Tamarack was returning to favor and, as a matter of fact, when its annual report is issued, will show net earnings for 1912 of between $5 and $6 per share. Tamarack, with its deep shafts and lean ore, is not of much value, with copper selling at its present price. Its cost has ranged over a term of years from 12 to 16c. per pound.

New England has had such a mild winter that it is difficult for people living here to understand the exceptionally severe conditions which have existed in the copper districts of the West and Southwest. At Globe, Arizona, the mines have been subjected to the severest weather ever known. During the greater part of February they have been practically closed because of lack of supplies. Spinal meningitis and smallpox broke out in Globe and a mild quarantine had to be instituted. At Bingham and Ely the heavy snows have greatly retarded copper production, and right upon the heels of a strike last fall. The effect of the curtailment is now being felt in the metal market. The directors of the Cortez Associated Mines were to have held their annual meeting a few days ago, but it was postponed for 60 days on account of failure to get news through the lines because of the Mexican hostilities. The company is reopening old shafts on an abandoned property lying in the Jacala district, Hidalgo, Mexico.

DENVER, COLORADO

Eagle and Platoro Divide Attention.

Discoveries at Eagle continue. Two additional prospects have been reported, and W. A. Gesner has found rich ore at the Sunnyside mine, about three miles east of the main district at Horse mountain. R. D. George, State Geologist, has furnished helpful data on the new district and has pointed out that there are a number of points at which conditions are favorable for finding additional veins. The ore is in sandstone of Mesozoic age and the silver is mainly in the form of chloride. Analysis shows the presence of as much as 1% of vanadium and the formations correspond to those in southwestern Colorado from which vanadium is now mined. There are basalt dikes in the district, but their relations to the ore are not yet known. These discoveries in Eagle county have detracted somewhat from an earlier interest in Platoro in Conejos county, where last October a 2-ft. streak of quartz containing gold tellurides and reported to assay $700 per ton, was found in territory previously considered barren. A number of men are now working on the vein and ore is being sacked for shipment. Altogether Colorado mining men are feeling more cheerful than for several seasons.

BUTTE, MONTANA

February Production.—Butte-Ballaklava Litigation.—Barnes-King Improves Position.—Labor Legislation.

The Anaconda Copper Co. mined 280,000 tons of ore in February, an average of 10,000 tons per day that yielded after treatment better than 62 lb. of copper per ton of ore. North Butte mined about 9000 tons, yielding 110 lb.; Tuolumne mined 4200 tons, yielding 120 lb.; Alex Scott mined 6000 tons, yielding 110 lb.; Davis-Daly mined 1700 tons, yielding 110 lb.; this makes a total of 325,000 tons of ore, yielding 22,000,000 lb. of copper. February production was light, owing to cold weather, mine fires, and a short month, but better than 12,000 tons per day of 4% ore and is not so poor at that. The Butte-Ballaklava Copper Mining Co. has received a setback in its litigation with the Anaconda Copper Mining Co. by the decision of the Silverbow County Court denying a change of venue. The Ballaklava company is expected to appeal from the decision. The annual meeting of the Barnes-King Development Co. was held at Lewiston, March 6. The old directorate was reëlected entire. The outlook for the company is better than at any stage in its history. The mine at Kendall is producing steadily, and the prospects of the Plegan-Gloster at Marysville are good. The time may yet come when the disgruntled stockholders can no longer cry 'Barnes-Skin' for Barnes-King.

The labor element made a hard fight for a compulsory compensation law in the legislature just closed. Their demands were so sweeping, however, that nothing was accomplished. A conservative compensation law would protect both employer and employee, but compulsory compensation regardless of the culpability of the injured, must certainly be regarded as class legislation. The question is likely to be brought forward again at the next legislature.

FAIRBANKS, ALASKA

Proposed Power Plant.—Active Quartz Mines.

J. L. Timmins, who is promoting a power scheme to supply power to the Fairbanks district, has just left town for the Tatlaneka, where the plant will be erected if sufficient power consumption is guaranteed. The plant, if built, will have a capacity of 10,000 kw., and, while using water-power in summer, will burn coal in winter. Abundance of water-power and coal make the Tatlaneka a suitable place for the plant. While much encouragement has been given Mr. Timmins, he will make no definite announcement of plans until his return. The increasing number of small mills and the large amount of low-grade placer ground that could be worked with cheap power and supplies would seem to justify the erection of such a plant, especially if the proposed government railroad becomes a certainty.

The first mill-run from the Teddy R. claim on Fairbanks creek, now held under lease and option by Pomeroy, Ford & Wheeler, proved encouraging to the lessees. Nineteen tons netted a bar worth $480, or an average of $25 per ton. All rock broken was sacked and milled, no attempt being made to sort the vein matter. The tailing assayed $6, bringing the average value up to $30. The ore was milled by the Chatham Mining Co. at its mill on Chatham creek. The absence of a concentrating-table at this plant explains part of the loss in the tailing. The Newsboy mill crushed a shipment in January from the Overgaard lease at the head of Willow creek. The bar weighed 55 oz., showing the ore to average about $30 per ton. This claim is owned by Louis Golden and Henry Ott. The first fairly large

mill-run from the Homestake was also run at the Newsboy mill the same month. The run netted 114 oz. of bullion, worth $16.52 per oz., showing the rock to average $75 per ton in free gold. The concentrate, of which there is a considerable amount, shows 360 oz. silver per ton and $72 in gold. The company has engaged C. M. Nicholson as engineer and will start extensive development. The ore was taken from the vein found about 350 ft. from the mouth of the tunnel and which was at first thought to be only a small stringer. The vein has widened to 10 in. and the pitch of the hill gives about 200 ft. of backs at present, while driving will increase the backs rapidly. The Homestake mine is at the extreme head of Wolf creek.

The Chena customs mill crushed from 300 to 400 tons of ore from the Rainbow mine on Skoogy gulch, early in February. The first 140 tons showed $15 in free gold with $5 in tailing and concentrate, but the last of the run was expected to bring the average close to $30 per ton. Extensive sampling of the mine and dump justifies these expectations. Roth & Maddocks, half owners of the property, will operate the mine for the present. A loading bin at Gilmore has been built to facilitate loading the ore on the cars of the Tanana Valley railroad, which delivers direct to the mill. Joseph Henderson is the new foreman and superintendent at the Rhoads-Hall mine on Bedrock creek, Allan Cunningham having resigned to take a position with the Rexall on Wolf creek. Sinking of the winze has proceeded until the water can barely be handled by the pump, and a level will be run and stopes opened before sinking is started again with the arrival of a new

RHOADES-HALL MINE.

pump. The vein seems to be as strong in width and value of the ore on the lower level as in the main adit. The mill is running steadily on good ore. The 2-stamp mill at the Rexall mine at the head of Wolf creek is now in operation, and the first clean-up was brought into town early in February. A good water-supply is assured, and the mill should crush steadily from now on. Allan Cunningham is the engineer in charge, while the property is owned and worked by George Horton & Co. It is reported that the owners of the Chatham Mining Co. are jubilant over the last clean-ups, the ore improving materially in grade. The 4-stamp mill is in constant operation. L. C. Hess has recently bought an interest in the property, which includes a large number of claims at the heads of Chatham and Fairbanks creeks. Driving on the 315-ft. level of the Newsboy seems to have resulted in discovery of the ore-shoot looked for, as assays have been made showing $20 rock in the east face. The vein here is large and the finding of the shoot materially increases the value of the property. The last clean-up for January netted 167 oz. of bullion at $17.07 per ounce. A lease and option on the Governor claim has been taken by Heys, Larson & Ellis from Cook Bros. and other owners. This claim was staked and named the day the governor, W. E. Clark, visited the creek, and considerable development work has been done since. A new shaft will be sunk and a boiler and hoist installed as soon as necessary. A lease has also been taken on the North Star, another claim in the same group, by Reichert & Ashton. Cook & Lundblad, the owners, are also working on another part of this claim. Enough high-grade rock has been found to warrant extensive development. After doing other assessment work, Cretes & Fallman are again busy driving their adit on the Helen S. claim. A broken-up and faulted portion of the vein has been passed and the solid rock again found. No mill-runs have been made, but the amount of free gold visible in the ore guarantees good returns. Big offers have been made for this claim and rejected by the owners, who figure on having a big producer by next season. So far, fully 200 ft. of adit has been run.

PHILIPPINE ISLANDS

Talk of Independence Scares Capital.—Gumaus Dredge Doing Well.—Quartz Mining Not Active.—Iron and Oil Discoveries.

The mining industry in the Philippines has received a number of set-backs in the past. At the present time, it is in a fair way to receive the worst of all. The Jones bill, providing for Philippine independence, and the indiscreet remarks made by prominent Democrats in the United States regarding a question of which they know little, has all but caused a panic in local business circles. Naturally, mining comes in for the hardest blows of all, as it is the most subject to nervousness of all forms of business. It is being demonstrated beyond all doubt that the Philippine Islands are rich in minerals. It is clear to those on the ground that the crying need in the Philippines is the development of material resources. With coal and iron occurring in all parts of the archipelago, but with little development and only three or four crude blast-furnaces operated by natives, it seems a joke for the question of independence even to be brought up. Capital, which was just beginning to turn its attention to these islands, has suddenly begun to shrink away, and several important projects which would have a lasting effect upon the welfare of the Filipinos are to be passed on to the future.

The most noteworthy happening in connection with the mining industry within the last month or so has been the record returns from the Colorado mill on the island of Masbate. This mill, in the month of December is reported to have cleaned up ₱100,000. The condition of this mine and mill is at the present time exceedingly satisfactory. The most exciting event is the reported robbery of amalgam from the tables on the Gumaus dredge. This dredge, which was christened 'The Governor Gilbert,' after the Vice-Governor in the Philippines, has been making, according to all reports, excellent progress. It is fortunate to have this modern dredge, designed and constructed by the New York Engineering Co., operating in the same district with boats of the New Zealand type. It will afford an excellent opportunity to compare the merits of the two systems. There are four dredges working in the Paracale district at this time, and by April it is expected that there will be two additional ones and orders for two more will probably be placed in the near future, so that by the end of the year there may be eight gold dredges digging in the Philippines. The Gumaus company has just announced its second monthly dividend of 10 per cent.

There is no quartz mining at present in this district, but we may look for a resumption of work on the San Mauricio property within a year. The Paracale Venture Co. has installed a 50-hp. boiler and a 4-in. Cameron pump. This company is doing some driving in placer ground. The pay dirt is said to yield an ounce of gold to every yard. The shaft is 70 ft. deep. From the Benguet country, there is little news to be given, except that assessment work is being carried on. The Headwaters mine on the Antamok river is still struggling, and it is sincerely hoped that the officers will be able to pull it out of present difficulties. There has been considerable trouble in this region over the timber supply, and it is evident to those who know the district, that a deliberate 'hold-up' of some of these companies has been attempted. It is hoped and believed that the Government will take early action.

It is gratifying to record the discovery of what may be a very large deposit of chromic iron in Antique province, island of Panay, by C. Harris; also the discovery of the natural bitumen, gilsonite, on the island of Leyte. Vigorous development is being carried on in both localities.

The gilsonite deposit is reported to be in the form of a vein about 20 ft. wide. Many years ago, the Mining Bureau called attention to the possibilities in lithographic stone in the Province of Bulacan. It is reported on good authority that a Manila company will shortly open up this deposit and put this stone on the market. It has already been tried out by local lithographers and found to be of good grade. The months of February and March will see a party from the Division of Mines from the Bureau of Science at work making a geological survey of the lower end of Tayabas peninsula, where several oil seeps have been found. In the coal industry, there is little going on at present, though development is in progress in the vicinity of Mt. Uling on the island of Cebu. The East Batan coal mine has suspended operation and has been sold at auction recently to the Philippine Government. The coal is not satisfactory for steaming purposes, but is satisfactory in gas producers. The Philippine Bureau of Science is at the present time using this coal in an Otto producer.

MELBOURNE, AUSTRALIA

BROKEN HILL OUTPUT FOR 1912.—THE YEAR'S GOLD RETURNS.—A WALHALLA MINE.—VICTORIA MINISTER FOR MINES GOES TO LONDON.

The 1912 output of Broken Hill, New South Wales, broke all records. The value of mineral exported was about 35% above that for the preceding year and more than double the value of the export for 1909. Reduced to dollars, the value of the export for the past half dozen years is as follows: 1907, $14,925,000; 1908, $9,778,000; 1909, $10,073,000; 1910, 11,800,000; 1911, $15,035,000; 1912, $20,302,000. Details for the last two years are given below:

1912.	Tons.	Value.
Silver-lead concentrate	279,915	$13,430,000
Zinc concentrate	433,054	6,407,000
Silver-lead crude	29,605	432,000
Silver-lead slime	4,503	34,000
1911.		
Silver-lead concentrate	276,963	$ 9,608,000
Zinc concentrate	420,031	5,078,000
Silver-lead crude	27,355	301,000
Silver-lead slime	11,761	48,000

It will be seen by a comparison of these figures that the improvement is almost entirely in metal value. The output shows very little difference, but the value of that output has, thanks to the greatly enhanced price of metals, swelled considerably. Had a sufficiency of labor been obtainable, there would, however, have been an even greater increase in value, because there would have been an appreciable improvement in output consequent upon both the satisfactory development in the mines and the excellent prices obtainable for their products. The twelve months' dividends distributed totaled $8,673,000. One pleasing feature of the year's production is that the value of the December output more than doubled that of the output of the opening month of the year. The value of production of each of the four quarters of the year was as follows: Quarter ended March, $3,823,000; June, $4,791,000; September, $5,447,000; December, $6,063,000. This marks a steady and tolerably even advance throughout the year.

The year's gold returns are gradually coming in. They indicate that in almost every state there has been a decrease in production. In New South Wales the decrease is 15,826 oz. fine on the previous year's figure of 165,295 oz. Victoria's decrease is 23,410 oz., bringing the total for 1912 down to 480,131 oz. fine. The Queensland total is estimated at approximately 346,390 oz., and if that figure be correct the decline will be one of 35,455 oz. As Western Australia's output of 1,282,651 oz. fine means a drop of 88,106 oz., four out of the six states of the Commonwealth are seen to have a heavy fall in their gold output. On the other hand, South Australia, whose report is as usual belated, does not amount to a row of pins, but Tasmania's return is estimated at 40,264 oz., which if correct will give an advance of 9164 oz. over last year's figure.

The Long Tunnel, one of the greatest and most famous of the Victoria mines, is closing down after an existence of nearly half a century, during which, on a paid-up capital of about $250,000, it has paid a dividend of $6,224,500. The tonnage treated has amounted to 756,169 (long tons), the yield being 813,050 oz. of gold, so that the return per ton has been a shade under 21½ dwt. The township of Walhalla grew up around the mine and has been almost entirely dependent for its existence upon it and the Long Tunnel Exteuded (which ceased work some months ago). It is probable that a new company will be formed and give the famous old mine yet another trial. Those who are in favor of this action point to the fact that according to the last report of the mine manager, there was 16 in. of ore in the stopes. The chance of getting it going again on a paying basis does not, seem promising.

The appointment of T. McBride, minister of mines and railways in Victoria, to the position of Agent General for the state in London renders vacant the portfolio of mines in a state which, though not one of the chief mineral producers of the Commonwealth, is certainly one of the greatest gold producers. The general feeling in mining circles about the appointment is perhaps best expressed in the words of the *Australian Mining Standard*, which remarks sarcastically that "both Mr. McBride himself and the mines department may be heartily congratulated." He has presided over the department for a space of four years, during which time he has naturally lessened the gold output of the state by his harrassing of the holders of dredging leases. He has distinguished himself mainly by the establishment of the State Coal Mine at Wonthaggi, a venture which has so far not warranted its existence.

HOUGHTON, MICHIGAN

ISLE ROYALE DIVIDEND.—MACNAUGHTON COMPARES COSTS.

People of the Lake Superior copper country recently gave a banquet in Houghton to the officers of the Isle Royale Copper Co., now a subsidiary of the Calumet & Hecla, in celebration of the first Isle Royale dividend. The Isle Royale company owns a large tract of copper-bearing land just south of Houghton, and had operated the mine for fifty years before paying a dividend. The principal address was given by James MacNaughton, manager for the Calumet & Hecla companies. His talk was briefly as follows: "Some authority has said that it takes from eight to ten years in this district to develop and equip a mine and put it on a producing basis. While I do not know that this figure is even approximately correct, I do believe that it takes much longer to develop a paying mine in the Lake Superior district than in any other of which I have any information. So far as we can now see, we believe that the Isle Royale mine was opened too far ahead of its time; in other words, it was opened and the management attempted to make the mine earn money before the art of mining had advanced sufficiently to permit of profit being made from such low-grade rock. This also applies to other mines in the district which have only recently been made to pay, and undoubtedly there will be mines worked at a profit in this district in the future that are now being worked at a loss, for as the art of mining improves, these mines will come within the profitable limits. I believe that mining as practised here is in advance of that of other districts. The rock of the Isle Royale mine is lower in copper content than the average of that for the district, and the cost per pound of copper is somewhat higher than the average cost per pound for the district. The average copper yield per ton of rock for 1911 in the Michigan district was 20¼ lb.; if the Calumet & Hecla conglomerate be eliminated and only the amygdaloid mines be considered, the average yield would be 18 lb., while the yield at the Isle Royale for the same period was 16.4 lb. The average cost of a pound of copper for the entire district in 1911 was 9.19c., whereas the Isle Royale cost was 10.85c." Following this, Mr. MacNaughton compared costs of copper production in the Lake Superior district with costs elsewhere and showed that local costs were low. The Hancock has found a rich lode on the 3600-ft. level. It looks like the Quincy.

General Mining News

ALASKA

Fairbanks

At the present time there are about 100 teams engaged in hauling firewood to Fairbanks, and it is estimated that the annual consumption is between 12,000 and 14,000 cords, worth $8 per cord. On Fairbanks creek, on the lower part of creek claim 4 above, owned by Meehan & Larson, three lessees have put down three holes to bedrock, a depth of 12 ft., and good 'pay' has been proved for a distance of 85 ft. Pan tests show about $2.50 per square foot of bedrock. The ground is wet, and can be worked by open-cut method.

Juneau

The January operations of the mines on Douglas Island were as follows:

	Alaska Mexican.	Alaska Treadwell.		Alaska United.	
				Ready Bullion.	700-Ft. Claim.
Stamps working	120	240	300	120	120
Driven with					
Water power, days	0.92	3.80	9.80	...	1.13
Steam power, days	29.68	26.30	...	30.22	29.36
Electric power, days	...	...	15.01	...	...
Ore crushed, tons	19,908	32,648	38,752	17,920	19,393
Concentrate saved, tons	396	596	774	468	380
Yield from amalgamation	$16,787	$ 80,746		$25,904	$20,010
Yield from cyanidation	18,646	76,005		21,274	19,585
Total realizable value	35,079	155,184		46,707	39,199
Average value per ton milled	1.80	2.19		2.63	2.04
Operating expenses	25,074	84,104		24,529	24,325
Construction expenses	1,436	4,049		218	1,218
Estimated net profit	8,567	67,030		21,959	13,656
Development work covered, feet	362	609		533	73
Stock of broken ore, increased or decreased	−53	+11,168		−9,241	+2,678

Valdez

Seventy-five tons of freight belonging to the U. S. Navy Department are being taken from Knik to Chicaloon, in the Matanuska coalfield. From this field 800 tons of coal

KNIK, ALASKA.

will be mined for testing purposes, and this should be ready for shipment about the end of September. From the Bering lake district 800 tons of coal was mined last fall for a trial.

ARIZONA

Cochise County

The lode at the Hoatson shaft of the Calumet & Arizona company has been proved to be 58 ft. wide at the 1200-ft. level. The Briggs shaft is 1450 ft. in depth and will be continued to 1500 ft. Fifty miles south of Bowie a large deposit of marble is being worked by the Arizona Marble Co., which has spent $250,000 in opening the quarry. Machine drills are used in mining, and polishing and finishing machinery has been installed, some of the product being shipped in a finished and some in a rough state, and traction engines hauled the marble to Olga, from which shipments are made. The company is composed of Nevada men, and J. Kerr is general manager.

The mines controlled by the Phelps-Dodge company produced 11,230,897 lb. of copper in February, of which the Copper Queen yielded 6,098,860 lb., and Montezuma 2,730,-314 pounds.

Gila County

The February output of the Miami mine was 2,817,200 lb. of copper, against 2,579,680 lb. for the same month of 1912.

Greenlee County

The Shannon mine yielded 2,152,000 lb. of copper in February, against 1,300,000 lb. for the same month of 1912.

Maricopa County

A cyanide plant consisting of four 50-ton leaching vats and solution tanks is being erected at the Relief Gold Mining Co.'s mine to treat a dump of 8500 tons of old tailing averaging $2.50 per ton in gold, and the current mill tailing. The cost of treating tailing is estimated at 65 to 75c. per ton. The mine has 50,000 tons of ore ready for stoping, average returns so far being $9 per ton.

Mohave County

The Gunn-Thompson company has acquired the Hackberry property, nine miles from Kingman. This mine was opened in 1874, and work ceased in 1884, when fire destroyed much of the plant, and the shaft caved. The ore carried from 200 to 500 oz. of silver per ton, and some gold. The dumps contain a fair quantity of ore. An incline shaft will be sunk 650 ft. at an angle of 38°, to cut the vein. T. Tighe is superintendent and 15 men are employed.

Gold has been found by W. Myers 15 miles east of Kingman, at the north end of the Wallapai mountains. The vein is said to be 20 ft. wide, and is an extension of the old Cummings mine, known as the Jonathan and Etta.

Yavapai County

A mill of 20-ton daily capacity is being erected at the Victoria mine, in the Slate creek district. The orebody in this property is of the nature of a 'stockwork,' 20 ft. wide, and is expected to yield a fair profit from the new type of mill. The Coronado Gold Mining Co. is to erect a 20-stamp mill at its mine at Rees, near Congress. The Aladdin company has leased the Postmaster and other claims of the Oriental Mining Co., of Big Bug creek, for five years, on a 25% royalty of the gross returns.

CALIFORNIA

Butte County

The cyanide plant at the Gold Bank mine is in full operation again. George Wingfield, of the Goldfield Consolidated company, has an engineer examining property at Forbestown.

Eldorado County

At 125 ft., the adit of the Marguerite mine cut 18 in. of ore last week, of which 5 to 8 in. is rich in gold. The balance of the vein will assay from $3.50 to $8.50 per ton.

Modoc County

Several mines at High Grade are being worked right through the winter. Some rich ore has been uncovered in the Sunshine Twins property, and lessees are satisfied.

Inyo County

All the electrical machinery for the Wilshire Bishop Creek mill, 18 miles from Bishop, has arrived, and the

plant should soon be in operation. Work has been delayed by snow and storms, the mine being at an elevation of 8400 ft. Grinding-pans have been installed in the mill below the stamps, and by slow grinding an extraction of 75% has been recovered by amalgamation in preliminary tests. The tailing will be treated by cyanide later on. Construction of this plant was described in the *Mining and Scientific Press* of November 2, 1912, by Algernon Del Mar, the superintendent.

SHASTA COUNTY

The Mammoth Copper Co. has taken another 5-years lease of the Original Quartz Hill mine at Old Diggings. Work will be resumed about April 1 with 75 men. This mine has a large supply of low-grade gold quartz suitable for fluxing at the Kennett smelter.

The Mountain Copper Co.'s smelter building has been pulled down by locomotives, the plant having been idle since the company transferred its operation to Martinez six years ago.

SIERRA COUNTY

(Special Correspondence.)—There is great excitement at Alleghany over the discovery of a large mass of gold quartz in the Tightner mine, which has been yielding returns of about $100,000 per month recently. The Tightner was brought to the front about two years ago by the discovery of ore that is reputed to have yielded about $500,000 gross. All that was mined was about eleven tons, though incidentally a large block of low-grade ore was developed. The mine passed to the control of A. D. Foote and associates, who found much of the reputed ore too low in grade to be of value, but who made a mine of the property none the less. They have been so successful that all payments on the property have been met as due from proceeds of the work and many improvements made. The last find justifies their confidence in the presence of sufficient high-grade ore to make the whole valuable.

Nevada City, March 10.

SISKIYOU COUNTY

Michigan people have been examining the Blue Ledge copper mines. A new adit will be driven in the Mona mine, near Yreka. The old shaft has opened the mine to 600-ft. depth, but is too far away from the orebody recently developed. The new mill of the Black Bear, in the Salmon river district, is nearly completed.

The Yreka Development Co. is opening its coal deposits near Ager. It has 3000 acres of land, and three coal seams have been discovered, and an 8-ft. seam is now being developed. J. E. Gamble is general manager.

The Supervisors of Siskiyou county are making good progress in collecting samples of ores for the Panama-Pacific Exposition in 1915. From the Homestake and Highland mines, rich gold quartz specimens have been secured, they being about one foot thick and two feet long.

TUOLUMNE COUNTY

(Special Correspondence.)—The 10-stamp mill recently completed at the Atlas mine, near Tuttletown, has been started and is working satisfactorily. A good supply of ore, some of which will go $50 to $60 per ton, and the continuation of active development work insure a long mill-run. Work was resumed at the Columbus mine this week, after a brief suspension of operation. The property, worked many years ago with success, is being extensively developed by sinking and driving, under the direction of T. G. Winwood, and some fine orebodies are being opened. The McRae mine, near Jamestown, has been bonded to N. A. Mahaffey, of Stockton, who, with others, recently began development operations at the Josephine mine, south of Stent. Work is to begin on the McRae claim within a short time.

K. Murai, of San Francisco, representing a strong Japanese company operating extensively in Mexico, has just made an inspection of the Barendgret ranch mine, near Jamestown, operated by the Manley brothers, and it is reported that the property will likely change hands. A 16-in. vein carrying heavy gold is being developed on the Pennsylvania ground, near Tuolumne, by John Sivori and Paul Casseretto, who recently obtained a lease on a portion of the property. A shaft is being sunk, and prospects are gradually improving with the progress of work.

Sonora, March 1.

COLORADO

GILPIN COUNTY

The Carr mine has been examined by A. Most. The War Dance in Russell gulch has 12 men working on company account and 10 lessees. The shaft is down 425 ft. and is being sunk a further 300 ft. Good ore is being mined from the 80, 200, and 350-ft. levels. The shaft of the Calhoun mine is down 980 ft., and the mine is being unwatered by means of a hoist.

LAKE COUNTY (LEADVILLE)

The Philadelphia Leasing & Mining Co., at Yankee hill, has started shipping sulphide ore carrying silver, lead, and zinc from a lode 7 ft. wide. Sinking the interior shaft near the breast of the Yak tunnel is finished, and stations are being cut prior to driving to the Diamond and Vega orebodies. Lessees at the Belgian, Iron hill, have opened 14 in. of ore which yields high in silver and lead, and shipments have returned $18 per ton. The Anderson adit is in 800 ft., in quartz, and a heavy flow of water is making. Lessees at the Little Ella, Big Evans, have opened 7 ft. of ore averaging $35 per ton, and in it are several streaks of ore rich in gold.

OURAY COUNTY

At the Camp Bird mine, the drift on No. 6 level, near No. 3 shaft has cut 2 ft. of ore. Last September, work was started sinking 200 ft. from No. 5 level, from where cross-cutting was started, with the above results.

IDAHO

SHOSHONE COUNTY

The high-tension transmission line from Thompson Falls, Montana, to the Iron Mountain mine at Carter, in the east Coeur d'Alene district, has been completed. There is 500 ft. of water in the mine, and the pumps are now at work. This is a lead-silver-zinc property, employing about 100 men. The Glen Metals mine shipped two cars of ore to Tooele in February, from the 700-ft. level. The King and Queen are sending out 40 tons of ore per day, and the new 75-ton mill is well under way. The Coeur d'Alene Development Co., operating the Keystone and O. R. & N. mines, has its adit in 3300 ft., and at 800-ft. depth cut high-grade silver-lead ore.

MICHIGAN

HOUGHTON COUNTY

The following is from the annual report of the Osceola Consolidated Mining Company:

Ore crushed, tons	1,246,557
'Mineral' obtained, pounds	24,282,312
Copper production, pounds	17,175,066
Revenue from copper	$3,041,408
Expenses	1,908,536
Profit	1,163,288
Dividends	1,153,800
Surplus	1,888,458
Total cost per pound of copper, cents	10.36

MONTANA

SILVERBOW COUNTY

(Special Correspondence.)—The section of the Butte & Superior concentrator which is being rebuilt along lines arranged for by D. C. Jackling, will be ready to go into commission in about two months. The section is being reconstructed in a mauner similar to the one now in operation, and which was rebuilt under the direction of Mr. Jackling. It is running to the satisfaction of the management and is treating on an average of 600 tons per day. It can be brought up to 750 tons per day, and when the two sections are running the company expects to maintain an average treatment of 1400 tons per day. The Davis-Daly company claims to be shipping 50 tons of ore per day, which is coming principally from the 1900-ft. level. The driving of the cross-cut from Gagnon mine to reach the

Silver King ground is still proceeding, but as yet there is no word of the objective point being reached, although a distance of some 2000 ft. has been covered. The object in running the cross-cut is to get under the rich ore which lessees have opened on the 300-ft. level of the Silver King. The fire in the West Colusa is now under control, the entire area having been bulkheaded. The exact amount of damage has not yet been definitely ascertained, but there is no question that it is more extensive than at first supposed. It will probably be several weeks before the mine is again in a position to be operated.

Butte, March 1.

(Special Correspondence.)—The general chemical laboratory of the Anaconda company at Great Falls was destroyed by fire a few days ago, and all the chemicals and testing apparatus was burned. For a time it was feared that adjoining buildings would also be destroyed, but the company's fire-fighters, along with a number of volunteers, succeeded in saving the property. There is a loss of about $20,000.

Butte, March 8.

The February production of the mines at Butte was as follows:

	Tonnage.	Lb. copper per ton.	Total lb.
Boston & Montana group..	92,600	65	6,019,000
Anaconda group	120,210	61	7,332,810
Butte & Boston	10,300	62	638,600
Washoe	6,300	61	384,300
Parrot	2,400	60	144,000
Trenton	10,220	61	623,420
North Butte	24,600	68	1,672,800
Butte Coalition	29,300	70	2,051,000
East Butte	9,200	110	1,012,000
Tuolumne	4,200	120	504,000
Original	8,000	60	480,000
Alex Scott	6,000	110	660,000
Davis-Daly	1,680	110	184,800
Total	325,010		21,706,730

NEVADA

Eureka County

The third new 'camp' discovered in Nevada this year is that of Lynn, situated 20 miles northwest of Corbin and north of the Southern Pacific railway. The district has been worked as a placer 'camp' for several years. The rocks are limestone and rhyolite. In the former lead is found, with gold in the rhyolite. The Big Six is sinking a shaft in rich ore, and George Wingfield has taken an option on seven claims adjoining this property for $10,000. It is stated that there are 630 people at Lynn. The weather is good, but roads are bad.

Humboldt County

At a depth of 80 ft., and in 120 ft., the Causten adit at the Crown Hills claim at Rochester has cut 4½ ft. of ore worth $104 per ton, metal content being 10% gold and 90% silver. The Nenzel Crown Point company will drive an adit 1000 ft., from Crown Point No. 5 claim under No. 1 and 3, giving a depth of 900 ft. Ore shipments from the Big Four lease continue to be sent to Oreana. The Rochester Hills Mining Co. has ordered a 60-hp. auto truck which with a trailer will carry 20 tons of ore.

Lander County

The Maricopa Mines Co.'s property is situated 2½ miles northeast of Austin, and is controlled by Cleveland, Ohio, people. It has not been operated for over two years, but at present 20 tons per day is being treated, to be increased at an early date to 50 tons. The ore carries gold and silver and is treated by amalgamation, concentration, and cyanidation.

Lincoln County

The Prince Consolidated is shipping 10 cars of ore per day to Utah smelters. The opening of the new stope on the 400-ft. level is expected to reduce mining costs, which are now $1.10 per ton, on ore delivered at Pioche. Diamond-drilling is 340 ft. below No. 5 level, in quartzite.

Lyon County

During the week ended March 5 the Mason Valley smelter received 5289 tons of ore and shipped 10 cars of matte. The Nevada-Douglas company has a number of men mining gypsum again, a contract having been made for a 300-ton daily supply. Work is to be started at the Black Copper claims, and an adit will be driven 500 ft., and a shaft sunk 500 feet.

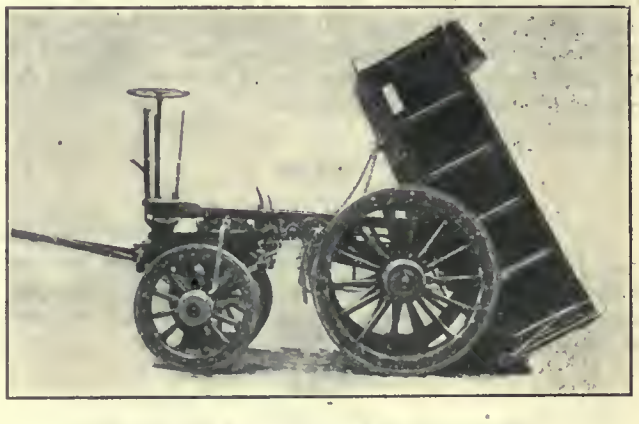
Mineral County

Lessees at various mines at Lunning are now shipping 15 cars of ore per month, containing 2.52 to 7.15% of copper.

Nye County

The new mill of the Big Four company at Manhattan started work on March 5. Construction was commenced last November, and the cost has been about $75,000. Treatment consists of a gyratory crusher, 10 stamps, 2 Akins classifiers, two 22-ft. tube-mills, and 4 amalgamating-tables, each 36 ft. in length. There is no cyanide treatment.

The mines at Tonopah produced 10,946 tons of ore, worth $232,644, during the week ended March 8, making the year's total 109,360 tons, worth $2,293,328. The Belmont company made a record shipment of bullion amounting to 90 bars of bullion, weighing 163,220 oz., this being the clean-up for the last half of February, the month's total being 10.93 tons of bullion, in addition to concentrate shipped.



TRAILER FOR AUTO TRUCK FOR HAULING ORE.

Storey County

The Mexican mill treated 531 tons of ore, averaging $30.46 per ton, with 93% extraction, during the week ended March 8. The tramway from the Monte Cristo mine is nearly completed. The 2400-ft. level of the Ophir yielded 120 tons worth $31.10 per ton, and the cyanide plant treated 629 tons of tailing. Repairs are being made in the Yellow Jacket mill. Pumps at the C. & C. shaft worked without serious interruption.

White Pine County

The Ely National company has cut a vein averaging $8.62 per ton in platinum in its claims near Hamilton.

NEW MEXICO

Grant County

The Chino mine produced 4,014,735 lb. of copper in February, against 1,168,586 lb. for the same month of 1912.

TENNESSEE

Polk County

(Special Correspondence.)—The change in the official roster of the Tennessee Copper Co. took place at the meeting held last week, as was anticipated. The new control of the company is headed by James Phillips, Jr. The Lewisohn interests, represented by Frederick and Walter Lewisohn, and J. Parke Channing, are withdrawn from the company, the other retiring directors being P. S. Henry, H. A. Keliar, Sidney Riddlestosser, E. C. Westlake, and O. B. Van Zant. The board at present consists of Richard Sutro of Sutro Bros. & Co. of the New York Stock Exchange; Joseph Walker, Jr., of Joseph Walker & Sons, also Exchange members; Horace M. Kilborn, vice-president

of the National City Bank of New York; James Phillips, Jr.; Sidney J. Jennings, vice-president of the United States S. R. & M. Co.; Felix Rosen, who is a member of Hayden, Stone & Co.; William B. Thompson, of Thompson, Towle & Co.; A. R. Peacock of Pittsburg, one of 'Carnegie's young men'; Utley Wedge, M. A. H. Westlake, Walter M. Briggs, George W. Breen, Edward T. Cusack, F. A. Sandland, George H. Johnson, Philip Yancey, and William Neeleamer.

The annual report submitted by Frederick Lewisohn, covering operations for the past year, shows a total net profit of $1,095,875; fine copper produced was 13,252,634 lb.; and in addition to this amount of copper taken from the company's mines, there was also produced 4,406,423 lb. of copper from custom ores smelted on toll account. Copper costs were estimated at 11c. per pound. The acid plant yielded 192,084 tons of sulphuric acid, which is the greatest production yet achieved, as this plant has just recently been brought to a point where it can be operated at full capacity. With regard to the policy of the company in making expenditures that have been made during the past few years, the retiring president, Frederick Lewisohn, says in his report that the seven years just passed have constituted a period of continued outlays for construction, involving the development of processes never heretofore employed, and the company has been under constant necessity of devoting large sums to the improvement and extensions of the various plants. From now on the company should be free from the delays and difficulties incident to new construction, which have been encountered in the past, and the stockholders should hereafter receive the benefit of these great expenditures.

Copper Hill, March 1.

TEXAS

El Paso County

It is stated that the American Smelting & Refining Co. will build another smelter at El Paso to handle zinc ore and concentrate from the Southwest and Mexico. The company owns some land near its present plant, and on this the new smelter, to cost $350,000, may be built.

UTAH

Juab County

The Eagle & Blue Bird company will pay a dividend of 5c. per share on April 1. On the 1350-ft. level of the mine, drifts are being driven north in ore. During 1912 the production was 22,341 tons of ore, worth $207,411, of which $91,912 was net earnings.

Salt Lake County

In January the Utah Apex Mining Co. milled 9217 tons of ore and produced 1365 tons of concentrate, all wet weight. Receipts from ore sales were $39,769, and profit from mining operations was $11,147. On the night of March 8 the Utah Copper storeroom caught fire from a hot-blast stove which had been left in the room and closed up. After a while 165 boxes of caps exploded and blew the building to pieces, and R. Hayes, son of the company's treasurer, and C. Abrams, an Italian, were killed by flying débris. The loss is estimated at $200,000.

Since last October the management at the A. S. & R. Co.'s plant at Garfield has been building tanks for the storage of oil, remodeling the reverberatory furnaces, and placing the plant in readiness for the use of oil as fuel. This is now practically completed and four of the six reverberatories have been using oil exclusively. The remaining two reverberatory furnaces are being remodeled. At present the company is using in the neighborhood of 1000 bbl. of oil per day at the plant, and with all the furnaces going it is expected that about 1200 bbl. per day will be consumed. Unlike the method used in the Steptoe Valley plant at McGill, the Garfield plant has raised the arch and widened the furnaces instead of extending them. It is probable that some of the furnaces will, in the future, be extended beyond the 20-ft. length now used at the plant. The management intends to fully try out both methods. New storage tanks have been built, two in number, each having a capacity of 20,000 bbl. of oil. In the slag dump has been sunk two smaller tanks that receive the oil direct from the cars. From this point it is pumped up to the large storage tanks which carry material enough to last 40 days at the present rate. The oil from the smaller tanks in the slag dump is used for immediate needs and the supply in the large tanks is used to provide against any emergency that might arise. The economy of the treatment of ores by oil heat is a question that the company intends to work out. The oil gives a steadier heat and a higher heat than the old method of using coal, but whether the life of the furnace will be as long as when the heat was generated by coal is a question. The work on the tanks and road over the slag bed was to have been finished about Christmas time, but on account of the blasting of slag for this work being extremely hard the work has been delayed. The furnaces are handling an average of about 750 tons of ore per day and the work has thus far given excellent satisfaction. The opening of the Utah oilfields would mean much to the smelting industry of the state. The Garfield plant is the first one to adopt oil-burning reverberatories in Utah. The Utah Copper Co. produced 7,560,521 lb. of copper in January.

Summit County

The report of the Ontario Silver Mining Co. for the year ended December 31, 1912, has been issued. The principal mining operations were carried on by the Mines Operating Co., whose lease expires in February 1921. This lease covers certain parts of the mine above the 900-ft. level. The Ontario company has been opening ore between the 1500 and 1200-ft. levels. The power-plant owned by the company has been sold to the Utah Power & Light Co. for $180,000. Revenue from ore sales and royalties was $23,606, and total receipts were $312,195. Expenditure totaled $20,841, and cash on hand amounts to $228,854.

During the year ended December 31, 1912, the Daly-Judge Mining Co. paid $225,000 in dividends and had $524,478 on hand. Development covered 9784 ft. The Snake Creek drainage tunnel is in 5700 ft. and makes 6300 gal. of water per minute. Most of the work done during the year was on the 500, 600, 700, 900, 1100, 1200, and 1400-ft. levels. At the mill one Wilfley table, one multi-deck Wilfley slimer, two Callow tanks, one Richards-Janney classifier, and one new jig were added to the equipment, resulting in a better separation of lead from zinc. The mill treated 58,951 tons of ore, and 3655 tons was shipped. Concentrate produced was 13,419 tons of lead and 4300 tons of zinc, the ratio of concentration being 3.4 tons to 1. Total ore sales amounted to $728,381. Costs were: marketing, $1.08 per ton; concentrating, 72c.; and operation, $4.70 per ton; and the total was $6.58 per ton.

WASHINGTON

Spokane County

(Special Correspondence.)—A deposit of silica, containing about 5,000,000 tons, has been found 15 miles north of Spokane by G. Latshaw and J. B. Carson. The owners have arranged with a Portland (Oregon) firm to supply 100 tons. Samples have been sent to a glass manufacturer at Pittsburg, and fine glassware was made, the product being considered of high grade. Samples have also been sent to the U. S. Geological Survey for report.

Spokane, February 26.

CANADA

British Columbia.

(Special Correspondence.)—At a special meeting of the Granby Consolidated, the president of the company, W. H. Nichols, stated that the limits of the Hidden Creek ore reserve had not yet been reached. The main adit is 2000 ft. in length on the 530-ft. level, and there are also other adits 100 ft. apart and connected by cross-cuts. The character of the ore is much the same as that at Phoenix, except that it contains about twice as much copper. With reference to the equipment of the property, he stated that the proposed smelter would cost about $1,500,000, and the entire plant $2,500,000. Up to the present time there has been expended about $1,500,000. While stipulating that he did not speak for the entire board of directors, Mr. Nichols said that he thought the shareholders might expect to

receive dividends regularly, while the Hidden Creek property was brought to the point of production.

New York, March 6.

Ontario

(Special Correspondence.)—The new owners of the Dominion Nickel Co.'s holdings in the Sudbury range have started operations. It is now stated that the Guggenheims have obtained an interest and will be associated with the Rothschilds in development of the properties. J. E. McAllister, formerly of the British Columbia Copper Co., will have charge of operations, and it is understood that $5,000,000 has been appropriated to cover the costs of construction and equipment of the mines and smelter. Engineers are laying out the ground, and construction work will be started as soon as possible. The metallurgical process has not yet been definitely decided upon, and no action will be taken until the process in use at the smelters in Norway has been investigated. It is also understood that the company will refine nickel in Canada, and in this case they must look for their market abroad, as there is a duty of 40% on refined nickel entering the United States.

Sudbury, March 3.

The new McIntyre mill at Porcupine is in full operation. It has been decided to increase the Dome mill from 40 to 80 stamps, the present plant having 450 tons capacity. The Beaver Consolidated mill at Cobalt is now treating 100 tons of ore per day, the increase having been obtained by the addition of a ball-mill, two pebble-mills, and six tables. At the 700-ft. level in the mine a cross-cut is being driven toward the vein. During the first quarter of its fiscal year the Conlagas mine produced 900,000 oz. of silver. Ore shipments from 23 Cobalt mines for the first two months of this year totaled 2301 tons, and bullion shipments from 10 mines were 1,154,340 oz., worth $614,448.

Yukon

During the year ended December 31, 1912, the output of the Yukon Gold Co. was worth $4,863,448, working costs were $2,142,029, and operating profits $2,721,419. From these profits were deducted royalties, $692,995; amortization and deferred charges, $577,146; and interest, general expenses, and examinations, $378,686.

Dredge No. 1 of the Yukon Gold Co., on Lower Bonanza creek, was blown up by dynamite February 24, at night. The charge was placed on the deck about midships. The explosion tore a hole about 8 by 20 ft. in the deck, destroyed twelve frames, housing, tables, and save-all, but did comparatively little damage to machinery. The hull filled and sank. On pumping out the pond, only a small hole was found in the bottom of the hull, and few main timbers were injured. Abundant materials are on hand for repairs, which have since been started. It is expected that the dredge will be ready to start operation with the rest of the fleet. No motive for the act is known and the perpetrator has not yet been discovered.

CHILE

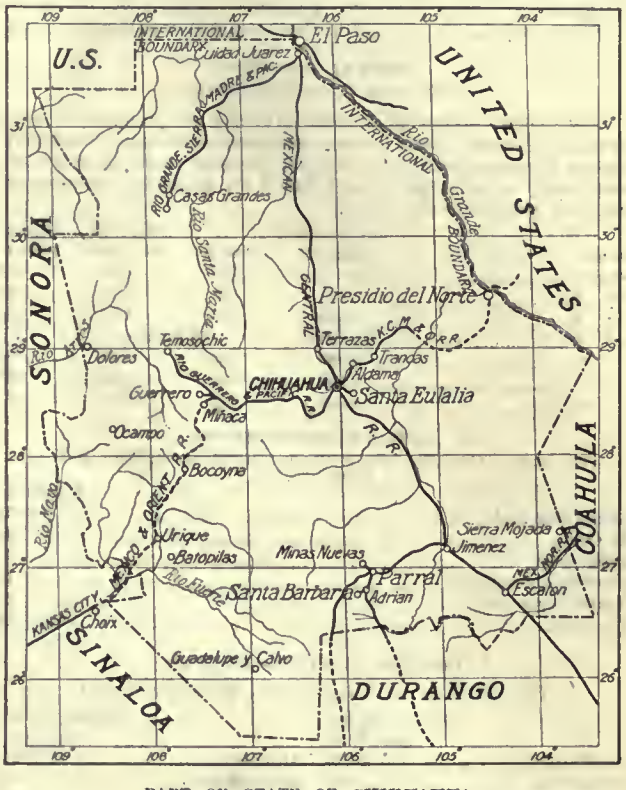
During January the Braden mine produced 742 tons of copper, from the treatment of 10,720 tons of ore averaging 2.34% copper, with 66.07% extraction, and the Minerals Separation plant treated 5451 tons of 2.28% ore with 70.20 recovery. This was in the old mill. The new mill treated 39,164 tons of 2.38% ore with 62.87% extraction, and the flotation plant 13,810 tons of 2.22% ore, with 71.5% recovery.

MEXICO

Chihuahua

Electric power from the power-station at the Conchos river is to be transmitted to all the mines in the Parral district as soon as the cables are erected. The Mines Company of America has made a claim against the Mexican government for $36,000 for damages done by rebels to its property.

The troops of this state, who rebelled against the Huerta government, and left Parral last week after mobilizing and recruiting at Santa Barbara, returned on March 5 to retake the city. About 1000 federals from Chihuahua City had reinforced the 200 regulars at Parral. On the afternoon of March 5 a battle started and continued until the evening of March 7. The rebels took the fortified hills surrounding the city, but were dislodged soon after. There were several hundred people killed and wounded, and the city, which is the centre of American mining and industrial



PART OF STATE OF CHIHUAHUA.

interests, was almost destroyed by bombardment and street fighting.

Mexico

During January the Esperanza mill treated 5542 tons of ore and 9044 tons of tailing, and shipped 287 tons of concentrate to the smelter for a total yield of $107,960. Expenses, including $5000 for depreciation of plant, were $81,263, leaving $26,697 profit. Development covered 847 ft. On the San Carlos vein the north drifts have been advanced 210 ft., the average width being 5 ft., assaying $20 per metric ton; also, 125 ft. has been advanced in the raises, ore being 5 ft., worth $40 per ton. Sinking done was 35 ft. in andesite.

San Luis Potosi

On February 11 a band of rebels attacked the property of the Tiro General, which belongs to the American Smelting & Refining Co. They were driven off, but the management abandoned the mine later on, and the rebels returned and looted the place. The damage is estimated at $100,000 and will be heavier if pumps are not kept working. S. F. Shaw is in charge and military protection is being provided.

Sonora

El Tigre mining district was attacked on March 9 by 100 rebels, and the garrison of 160 Federal soldiers surrendered. One hundred Federals escaped with arms and ammunition, but the rebels overtook and disarmed them. The victors of Nacozari and El Tigre are marching upon Agua Prieta and Nogales.

VENEZUELA

The first cargo of iron ore sent to Philadelphia from Imataca, by the Canadian Venezuelan Ore Co., Ltd., of Montreal, averaged 68.20% metallic iron, 0.016% phosphorus, 0.042% sulphur, 1.40% silica, and 0.231% titanic acid. This property is situated about 75 miles from the mouth of the Orinoco river, and over 10,000,000 tons has been opened. Two geologists engaged in exploration of petroleum fields near Lake Maricaibo for the Barber Asphalt Co. have been captured by Indians.

Market Reports

LOCAL METAL PRICES

San Francisco, March 13.

Antimony	12—12½c	Quicksliver (flask)	40
Electrolytic Copper	18—18½c	Tin	52—53½c
Pig Lead	4 60—5.55c	Spelter	8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES
(By wire from New York.)

NEW YORK, March 13.—Copper is firmer on account of better domestic demands. Lead is easier with larger offerings by producers. Spelter is firmer with more buying. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Mar. 6	14.77	4.34	6.25	59⅜
" 7	14 80	4.34	6.25	58⅞
" 8	14.80	4.33	6.25	58⅜
" 9	Sunday.	No market.		
" 10	14.80	4.33	6 25	58¾
" 11	14 80	4.33	6.25	58⅜
" 12	14.80	4.33	6.25	57⅞

LONDON QUOTATIONS
(By cable, through the courtesy of C. S. Burton & Co., New York.)

	March 13.
Camp Bird Ltd	$ 4⅞
El Oro	4½
Esperanza	7
Oroville Dredging	1¾
Santa Gertrudis	6⅝
Tomboy	6⅝

COPPER SHARES—BOSTON
(By courtesy of J. C. Wilson, Milla Building.)

	Closing prices. March 13.		Closing Prices. March 13.
Adventure	$ 2¾	Mohawk	$ 48½
Allonez	36¾	North Butte	27¾
Calumet & Arizona	63⅜	Old Dominion	48
Calumet & Hecla	455	Osceola	88
Centennial	15½	Quincy	67½
Copper Range	44	Shannon	10¾
East Butte	12¾	Superior & Boston	3½
Franklin	6¾	Tamarack	28
Granby	59¼	U. S. Smelting	40
Greene Cananea	8	Utah Con	9¾
Hancock	20	Victoria	1½
Isle-Royale	21¾	Winona	2¾
Mass Copper	9½	Wolverine	61

NEVADA STOCKS
(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 13.

Atlanta	$ .16	Midway	$ .49
Belmont	7.45	Montana-Tonopah	1.55
Big Four	.88	Nevada Hills	1.22
Buckhorn	.90	North Star	.22
Con. Virginia	.21	Ophir	.19
Crown Point	.30	Pittsburg Silver Peak	.55
Florence	.50	Round Mountain	.50
Goldfield Con	2.85	Sierra Nevada	.11
Halifax	1.20	Tonopah Extension	1.80
Jim Butler	.77	Tonopah Merger	.82
Jumbo Extension	.28	Tonopah of Nevada	5.50
MacNamara	.21	Union	.12
Manhattan Consolidated	.06	West End	1.32
Mexican	.73	Yellow Jacket	.23

MINING STOCK QUOTATIONS—NEW YORK
(By wire from C. S. Burton & Co., New York.)

	Closing Prices. March 13.		Closing Prices. March 13.
Alaska Mexican	$12½	McKinley-Darragh	$ 2⅛
Alaska Treadwell	41¾	Miami Copper	22⅝
Alaska United	22⅜	Mines Co. of America	2⅜
Amalgamated Copper	69	Nevada Con	17
A. S. & R. Co	69	Nipissing	8⅞
Braden Copper	8⅝	Ohio Copper	¾
B. C. Copper Co	3¾	Ray Con	18⅝
Chino	39	Tenn. Copper	36
First National	2	Tonopah Belmont	7⅜
Giroux	3	Tonopah Ex	1⅛
Goldfield Con	2¾	Tonopah Mining	5⅜
Greene-Cananea	8	Trinity	4½
Hollinger	17	Tuolumne Copper	2⅜
Inspiration	16¾	Utah Copper	53
Kerr Lake	3	West End	1¾
La Rose	2¾	Yukon Gold	3
Mason Valley	7⅛		

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

J. A. MURRAY is in San Francisco.

C. M. EYE has returned from Mexico.

SMITH MCKAY is here from Hamburg.

W. H. STORMS has gone to Shasta county.

STEPHEN BIRCH is visiting Peru and Chile.

C. F. SPAULDING is back from Reno, Nevada.

T. M. LEE, of Reno, is at the St. Francis hotel.

R. P. MCLAUGHLIN was in Bakersfield last week.

CLIFFORD DENNIS has returned from eastern Nevada.

R. T. MASON, of Salt Lake City, is in San Francisco.

W. E. PERDEAUX, of Bakersfield, is in San Francisco.

J. V. N. DORR has returned to Denver from New York.

E. F. PELTON is at Columbia University, New York City.

C. S. HALEY is at Panama, but will return to California March 20.

CHARLES JANIN will sail for London from New York March 29.

THOMAS F. PHELAN, of Santa Monica, is visiting San Francisco.

S. J. LEWIS has removed from Guadalajara to Calle Gante 14, Mexico City.

EDGAR RICKARD left San Francisco Friday, returning to London by way of New York.

ALEXANDER ANDERSON has been visiting Western mining districts and was in San Francisco.

EDGAR NEWHOUSE is in Peru and will go from there to Europe by way of Chile and Buenos Ayres.

JOSEPH HENDERSON is foreman and superintendent of the Rhoads-Hall mine on Bedrock creek, Alaska.

J. S. C. WELLS has gone from New York to Santa Domingo. He will return about the first of July.

F. G. FORESHAW left London for Papua, his address being in care of Bank of New South Wales, Port Moresby, Papua.

LLOYD N. KNIFFEN, of White Oaks, New Mexico, is now with the United States Metals Refining Co., Grasselli, Indiana.

ALLAN CUNNINGHAM has resigned as superintendent of the Rhoads-Hall mine to take a position with the Rexall on Wolf creek.

C. R. CORNING and BRADLEY STOUGHTON were among those attending the meeting of the Canadian Mining Institute at Ottawa last week.

A. B. W. HODGES is returning to the United States from Peru. He will probably make headquarters hereafter in one of the Pacific coast states.

GEORGE MATTHEY, who died recently in England at the age of 88, was chairman of Johnson, Matthey & Co., and was best known for his researches on platinum and associated metals.

L. D. RICKETTS, J. PARKE CHANNING, NORMAN CARMICHAEL, J. C. GREENWAY, WILL L. CLARK, A. T. THOMPSON, E. A. COLLINS, and P. G. BECKETT were at Tucson recently to take part in the formation of a Mine Operators' Association, of Arizona.

THE next regular meeting of the 'Old Freibergers in America' will be held on Tuesday, March 25, 1913, at the Hofbrau-Haus, Broadway and 30th street, New York City. This is the 147th anniversary of the founding of the Freiberg *Bergakademie*. At this meeting it is expected that definite plans will be made to hold a meeting in San Francisco and that arrangements will be made to get a large number of the members to plan to go over to Freiberg in 1916 and help celebrate the 150th anniversary of the founding of the old mining school.

Company Reports

WASP NO. 2 MINING COMPANY

The annual report of the Wasp No. 2 Mining Co., covering the year ended December 31, 1912, has just been issued to the stockholders. It shows that the mine was operated steadily except from January 4 to February 13, when extreme winter weather forced a suspension. There was mined 158,840 tons of ore, which yielded $308,175, or an average of $1.94 per ton. Mining cost $90,077, or $0.567 per ton; milling, $99,513, or $0.627 per ton; general expenses were $6377, or $0.04 per ton; a total of $1.234 per ton. Rents and incidental profits bring the gross profits of the year up to $115,519, of which $85,000 was paid in dividends. There were no extraordinary changes or improvements made during the year, the dry-crushing cyanide plant operating satisfactorily, and the open-cut system of mining, utilizing a steam-shovel for stripping, giving about the best possible economical results.

HEDLEY GOLD MINING COMPANY

During the year ended December 31, 1912, development at the Nickel Plate, Silver Plate, and Sunnyside No. 4 mines covered 1340 ft., and 6380 ft. of prospecting by diamond-drill, and ore reserves in the Nickel Plate and Iron Duke claims are estimated at 413,000 tons averaging $11.35 per ton. Mining below No. 4 tunnel-level has been satisfactory, and an incline shaft, known as 'Dickson's incline' has been started, and will be sunk 3000 ft., to be under all the known orebodies, including those in the five claims acquired for $145,913. This should then give payable ore for a length of 1100 ft. The reserve tonnage of broken ore has been maintained at 10,000 tons. The report also gives the following information:

Ore treated, tons	70,445
Gold production	$748,133
Extraction, per cent	95
Total costs, per ton	$5.14
Profit	$385,880
Dividends, No. 10 to 13	360,000
Surplus	226,841

Wages have been increased, and all improvements to plant charged to operating expenses.

GOLDFIELD CONSOLIDATED

During the month of January 1913 the total production of Goldfield Consolidated Mines Co. was 27,169 tons, containing $535,736, or an average of $19.72 per ton, according to the report of J. F. Thorn, general superintendent. Of this, 25,549 tons was milled with an average extraction of 93.76%, and 1620 tons was shipped of an average value of $21.57 per ton, the net recovery from all ore being $18.57 per ton. The net realization was $327,956, or $12.07 per ton. During the month 3296 ft. of development work was performed. The total cost of mining, development, transportation, milling, office, and general expense was $6.64 per ton, distributed as follows:

Mining (including stoping and development)	$3.09
Transportation	0.08
Milling	2.27
Marketing	0.07
General expense	0.30
Bullion tax	0.14
Construction	0.06
Marketing ore	0.70
Total cost of operation	$6.71
Miscellaneous earnings	0.07
Net cost per ton	$6.64

In the Combination, the sill of the 136-BX stope on the second level, about 350 ft. north of the shaft was considerably extended, and produced 1375 tons of ore that averaged $30.56 per ton. The 163-M stope is being cut about 50 ft. north of the 136-BX, and a drift between the two stopes indicates that they are of the same orebody, making a total length of nearly 200 ft., with an average width of 40 ft. Two raises in this orebody have reached a height of 45 ft. Drifts, cross-cuts, and raises are being driven under this on the third level, but up to the present time not enough work has been done to demonstrate its downward extent. In the Mohawk, the 466 cross-cut in the foot-wall of the 490-R stope, between the 450 and 600-ft. levels, and about 250 ft. south of the 354 stope, has been driven 20 ft. through ore that averaged $20 per ton. Two raises and a cross-cut under the big 354 sill are being driven in ore that is averaging about $50 per ton. In the Laguna, rather an important discovery was made in this mine in the 348 intermediate below the 329 stope, between the 450 and 600-ft. levels, 700 ft. south of the shaft. The 303-J raise driven into the hanging wall of the 348, exposed 16 ft. of ore averaging $80 per ton. The 303-K raise driven into the hanging wall from the 329 intermediate 60 ft. higher up, exposed 12 ft. of ore averaging $10 per ton. Other raises are being driven to determine the extent of this orebody.

In the Clermont, the 604-W stope on the downward extension of the 534 orebody, just below the 900-ft. level, 750 ft. south of the shaft, produced 359 tons of ore which averaged $53 per ton. The 802-A sill on the 1300-ft. level was considerably extended, and produced 862 tons of ore that averaged $25 per ton, which was shipped to the smelter. The 420 stope under the 413 sill, about 700 ft. south of the shaft, has been producing a large tonnage of good ore, which has brought the average grade of the Clermont up to about $40 per ton for the month. The formation on the 1400-ft. level is promising, and it is expected that the 1300-ft. orebody will be found at this depth within a short time. The diamond-drill is on the ground, and will be in operation about March 1. A short hole will be drilled in the Reilly vein on the 450-ft. level of the Combination, and after this hole is completed, the machine will be used to prospect the territory below the 1400-ft. level of the Grizzly Bear.

HOMESTAKE MINING COMPANY

This company owns one of the largest gold mines in the world; its mine, 1000 stamps, huge tailing and slime plants, and hydro-electric plant are valued at $21,840,000. The report of the superintendent, T. J. Grier, is extremely short for so important a mine. He states that during the year development covered 914 ft. of raises, 550 ft. of shafts, and 15,264 ft. of drifts, and that there is broken in the stopes 2,030,217 tons of ore. The Ellison shaft is 1850 ft. deep; B. & M., 1550 ft.; Golden Prospect, 1100 ft.; Golden Star, 1400 ft.; Old Brig, 800 ft.; and Golden Gate, 800 ft. deep. The hydro-electric power-plant on Spearfish creek was completed, and power supplied to the works. At January 1, 1913, the balance in banks was $1,614,928; with superintendent, $83,051; and bullion in transit, $273,796. The mills and cyanide plants were described in detail by A. J. Clark and W. J. Sharwood in Bulletin No. 28 of the Institution of Mining and Metallurgy. From the report the following data have been worked out:

Ore treated, tons	1,528,923
Average value, per ton	$4.31
Production	$6,600,953
Receipts from other sources	189,944
Dividends	1,310,400
Costs.	Per ton.
Shafts	$0.01
Mining and 'dead work'	1.52
Milling	0.28
Cyaniding sand	0.12
Regrinding	0.02
Cyaniding slime	0.10
Expenditure in assay office	$ 22,973
Expenditure in foundry and shops	89,986
Purchase of property	151,567
Hydro-electric plant	237,368
General expenses	580,705
Hospital and recreation hall	79,062

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

SILVER-PLATING at the six stamp-mills of the Homestake company cost a total of $26,577 in 1912.

STEAM consumption at the Douglas power plant for the first five months of 1912, on an output of 4700 i.hp., was 13.65 pounds.

WASTE of resinous wood in the lumber industry of the United States amounts to 8,000,000 cords. This can be manufactured into paper products worth about $300,000,000.

MONAZITE is found disseminated through the old placer gravel beds of central Idaho, particularly in the Boise Basin, Long Valley, Rock Flat, Resort, and Warren districts.

PHOSPHATE ROCK is produced from the Waterloo mine, near Montpeller, Bear Lake county, Idaho. The deposit occurs in all respects like pitching coal veins, and are mined with similar tools, at a cost about the same. The rock is clean and requires little sorting, and the average grade shipped is about 70% calcium phosphate, being free from iron and alumina.

SILVER used in manufactures and fine arts in 1910 amounted to 24,789,807 fine ounces, of which 77,344 oz. was from United States coin, 19,691,780 oz. from domestic bullion, 3,417,704 oz. from foreign bullion and coin, and 1,602,979 oz. from old material. The consumption in 1911 was in excess of these figures. Gold used in similar work amounted in value to $41,382,832.

WATER, from mines and other sources, which contain a high percentage of carbonates or chlorides, may be evaporated by the system which uses live steam from boilers and passes through three evaporators. The cooling of steam in raising the temperature of the water produces a vacuum, and consequently less heat is required to reach boiling point. Such a plant is being installed at the Burbanks Main Lode mine, in Western Australia, and is used on steamers and at sugar mills.

THE apex rights of a blanket or flat vein depends upon how clear is the proof of the vein dipping. Apex rights are not allowed on the outcrop of the dip, only on the apex or outcrop of the strike. It is usually hard, in the case of flat veins, to say what is the strike and what is the dip, and in such cases no apex rights are allowed. Speaking generally, there must be a substantial dip before apex rights will be allowed. How much dip is required cannot be said. Deposits which require to be located as placers have no apex rights. Known lodes in placers have dip rights, but other lodes in placers have not.

POHLE AIR-LIFTS may be constructed with the following dimensions to give the capacity stated:

Air pipe, in. diam.	Water pipe, in. diam.	Well pipe, in. diam.	Gallons, per min.
½	1	3	7
¾	1½	4	20
1	2	4½	35
1	2½	5	60
1½	3	6	90
1½	3½	7	120
1½	4	8	160
2	5	9	250
2	6	10	350

GALENA is more resistant to weathering agencies than are the copper sulphides. Where, therefore, galena is found with copper oxides, carbonates, and minor amounts of copper sulphides, in a surface outcropping, there would seem to be more probability of an increase of copper in depth than of lead. So far as surface agencies have entered into the matter they would normally concentrate the lead at or near the surface and carry such copper as was dissolved, into the zone of secondary enrichment. All such deductions must be received with caution, since variation in richness of the primary ore-shoot may more than offset differences due to this secondary action; also secondary galena is known and under favorable circumstances may be abundant.

TUNNEL-SITE LOCATIONS are not strictly mining claims, but such a location gives an inchoate right which may be developed to patent blind and unknown lodes cut by the tunnel. The rights and requirements are succinctly stated in the statutes and regulations. The locator, on commencing work, acquires the right to all veins which may be cut by the tunnel within 3000 ft. of its portal; provided these veins do not exist on the surface, but are blind veins whose existence has theretofore been unknown. The right entitles him to 1500 ft. of the strike of each vein cut, all on one side of the tunnel or divided as he may desire, and from the apex to the lowest depth, just as if located on the surface. He acquires no specific rights by this location over any prior locations, no right to any blind lodes apexing in their ground which he may cut, or right of way through their ground. All locations made subsequent to the commencement of work in the tunnel are made on the peril of losing any blind veins apexing in them, which the tunnel locator may be entitled to through cutting in his tunnel, and which are subject to his right of way.

EXCLUSION OF WATER from oil wells is one of the most important problems connected with economical recovery of oil. In California it has been accomplished in a number of ways, but so far the most uniformly successful method is the cementing process, which is used with slight modifications throughout the 11 principal districts of the state. The operation is in general accomplished in two ways: (1) By pumping the cement mixture through tubing, whence, unable to flow back between the tubing and the casing, it is forced outside the casing; or (2) by lowering the cement mixture in a dump bailer, and forcing it to the outside either by means of a plunger driven down with the aid of water under pressure, or with a plug fitted to the end of the casing. The first mentioned method is commonly known as the pump method, and the devices used for the latter, according to detail, are variously designated by the names of inventors, as the Perkins cement plunger, or the Baker cement plug. The pump method may require from 700 to 50,000 lb. of cement, and the cement is allowed to remain undisturbed for 12 to 14 days, when the tools are run in, and the hole drilled out for about 10 ft. below the casing shoe, and the well let alone for another 24 hours.

COMPRESSED AIR is used for hoisting at the Copper Queen mine, Arizona, and the plant consists of the following: The power plant consists of three air-compressors, two of which are 2-stage, driven by compound steam engines, each delivering 3500 cu. ft. of free air per minute at a rated speed of 75 r.p.m., the third being 2-stage, driven by a triple-expansion four-cylinder steam engine, delivering 7000 cu. ft. at 72 r.p.m., the average pressure being 90 lb. per sq. in. The air-compressor engines are connected to individual ejector condensers. The air is used to operate five first-motion and two geared hoists, several hundred machine-drills and tools, a few air-jet blowers, and some small hoists in the mine. Air for the surface hoists is reheated to 275°F. before use. The old boilers at the various hoists are used as air-receivers to equalize the work of the compressors. In 1911 the average consumption was 6127 cu. ft. of free air per minute, but as the mines are only worked for 16 hr. per day, on six days per week, the consumption during working hours is probably 9000 cu. ft. Two of the first-motion hoists take air for a few seconds at a rate of over 5000 cu. ft. per minute when starting, and require from 1400 to 1600 cu. ft. per shaft per hour. To compress the quantity of air at the power plant takes from 50 to 55 lb. of steam, or approximately 50% of the steam the hoists consume when operated by steam.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

COMPULSORY industrial accident insurance, covering all employees, is proposed in the bill fathered by the California Industrial Accident Board and now before the Legislature at Sacramento. To reduce the charge, optional state insurance is proposed at cost.

APPOINTMENT of Mr. W. G. McAdoo to be Secretary of the Treasury, while it does not place an engineer in the cabinet, at least gives the President an adviser who is perhaps best known for his share in the accomplishment of a great engineering project. We anticipate that Mr. McAdoo will be known longer as the man who tunneled under the Hudson, than as a lawyer.

MINING does not respect political boundary lines, as is forcibly impressed by reading the list of machinery used in the Scheelite mill described by Mr. V. G. Hills on another page. The fact that Montreal investors in a Nova Scotia mine drew on the experience of a Colorado engineer to plan the work, is a further illustration of the close bonds that tie mining men together.

MECHANICAL charging of blast-furnaces has many advantages and many difficulties. The plan adopted at the Tennessee plant of the Ducktown Sulphur, Copper & Iron Company has been operated so long as to be beyond experiment. Through the courtesy of Mr. W. H. Freeland, the inventor, and Mr. C. W. Renwick, the general manager for the company, we are able this week to give full details.

ATLIN and indeed the whole northwestern coast is excited over reported discovery of placer ground "yielding $6 per pan" at the head of Jennings river in Cassiar mountains east of Lake Teslin. Report of the discovery comes from Skookum Jim, the Indian who was associated with George Carmack in finding the Klondike. A stampede is on, but how important, and with what chance of success, is yet unknown.

UTAH is to be congratulated on having a state mining school that believes research to be no less a part of its work than instruction. No phase of modern university development in the United States is more striking, or, we believe, more significant, than this disposition to make the university in the fullest sense the servant of the state. Discovery of a new method, or adaptation of an old one to meet new difficulties, may well render available ore worth many times the amount of money spent in investigation.

WITHDRAWAL of potash lands from entry does destroy any valid rights previously acquired by location. To set this matter at rest, the order signed by Mr. Taft included the following phrase: "This withdrawal is made subject to all rights lawfully initiated under any valid mining locations made upon such lands so long as such rights are maintained in full compliance with the law.

DROUGHT has been staring in the face the miners of such widely separated states as California and Rhodesia. Up to this week only about half the normal amount of rain had fallen in California, and early in February Rhodesia had received but one-tenth its usual precipitation. The rain that fell Monday last on the Pacific Coast brought comfort to miners and farmers as well. Copious rains are also reported to have fallen recently at Bulawayo and to have relieved anxiety.

NATOMAS CONSOLIDATED has been much in the public eye this week, both because its work in gold dredging and land reclamation has come up for comment in connection with the proposed regulation of dredging, and because of the annual meeting. At the latter Mr. F. W. Griffin, as president, presented a cheerful report on the year's work, of which details are given in our news columns. The stockholders indicated their approval by re-electing the incumbent officers. Mr. Griffin's statement that the company is now fully equipped, emphasizes the point not generally appreciated, that the area of dredging ground is limited, and that even a company with such large holdings as the Natomas cannot go on indefinitely enlarging its plant.

AUSTRALIANS have been celebrating the founding of the new capital of the Commonwealth at Canberra. While there are rumors of discontent at the choice made, and it is, in particular, insisted that the Dalgety district would have afforded a better site, a capital is, after all, the first consideration. State feeling is strong in Australia and the states are much more autonomous than with us. Means to bind the people together, to weld them into one nation, are needed if the Commonwealth is to gain rapidly that place among governments that its area and resources together with the spirit of its people entitle it to aspire. We join in good wishes for Canberra coupled with a modest feeling of pleasure that the plan is that of an American. Our own Washington was laid out by a French engineer, and so we make return to another for what we received from an older people.

ORE DRESSING, lying in the twilight zone between mining and metallurgy as they were long defined, is coming into its own. The field is an inviting one, and the rapidly growing disposition to sieze and apply in it the latest result of abstract science, is a particularly healthy sign of advancement. The study of colloids in relation to ore dressing that we present this week, is an instance in point. Colloids have long been rated puzzling substances through which, while solutions might, as chemists aver, diffuse unimposed, ideas have struggled slowly. We had the pleasure of publishing one of the first important papers on colloids in relation to ores, that of the late H. E. Ashley. Mr. Caetani carries the discussion further and shows just how colloids, sand, and slime complicate the problem of the mill-man. A gradnate of the Univeristy of Rome, of Columbia, and the Bunker Hill mill, Mr. Caetani has an unusual combination of theoretical and practical knowledge. We are glad to announce that he has become one of our special contributors and will write especially about ore-dressing problems. He has an elaborate series of articles in preparation. A number are already completed and others will be available within the year.

MEXICAN conditions change too rapidly for comment by a weekly paper. In the City of Mexico the tone is distinctly hopeful. It is generally agreed that the government is in the hands of strong and competent men. Bankers and mining men are regaining confidence, and the hope is expressed that three months will see an end of disorder. An unexpected and pleasant feature of the situation is the disappearance, at least on the surface, of the anti-American feeling that has been a cause of much anxiety. In the south the situation is unsettled, and it is still to be decided whether Zapata and his followers will continue to fight. If left alone, General Huerta probably would be able, by vigorous measures, to restore order. The surprising feature of the situation is the widespread revolt in the northern states. How substantial the movement may prove when strong columns of regular troops move into the territory, is uncertain, but at present the rebellion shows more signs of popular support than any since the original Madero rising.

PLATINUM discoveries in British Columbia have been repeatedly reported in the last few years, especially by Mr. A. Gordon French, who claimed to have discovered a new method of assay which permitted finding minerals of the platinum group not detected by ordinary analysis. The new localities have been investigated most painstakingly by Mr. W. Fleet Robertson, the capable provincial mineralogist. Mr. Robertson took samples of the reputed platinum-bearing rock and had them assayed both by the ordinary and Mr. French's special method, with negative results that are conclusive. The only firm reporting any platinum in the rock was the S. S. White Dental Company, which is engaged in the manufacture of platinum ware, but of the competence of whose assayer, as Mr. Robertson justly observes, he knows nothing. Remembering the ease with which contamination of ware and fluxes occurs in a commercial laboratory, the evidence of these few assays can hardly lie against negative results from the laboratories of the Bureau of Mines at Ottawa, Johnson, Matthey & Company, the United States Mint, Ledoux & Company, Consolidated Mining & Smelting Company, and the British Columbia government laboratory. In settling this question, though in the negative, Mr. Robertson has performed as valuable a service as though he had discovered a new lode. Government officers must

often puncture rising balloons of hope, but it is theirs to determine always the exact facts and protect the public from exploitation.

LABOR matters at Cobalt have given rise to a good deal of uneasiness among mine managers, and it is feared that there are possibilities of a strike some time in the near future. The miners held a meeting on February 9 to consider the matter, and there were a number of men who were anxious to call a strike at once. The eight-hour law is to come up before the Ontario legislature, and it is believed there is little possibility of it passing. It is thought that this might give the necessary stimulus to the miners to call a strike, and in order as far as possible to offset this action, the mine managers throughout the district met and decided to put the mines on a nine-hour basis. Previous to this, a couple of the mines were working eight hours, others were working nine, while the majority were working ten. Only those mines which were previously working ten hours will be affected by the new regulation. It is not as yet known what influence this may have on conditions, but it is believed that a large majority of the men who have their homes and families in the district are not at all anxious to strike.

Witwatersrand Geology

Johannesburg advices announce the publication of an important monograph on the geology of the Rand, written by Mr. Edward T. Mellor of the Geological Survey of Transvaal. It has long been a matter of comment that no adequate study of the world's greatest goldfield had been made by official geologists. To this it was replied that the importance of the mines had caused the Rand companies to employ the best geologic talent in private studies, and that accordingly much more was known of the Rand than the rest of the Transvaal. The government geologists, therefore, long devoted their major attention to the back districts which, because of failure to promise immediate returns, were not investigated by those privately employed. It came to be realized a couple of years ago that final conclusions could only be drawn from the broadest studies and that for a variety of practical reasons, only a geologist employed by the Government is ever likely to have all of the data before him. As we noted at the time, the Transvaal Survey then entered upon a serious study of the Rand. The volume now published is the first fruit of this investigation and deals with the lower or unproductive division of the Witwatersrand system.

It will be remembered that the gold deposits at Johannesburg occur in certain pre-Cambrian sediments separated by unconformity both from the Swaziland schist and granite below, and the Ventersdorp volcanic lavas, breccias, and conglomerates above. The system itself is divided into an upper and a lower series. The 'reefs' of gold ore that have been mainly worked, occur in the upper division and in the central part of the great area of outcrop. In this part of the field the lower division is poorly developed, but on the Western Rand the beds are well displayed and attain great thickness. The importance of this lower division will be realized when it is recalled that the Brixton section, according to Hatch and Corstorphine, measures 12,650 feet. The difference between the thickness of the beds in the central and western fields, in the absence of unconformity, has been a great puzzle, and the accepted explanation has been an abnormal development to the west. There has always been the hope that in this great thickening of the quartzites, slates, and conglomerates to the west there might be found a corresponding development of gold-bearing 'reefs,' and much money has been spent upon this theory. Patches of ore have been found, but no such continuous bodies as would be called for by the theory of abnormal development. It was to this problem that Mr. Mellor addressed himself, and he finds an explanation in the greater compression to which the beds in the central field have been subjected. He has traced the horizons of one field into the other and made a complete correlation of the beds. That the lower rocks of the Central Rand have been contorted and compressed has long been recognized, but it was not thought that the amount of compression was sufficient to account for the difference in thickness of the rocks in the two areas. Mr. Mellor's explanation will be received with much interest by students of the pre-Cambrian elsewhere, and if the complete evidence, when at hand, sustains his conclusions, as it presumably will, a new and valuable quantitative statement of the effect of one of the earth's great processes will be available. Previous measurements have been of crustal shortening during regional mountain-making. The effect locally of vertical compression has been studied only in a small way.

There is nothing in this first report touching on the geology and structure of the Main Reef series, the principal gold carrier on the Rand, but to this equally detailed attention is being given. That subject is so important and far reaching that it was deemed inadvisable to go into details at this stage of the survey. The Elsberg series is considered by Mr. Mellor to be unconformable to the lower Witwatersrand beds, but not necessarily unconformable to the upper division, the evidence so far obtained pointing to overlap. Nevertheless, there is still much to be learned before the geology of the Elsberg series can be said to be fully known, nor can it with any degree of accuracy be as yet established as a separate geological system. The Elsberg series so far has not proved to be of much economic value, though it contained numerous gold-bearing reefs. The only profitable patch of superposed Elsberg reef is that of the New Reitfontein mine, but whether this is really Elsberg has not yet been established beyond doubt.

Economically this, the first volume on the Rand by the Transvaal Geological Survey, abundantly justifies itself. Indeed, if the study could have been made earlier the useless expenditure of much money would have been saved, and the mines are sure to profit largely from the succeeding volumes of the series now in preparation.

Sand, Slime, and Colloids in Ore Dressing

By Gelasio Caetani

Sand, 'fines,' crystalline matter, slime, and colloid are terms that are used rather indiscriminately to designate various degrees of comminution of an ore; the man in the mill generally applies these terms to various products as they happen to be subdivided in some particular mill. Metallurgists have advanced various definitions, but in this case definitions are based chiefly on some particular feature rather than on the intrinsic physical and chemical characteristics of these materials. It would be well if this matter were some day definitely settled; in this paper the above-mentioned terms will be used with the following meanings.[1]

Definitions

There exists only one well marked division, and that is between crystalline matter and colloid. The crystalline matter includes all particles of minerals, whatever be their size, that show a crystalline or granular structure; it has little or no chemical affinity with water, and its solubility under ordinary ore-dressing conditions is negligible. The colloid will be discussed later. The word 'sand' includes all crystalline matter that is not too coarse to be treated on reciprocating-tables of the Wilfley type. Sand may be subdivided in: 'coarse sand,' 'fine sand,' and 'fines.'

'Coarse sand' may be defined as including all sand that is sufficiently coarse to settle very rapidly and that is not carried in suspension by water running at moderate speed. Any sand coarser than 100 mesh I designate as coarse sand.

'Fine sand' will settle in a short time in still water; in the water running at a moderate speed it is kept in suspension; it will all pass 100-mesh screen, and much of it is found in the undersized of a 250-mesh screen; it can be successfully concentrated on a Wilfley table.

'Fines' includes all crystalline matter so minute that it cannot be included in the fine sand; the diameter of the smaller particles is measured in ten-thousands of an inch. At this extreme state of subdivision the crystalline matter loses many of the attributes of the coarser sand. The viscosity of water and electrostatic repulsion, in great part, or even completely, offset gravity and the particles will remain in suspension for a long time. These very small particles probably have some chemical affinity with water; in size they belong to the same order of dimension as the large polymerized molecules of colloid, and these, in flocculating, will build around some of the crystalline particles. For this reason the complete separation of colloid from the crystalline matter is not possible in practice.

The mixture of colloid and fines is called 'slime', though usually this term is applied to all material that will pass through a 200-mesh screen, regardless of the amount of fine sand it may contain. In some plants it is applied in a still broader sense to all material that is treated in the slime department, even if it contain some comparatively coarse sand.

A colloid is an amorphous substance of gelatinous nature having a well marked chemical affinity. A colloid reacting with ammonia or caustic soda becomes soluble, forming a turbid suspension that will not settle clear. The ammonium or sodium combines with the colloid, forming very large and complex polymerized molecules in which the alkaline radical is an exceedingly small part of the whole. This is the 'sol' form of a colloid. By adding sulphuric acid to a sol, the acid combines with the sodium or ammonium base and the colloid passes into the 'gel' form, which is insoluble and precipitates. By adding barium chloride or lime to a sol, the barium or calcium displaces the sodium or ammonium, forming a new compound which is insoluble and precipitates.

Colloid particles carry also an electrostatic charge which in most cases is negative; under the influence of this charge the particles repeal each other; besides this, with most clays, the negative OH ions have a marked effect in causing the colloid to assume the sol form. An electrostatic charge, therefore, has a marked effect in hindering the settlement of slime. The addition of certain electrolytes, like sulphuric acid, will not only destroy the sol compound, as previously mentioned, but will also decrease the concentration of negative ions. H. E. Ashley, from whom I am quoting freely, has discussed this subject very thoroughly.[2]

Colloids and Electrolytes

The reaction between colloid and electrolytes will vary a great deal from ore to ore; in certain cases the addition of an excess of electrolyte will hinder the settlement of a slime. From all that has been said it becomes evident that the reaction of colloids and electrolytes is quite complicated; in practice the selection of an electrolyte, and the amount required, can best be determined empirically by repeated trials. At times electrolytes such as soap or alum will have a remarkable effect in coagulating and settling slime, even if used in very small quantities. Under the action of an electrolyte the colloid assembles into flocculent masses and the water between the floccules becomes clear. Settling begins immediately and is proportional to the density of the floccules and their size. As the coagulated colloid sinks toward the bottom of a tank it displaces the water, which necessarily has to rise through the interstitial spaces between the floccules. To pass through these tortuous interstitial channels the water must overcome a frictional resistance proportional to the viscosity of the water and inversely proportional to the size of the interstitial channels. At the same time as the floccules settle they come in

[1] Revoking the nomenclature given in *Trans.* Amer. Inst. Min. Eng., Vol. XXXVII, p. 3.

[2] Ashley, H. E., *Mining and Scientific Press*, June 12, 1909. *Trans.* Amer. Inst. Min. Eng., Vol. XLI, p. 380.

contact with each other and become compressed. The measure of the force required to perform this work is given by the difference in specific gravity between the colloid and the water.

Effect of Heat

On heating the water its viscosity rapidly decreases; at 80°C. this viscosity is one-fifth of what it is at zero Centigrade, and on this account heating of the slime water, when this can be done, is most effective in accelerating the settlement of slime. In an instance analyzed by Ashley[3] the rate of settling was a linear function of the temperature; that is, by heating the water from 25 to 65°C. its viscosity is reduced to one-half and the time required to settle a slime to a certain depth is also reduced to one-half.

The addition of an electrolyte will increase both the viscosity and the specific gravity of the liquid; these two features tend to hinder the rate of settling of the colloid, but their effect is more than offset by the beneficial effect due to the coagulation of the colloid.

The size of the interstitial channels between the flocculs is another item that strongly affects the rate of settling. When the flocculs are at a considerable distance apart, either on account of the dilution of the pulp or because the colloid, in coagulating, has segregated in large flocculs, the rate of settling is more rapid; on the other hand, when the flocculs are uniformly and finely disseminated, the water finds difficulty in filtering through, and the settling is retarded. This is well illustrated by taking two glass tubes filled with water containing coagulated colloid and placing one tube vertically and the other at an angle of about 65°. In the vertical tube settling proceeds in the ordinary way; in the inclined tube the flocculs settle vertically until they come in contact with the side of the tube along which they begin to slide, while on the other, or upper, side of the tube there forms a channel of clear water. While the colloid descends along the lower side of the tube, the water rises freely through the open channel, and the settling in the inclined tube proceeds much more rapidly than the settling in the vertical tube. Settling devices based on this principle have been patented, but, strange to say, are not extensively used.

Settling Colloidal Material

Some colloids will settle gradually until they become, in course of time, a compact mass resembling clay; other colloids, instead, will settle within a few hours to a certain degree of consistence, and after that all further settling practically stops. I have had a colloid under observation in bottles for two weeks without being able to detect any further thickening after the colloid had settled to about a fifteenth of the original volume of the pulp. Lime in various proportions was used in these tests as electrolyte; what the effect of other electrolytes would have been I am unable to state. The practical result of this will be discussed later.

The repulsion between the colloid particles due to the electrostatic charge, and the resistance of the flocculs to compression, are two quantities which, to my best knowledge, have not been determined, but are by no means negligible. It is probable also that some water remains imprisoned in the flocculent, cellular mass of colloid and prevents the slime settling beyond a certain limit.

All that has been said is only a summary review of the nature and properties of colloids. The subject is a very wide one and has been the object of a great deal of scientific research work in connection with other industries, and the literature on colloids is extensive.[4]

In current ore-dressing practice it is not possible to make use of all the physical and chemical properties of the colloids; only certain electrolytes can be used, and these must be cheap or must be effective when used in very small quantities. The colloid of one ore will generally differ substantially from the colloid of another ore, and the kind and proportion of the electrolyte required can be best determined empirically by testing the slime with a large number of chemicals. Further than this, it is not necessary nor economically possible in mill work to make a complete separation of crystalline matter and colloid; usually the fine sand passing 200 mesh is separated with the colloid and this slime is treated as one product, no attempt being made to subdivide it further by classification, sorting, or sizing.

Slime

Slime must be considered from two different points of view: as a liquid and as a mill product.

The slime must be considered as a liquid as long as the agitation is sufficient to keep the sand particles in suspension. Under these conditions the slime is a liquid of higher density and viscosity than water, and as such affects the classification and settlement of the coarse sand and the flow of pulp through the launders, over the concentrating tables, and through the grinding machinery. A stamp-battery discharge containing six parts of water to one part of solid and 40% material passing a 200-mesh screen, when kept in agitation, can be considered, for all practical purposes, as a pulp consisting of one part of sand coarser than 200 mesh and of 10.7 parts of liquid consisting of the –200-mesh material kept in suspension in the water. This liquid will have a specific gravity of 1.038; the higher specific gravity of the liquid does not much increase the buoyancy of the sand, but its increased viscosity will cause the sand to settle through the liquid at much lower velocity than would be the case when settling through clear water.

This retarding effect is very noticeable in classification. In most classifiers the sand segregates from the pulp as it reaches the classifier box and sinks toward the bottom, where it is sorted by the rising hydraulic water-columns. The Richards 'hindered-settling classifier' is a typical machine of this kind. While the sand is settling, the pulp progresses through the classifier and the coarse sand therefore follows a more or less parabolic trajec-

[3] *Mining and Scientific Press, loc. cit.*

[4] See bibliography in 'Textbook of Rand Metallurgical Practice,' Vol. I, pp. 205 and 241.

tory. The size of the classifier box must be so calculated that all the coarsest sand will settle over the first sorting column, but at the same time its settling capacity must not be too great, otherwise too much fine sand will settle with the coarse and the first sorting columns become burdened with an excess of fine material. Now if in a classifier of this type, the percentage of slime in the pulp be suddenly increased, the whole regime of the classifier is upset. The increased viscosity of the liquid hinders the free settling and the trajectory of the sand particles becomes elongated, the result being that part of the coarse sand passes beyond the first sorting columns and finds its way into the fine sand spigots. With very colloidal ores I have seen the coarse sand particles go completely astray, travel right over the classifier, and get into the slime overflow. On the contrary, when the amount of slime is much reduced, the sand settles rapidly and the classifier boxes can be made smaller.

Viscosity of Pulp

The Rittinger parabolic formula does not apply to very small particles of sand as the skin friction of the particles and the viscosity of the water in great part counteract the force of gravity. The same is true when applied to coarse sand particles immersed in water containing a large percentage of colloid, and it is for this reason that all the laws of free settling seem to be upset in direct proportion to the amount of slime present in the pulp. With very colloidal pulp, it is practically impossible to keep the slime out of the classifier products except by increasing the hydraulic water and decreasing the output of the spigots. On the contrary, if the slime be separated from the sand before reaching the classifier, the classification is so much improved that even home-made crude appliances give satisfactory work. It is on this account that desliming previous to classification is being more and more adopted. No new plant ought to be erected without this arrangement, and in most of the existing plants serious efforts should be made to install a de-sliming machine of the Dorr, Akins, or 'drag-belt' type.

Choking Launders

Another effect of the presence of slime in a pulp is to increase the carrying capacity of the launders; in other words, the minimum grade required to carry a certain tonnage can be decreased. To understand this it is necessary to analyze the behavior of the sand grains when flowing with clear water through a launder.

When water flows through a launder the frictional resistance against the sides and bottom reduces the velocity of the flow near the contact surfaces; the zone of greatest velocity is found near the centre of the launder and close to the surface; small asperities along the sides deflect the water in small streamers toward the centre of the launder. The result of all this is that the water particles do not travel in a straight line, but rather follow a series of elongated, irregular helicoidal lines that rise from the sides and dip toward the centre of the launder. In addition to this, any obstacle on the bottom of the launder, as the joint between two liners, causes a raising and consequent dropping of the water and generates a well marked wave motion. The small sand grains carried along by a swift-running stream are therefore raised and lowered continuously. On the coarser sand grains the gravity preponderates over the carrying power of the water, and these grains only occasionally are raised from the bottom of the launder; these grains progress by rolling and sliding, and the rolling motion is induced by the friction against the bottom of the launder and the differential speed of the layers of water. The coarse particles of ore progress chiefly by rolling. When a launder is loaded, the grains covering the bottom are so closely packed that the rolling of one particle interferes with that of another; if the load is increased, the sand will build up several grains deep and will interfere still further with the rolling of the bottom layer; these layers of sand form a thick pulp which expends most of its potential energy in overcoming internal friction. At this point the sand particles interlock and the bottom layer stops progressing; a sand bar forms across the launder and conditions grow worse every minute. This is the pathological history of a 'choke-up.'

When the water is clear its viscosity is so small that even small grains travel along the bottom of a launder and coöperate in taking up all the rolling area available. On the contrary, when the water is slimy, its viscosity and specific gravity are increased and the small sand grains cannot settle, but are carried along by the water only 'touching the high spots.' The result is that a launder which will work satisfactorily at a minimum grade with a certain slimy pulp will refuse to work if the slimy water be substituted by clear water, the tonnage and ratio of solid to water remaining the same.

Flow of Mill Pulp

It is erroneous to believe that the flow of a mill pulp is governed by Kutter's formula and that the minimum hydraulic radius will give the best results. Mill launders must be broad, so that the sand grains can spread out and roll without interfering with each other. There is naturally a limit to everything; if the film of pulp in a launder is too thin, the skin friction of the bottom reduces so much the velocity of the water that the efficiency of the launder falls off. Coarse pieces of ore (measuring above 5 mm. in diameter) must always run one grain deep, and if the slope is close to the minimum the water film should be thick enough to cover the ore completely. Where the flow of pulp is liable to vary, a V-shaped launder has the advantage of the channel adjusting itself to the flow of pulp, but it should never be used for coarse material running at a minimum grade because it represents the most unfavorable condition for the free rolling of the particles.

As previously mentioned, when handling very fine sand and slime, the viscosity of the liquid is sufficient to offset the action of gravity on the sand as long as the pulp remains in agitation. In such case a pulp must be considered as a liquid and treated

as a liquid; the launders can be built deep and narrow. If too broad the pulp will deposit banks of sand on the bottom of the launder and only a tortuous channel will remain open through the middle. It is a good practice to use pipes for this kind of pulp; a pipe is cheaper, cleaner, and neater than a launder, and can be run even uphill if there is sufficient hydraulic head available. When this is the case, even coarse sand can be conveyed in this manner. A horizontal pipe has the peculiar equality of adjusting the area of open cross-section in accordance with the flow of pulp; if the pipe is too large it will partly fill with sand; when the flow of pulp increases it will increase the hydrostatic head back of the restricted section and erode the sediment until equilibrium is again established.

Settling Sand

The sand in general will not form accretions permanent in character; where there is a chance for settling, the sand will rapidly lodge itself, and if exposed to vibration and boiling, a concentration of the gold and heavier minerals will take place. This enriched material is, however, easily eroded when the dilution of the mill pulp increases, and this accounts for the increase in the percentage of concentrate that appears on the tables when the feed is cut off from the mill.

The slime in general has a marked tendency to form accretions. Not only will accretions form, and on the side and on the bottom of a launder, but even the water from a settling-tank, after having stood practically motionless in the tank, will on entering a steep launder form slimy or gelatinous deposits that it would be hard to conceive could be deposited from swift-running water. Most of this material is gelatinous, and it is probable that it is derived from the precipitation of colloids that were in the sol form while in the tank. It is also possible that these colloidal 'growths' build up very much in the same manner as crystals are formed.

Turning again to the subject of sand and slime as distinct mill products, it can be said in a general way that in any mill the more completely these materials are separated, the better it is; the treatment of sand in an ore-dressing plant is substantially different from that of slime. It is difficult to effect the separation of sand and slime in one operation; it is easier and more satisfactory to accomplish it by successive stages. In this regard a table of the Wilfley type is a most thorough finishing machine in removing the last traces of colloid from the sand.

Source of Colloids

In most ores the colloid is produced from the decomposition of the feldspar silicates and other minerals in the ore, and is not created to any appreciable extent by the comminution of the ore. Crushing and fine grinding will liberate the included colloid and increase the percentage of colloid to be handled, but the crushing of the undecomposed part of the rock will generate only a small amount of colloid. It is on account of this that the slime obtained from the regrinding of sand, that has already been washed clear of slime, contains generally a low percentage of true colloidal matter and will settle much more rapidly than the slime from the original ore.

In most mills the mistake is made of mixing this crystalline slime with the colloidal slime, whereas by keeping the two seperate the settling capacity of the tanks is increased; to mix the two is, more or less, like sending clear water to the settling-tanks. It is for this reason that in plants where the recovery of water is an important factor, the slimy water from the sand tables and jigs, and the tailing of the slime machinery working on reground material, ought to be kept separate from the original slime. In addition to this, the crystalline slime is physically different from the colloid slime and will concentrate differently and yield a different kind of concentrate.

Settling Slime

Under fixed conditions of dilution, temperature, and percentage of electrolyte, a slime will settle at a certain well defined rate characteristic of its own; this settling rate, that is, the distance settled per minute, will decrease as the slime, in settling, becomes thicker. In a tank operated in a continuous manner, the process of settling will soon acquire a condition of equilibrium which will remain unchanged as long as all other conditions remain stable. When part of the colloid is in the sol form the overflow of the tank will remain turbid, whatever be the rate of feed; if an electrolyte is present, or if all the colloid is in the gel form, the surface of the tank will be clear. In both instances the top of the slime can be seen through the supernatant liquid, and the demarcation between slime and liquid is generally very sharp. When the tank receives neither additional pulp nor discharges through the bottom, the surface of the slime descends at a well defined rate, a specific function of that slime under those conditions. This rate gives the exact amount of clear water (or turbid water if the colloids are in the sol form) that can be drawn off from the tank.

The volume of pulp therefore that can be fed to a tank must be equal to that corresponding to the settling of the slime's surface plus the volume of thickened pulp discharged through the spigot. If the rate of feed is greater than the allowable rate, the surface of the slime will rise until at a certain point the slime overflows; if the rate of feed is less, the surface of the slime will sink deeper until a position of equilibrium is reached.

It is common practice to regulate the flow to a settling-tank in such a manner that the surface of the slime will remain close to the overflow lip of the tank; special care is taken to make the overflow lip as broad as possible and to keep it well leveled so that the flow of the film of water running over shall be the same in every point. If these precautions are not taken, the flow of clear water converging toward the overflow will acquire such velocity in approaching the weir that it will generate ascending currents in the underlying layer of slime and carry some of the colloid into the overflow. So far all this is perfectly correct and justified. Where,

however, many millmen fall into error is by believing that the amount of clear water recovered can be increased by increasing the length of the overflow or by skimming off the clear water as fast as it rises to the top of the slime. As a matter of fact, the amount of clear water produced is not dependent on any such consideration, but corresponds exactly to rate of settling of the slime multiplied by the area of the tank. If a tank is fed beyond capacity, the best decanting arrangements are of no use.

The slime in a deep tank will settle more rapidly than in a shallow tank, but a variation of a few inches in the depth will make little difference in the rate of settling of the slime. It is immaterial, therefore, whether the surface of the slime be kept close to the overflow lip of the settling-tanks or at a few inches below that level. For this reason, when the object of settling is to separate clear water or solution, it is best to keep the level of the slime at some distance from the overflow level; the shape of the tank or the irregularities in the overflow lip are then of secondary importance.

Settling Capacity

From all this it results that the settling capacity of a plant is given by the area and depth of the settling-tanks and not by the overflow or decanting arrangements. In cylindrical tanks discharging through a spigot the slime will build up in the shape of a cone and decrease the volume of the tank available for settling; the Dorr thickener, which is provided with slowly revolving rakes, obviates this by scraping the slime toward the centre as fast as it deposits on the bottom, and for this reason makes it possible to use very broad and comparatively shallow tanks provided with only one central spigot-discharge. In operating these or any other settling-tanks, it must be remembered that a slime is composed always of two distinct materials: (1) a quick-settling material consisting of fine sand, fines, and some colloid; and (2) the true colloid.

As previously mentioned, most colloids after reaching a certain well defined degree of consistence in a comparatively short period of time, will either stop settling any further or will do so only with extreme slowness. It is this particular feature that governs the settling capacity of a tank on any particular slime; if the colloid is not removed from the tank as quickly as it settles to its maximum degree of consistence it will accumulate and eventually overflow. The consistence, therefore, of any slime-discharge is governed by the relative amount of quick-settling material and that of colloid at its maximum degree of consistence; the latter forms the liquid (or moisture) of the spigot-discharge. In other words, a settling-tank acts much as a filter. Both need some granular material to operate successfully; the tank to give a thick discharge, and the filter to form a thick cake.

J. V. N. Dorr has pointed out to me that deep tanks have the advantage of yielding a thicker discharge than shallow tanks. This is accounted for by the fact that the particles of crystalline matter, in settling on top of the spongy mass of packed colloid flocculos, compress these by their weight. It pays, therefore, to use deep tanks when the necessary headroom is available; deep tanks cost comparatively little more than shallow tanks.

Application to Grinding

All that has been said of the slime and sand finds its practical application also in the operation of grinding machinery and of concentrating-tables. The viscosity of the pulp has a great importance in both cases. In the grinding machinery the absence of slime (or the dilution of the pulp) allows the sand to settle rapidly and lie on the die at the moment that the muller or shoe performs its work. If the viscosity of the pulp is raised by the presence of slime, the finer particles of sand have a tendency to remain in suspension and are washed off by the splash caused at the moment that the two crushing surfaces come in contact. This is one of the reasons why dilution of the pulp will increase the capacity of the grinding machinery. An excess in the contrary direction will cause similar effects: in pebble-mills the dilution is often reduced to 50% moisture: in such cases the pulp becomes so thick that not even the very finest material can evade the crushing parts as they come into contact.

Application to Concentrating

On the concentrating-tables the viscosity of the pulp hinders the process of classification and concentration. A Wilfley table will do better work on a fine sand free of colloid than on a slimy pulp. For this same reason a vanner will do better work on a diluted pulp than it will on a thick pulp, and the necessity of feeding a thick pulp to a vanner is solely due to the need of reducing as much as possible the velocity of flow over the belt without decreasing too much the tonnage of solid treated per machine. The presence of slime especially hinders the settling and the concentration of the fine particles, and it is on this account that the recovery of a concentrating-table decreases rapidly as the average fineness of the pulp increases. When hardly any fine sand or 'fines' are present in a pulp, the recovery often becomes so low that it does not pay to attempt to concentrate the pulp; on this account the loss of some colloidal matter in the overflow of the settling-tank is generally of little importance so far as concentration is concerned.

The subject analyzed in the preceding pages is complicated and open to discussion. What I wish to emphasize is that all operations of settling, conveying, and concentrating are affected by the viscosity of the liquid to an extent that is not usually appreciated as much as it should be. The viscosity of water is one of the principal factors in retarding the settling of slime; by heating the water, this viscosity is decreased, and the rate of settling increased: this has been clearly pointed out by Ashley. In a similar manner, the free settling of sand and all granular or crystalline material is hindered by the viscosity of the liquid medium, and this viscosity is not only due to that of the water itself, but also to that caused by the presence of colloidal matter and of fine crystalline particles kept in suspension by the agitation of the liquid.

The Freeland Charging Machine

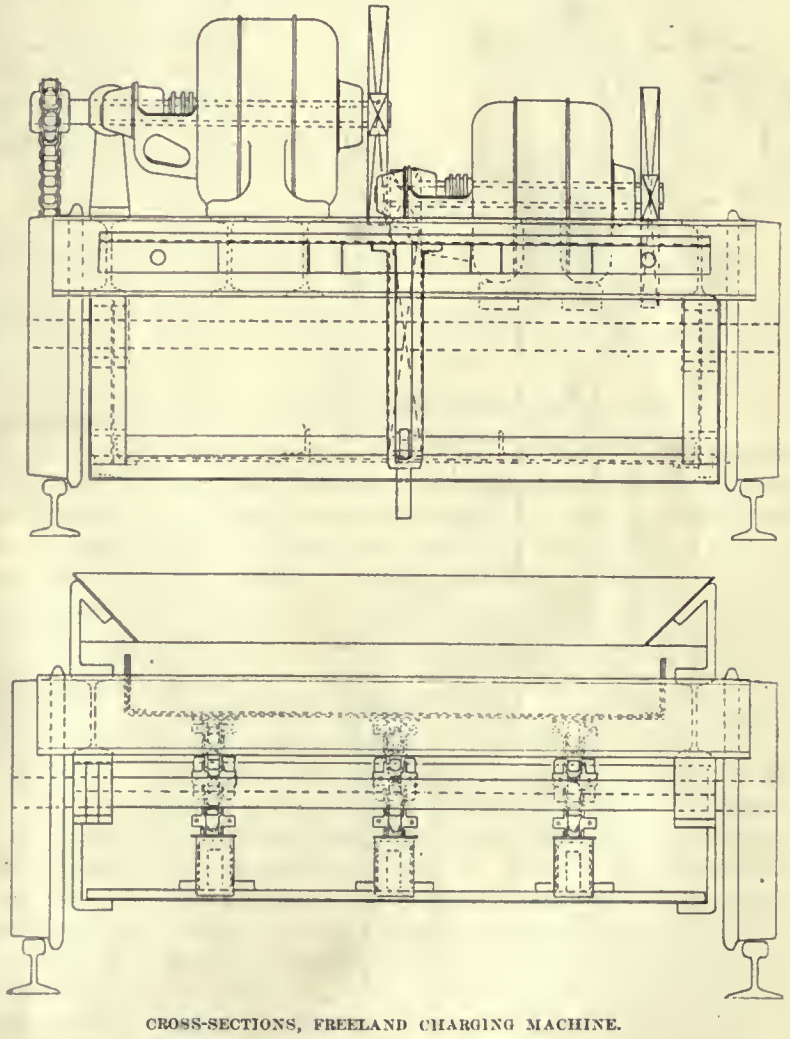
By C. W. Renwick

The original development of the mechanical charging device used at the smelter of the Ducktown Sulphur, Copper & Iron Co., Ltd., at Isabella, Tennessee, dates back to about 1902, when W. H. Freeland, then general manager for the company, began his experiments with pyrite smelting in connection with the Ducktown ores. Previous to this time all the ore was treated by open heap-roasting, the roasted ore then being smelted in small ovel-shaped Herreshoff furnaces of perhaps less than 100 tons daily capacity. Immediately following his well known success in treating these ores by pyritic smelting, the capacity of the furnaces was greatly increased. Naturally the cost and difficulty of hand-feeding was increased in corresponding proportion, and thoughts were immediately turned toward a more practical method of mechanically feeding the furnaces. On account of the varying composition of the ores, as well as the frequent and unavoidable occurrence of 'fines' in the ore, great difficulty was encountered in hand-feeding, to maintain a uniform distribution of the charge. It was impossible to overcome this difficulty so long as the furnace was charged by hand or by means of the usual type of side-dump charging-cars. Accretions and 'scaffolds' persistently formed along the sides and ends of the furnaces, not infrequently bridging from wall to wall, continually threatening the furnace with the danger of 'freezing up.'

To overcome these difficulties, Mr. Freeland conceived the idea of dropping the charge directly and vertically into the furnace with uniform distribution of the charge, not only lengthwise of the furnace, but from side to side as well, the ores and fluxes to be uniformly mixed as they entered the furnace.

This he accomplished by means of a movable framework traversing the furnace lengthwise, this framework carrying an endless-belt conveyor, upon which rested the furnace charge, the motion of the carriage and that of the conveyor being actuated by means of individual motors so arranged as to be capable of operating together or entirely independently of each other. The width of the conveyor was approximately the same as that of the furnace, so that the charge was distributed uniformly from side to side of the furnace. Furthermore, the carriage could be moved or stopped at any point lengthwise of the furnace, thereby allowing any portion or even the whole of the charge to be dropped at any point from end to end. It is to be noted in particular that as the machine traverses the furnace, opportunity is afforded the charger attendant (who rides with the machine) for viewing the interior of the furnace through the opening through which the charge passes, and he can therefore drop the charge directly into such places as where most needed, thereby maintaining an even and level distribution within the furnace. This is essentially the principle of the present charging machine. The idea was ingenious, and the application exceedingly simple. Eight years of successful operation has demonstrated the practical value, and it is unquestionably a fact that much, if not all, of the successful operation of these furnaces is due to the perfect feeding obtained by the use of this machine.

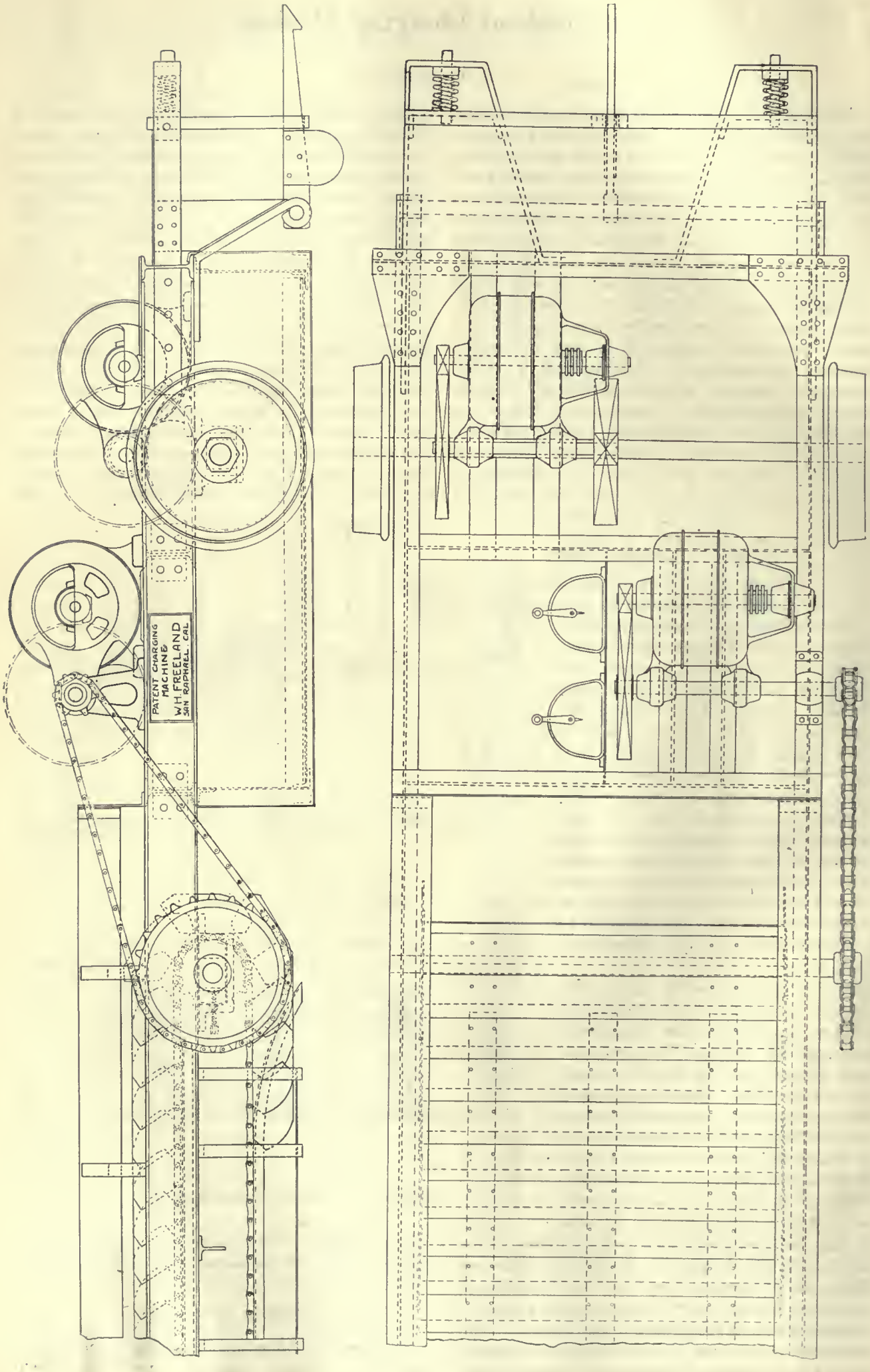
Furthermore, the actual labor involved in charging the furnaces has been very materially reduced, for whereas formerly eight men were required per shift for handling the ore and fluxes and charging same into the furnaces (then smelting about 200 tons per diem), there are required today but two men per shift for the same purpose with furnaces smelting 450 tons per diem.

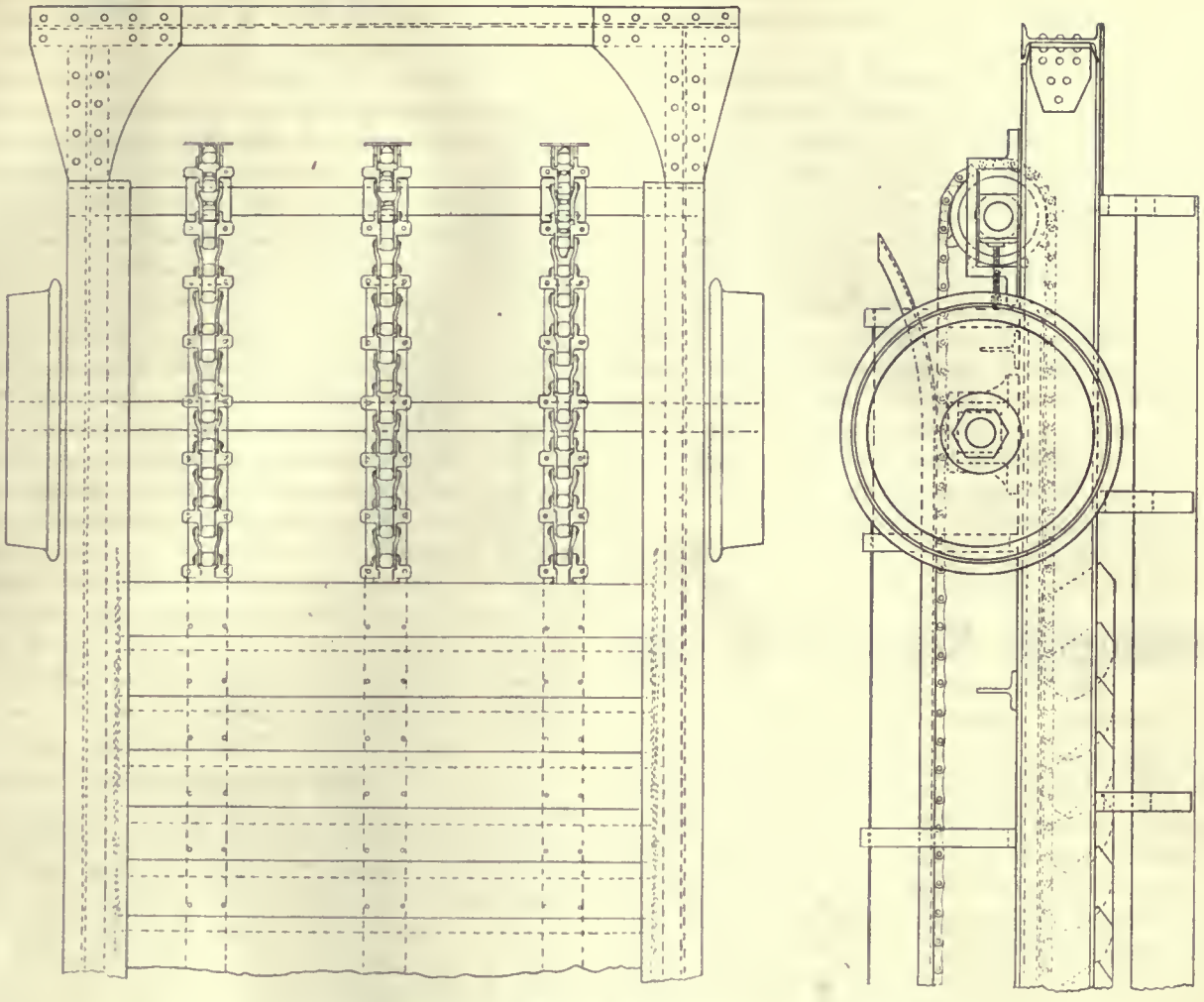


CROSS-SECTIONS, FREELAND CHARGING MACHINE.

Method of Loading

The method of loading the charging machine is likewise exceedingly simple and provides a conven-


PATENT CHARGING
MACHINE
W.H. FREELAND
SAN RAPHAEL, CAL.



PLAN AND LONGITUDINAL SECTION OF FREELAND CHARGING MACHINE.

ient means for the bedding of the ore and other materials upon the charging machine in any manner desired. The track upon which the machine travels over the furnace is extended back so as to pass directly underneath the ore bunkers, the various compartments of which are provided with chutes and gates of about the same width as the charging machine. It is evident that as the carriage is propelled beneath these chutes, the ore, fluxes, coke, or other materials, can be allowed to drop upon the apron or conveyor, forming beds or layers of any desired depth within the limits of its capacity. When in turn the charge is dropped into the furnace, all the materials are intimately mixed according to the proportions in which they are bedded. Or, if it is desired for any reason to deliver a certain portion of the charge against either side of the furnace, or even entirely in the middle of the furnace, as it is frequently necessary to do in the case of coke added for fuel; this can be accomplished by placing deflecting pieces in the chutes so that the material, as it passes down the chute, is deflected to either side, or by the use of two such deflecting pieces it can be confined entirely to the centre, thus falling upon the charger in the same relative position. In fact, the facilities so readily and easily afforded for loading the charging machine permit of delivering the charges into the furnace in any manner desired, dependent upon the condition of the furnace or the will and judgment of the operator. This is a distinct feature impossible to obtain in any form or type of dump car discharging the ore and fluxes through the sides or top of the furnace.

Used with Open-Top Furnace

The charging machine described and used at the Ducktown plant necessarily operates in connection with an open-top furnace, so that the smoke and gases must be conveyed away to the stack by means of a lateral off-take, the furnace being closed by a movable water-cooled top or cover which is moved out of the way by the carriage as the conveyor dumps its charge into the furnace through the space left open by the dislodgment of the movable top.

By making suitable provision in the design of the charging machine, with accompanying alterations of the furnace top, this principle and method of charging can be applied to almost any rectangular blast-furnace now in use. It can be readily appreciated that in the design of smelter plants yet to be built, suitable provision could be made for the adoption of the charging machine without involving any unreasonable expense, and any expense so involved would be repaid many times over through increased efficiency and decreased cost in the operation of the furnaces.

Summary

Briefly summarizing the above description, there may be noted the following claims of merit for the Freeland charging machine:

1. To secure absolutely uniform distribution and

positive mixing of ores and fluxes entering the furnace, thereby increasing the capacity and efficieney of the furnace.

2. To substitute mechanical for manual labor, whereby a very material saving is made in the cost of feeding the furnaee. The motors actuating the charging machine are of the variable-speed reversing type, therefore the speed of either motor and the direction of the carriage's travel is made instantly variable at the will of the operator. Thus the apron conveyor may be discharging its burden into the furnaee at any speed, variable at will, while the carriage is being propelled forward and backward or to and fro over the furnace at any desired speed, or the carriage may be stopped at any point in its travel and the apron or conveyor be caused to discharge its burden, or any portion of it, while the carriage is stationary.

3. The position of the operator is such that he can inspect the interior of the furnaee at all times, and thus be able to impel or move the carriage in any desirable direction and at any desired rate of speed to distribute the charge to the best advantage and as may be required by the furnaee's condition. To this feature of variable distribution great importance is attached, since a furnaee's condition is often irregular, owing to scaffolding or incrusting and other causes, which conditions are susceptible of remedy by varying the distribution of the charges as such conditions may call for.

4. The cost of these charging machines, as well as the cost of repairs and power for operating them, is but a small consideration when compared with the savings effected through increased capacity and the more efficient operation of the furnace. Other than the ordinary wear to be expected of the chain and conveyor leaves, there are practically no repairs to keep up.

Metallurgical Research in Utah

An interesting resumé of the research work in metallurgy done by the Utah School of Mines has been issued. The principal funds available come from a fellowship provided by E. A. Wall. The report states that in the laboratories of the school a new process has been worked out for the roasting and leaching of silicious silver ores, using salt. This is the process which has been adopted by the Mines Operating Co. in treating the ores at the old Ontario in Park City, and which, it is stated, has brought the saving up from 68 to 85%, with a material lessening in costs. A process is now being perfected for the treatment of the ores in the Tintic district. In search for a cheap method of preliminary roasting for silver ores to be treated by cyanidation, a pseudo-sinter roasting has been worked out. The product of this process can be leached with a weak cyanide solution, and an extraction obtained of 90% and better. By the use of a blast-roasting furnace, a cheap method of making hydrochloric acid from salt has been discovered, so that the acid may be available at a practical price for use in leaching copper or treating phosphate deposits for the manufacture of fertilizer. An investigation was made of the cause for the low extraction of gold from Mercur base ores. This was determined to be the presence of graphite, which reprecipitates the gold dissolved by the cyanide solution. Experiments resulted in better methods for removing the graphite.

The report goes on to say: "In our investigations on cyaniding silver ores much important data has been obtained concerning reactions of the cyanide solution upon all the common silver minerals and additional agents employed to increase the percentage of extraction of the silver. Also data have been obtained whereby one engaged in the process of designing a concentrating mill can determine definitely the size and inclination of his launders, and the amount of water necessary for transferring a certain tonnage of material of a definite degree of fineness. In connection with these tests there has been developed a unique discharging device for bins feeding launders at a definite tonnage per hour, by means of which a bin of crushed ore may be discharged by the use of an adjustable launder and a jet of water at any speed desired.

"As a further result of an exhaustive series of experiments in our mill a process of water classification has been worked out which may be called reversed hydraulic classification. In this method the slime or finest material is taken out first and then, in their order, the relatively heavier materials. The largest heaviest particles, clean and free from the fine slime, are susceptible to the most delicate gradation by this system. As a result of the close sorting much better separations of the mixed constituents are possible than is the case with any water classifiers ever before used. At the Yellow Pine mill at Good Springs, Nevada—one place where this process is used—oxidized lead-zinc ore, a very undesirable combination—is separated into a lead product and a zinc product, both of which are marketed at a handsome profit. Other separations by use of this method of close sorting of fine materials promise excellent returns.

"Other important research experiments include the testing of portland cement cupels to replace the more expensive bone ash product; the determination of the actual temperatures of the lead button in cupellation; improvements in the methods of assaying cyanide solutions for gold and silver, etc."

White Island, situated in the Bay of Plenty, and about 50 miles from the mainland and 100 miles from the Rotorua district of the North Island of New Zealand, has often been termed the 'safety-valve' of the North Island, as there appears to be a connection with the volcanic district of Rotorua. About the year 1886 the island produced a little sulphur and was then abandoned, and New Zealand depended on imports from Japan for its supply. The White Island Sulphur Co. has recently started work again, and is pumping out the lake, an old crater, preparatory to mining sulphur. Water has been lowered 17 ft., which is 5 ft. above sea-level, and good deposits have been opened. About 4000 tons of high-grade sulphur is on the dump. Retorts for refining are being installed on the island.

Russian Copper in 1912

ST. PETERSBURG CORRESPONDENCE

The copper-smelting industry of Russia continues to make gratifying progress. Progress began in 1907; production in 1906 being 22,680,000 lb., and that of 1907, 31,860,000 lb., after which year the progress was steady and great, reaching 56,304,000 in 1911. Statistics to December 31, 1912, are not yet available, but reports for the first eight months of 1912 show that production of metallic copper in Russia amounted to 48,420,000 lb., and as that total compares with 35,124,000 lb. produced in the first eight months of 1911, which was the record year, obviously 1912 exceeds the preceding year by more than 1911 exceeded 1910. It is anticipated by competent authorities that the total production in Russia of metallic copper for 1912 will be found to have exceeded 72,000,000 lb. In such event the interesting period that has been foreseen for several years will have been attained, when the Russian metallic copper production equals, if not exceeds, its metallic copper consumption: for in 1911 the consumption of copper in Russia was 73,280,000 pounds.

Local Demand

Of course, it must not be assumed, even if the production for 1912 shall have exceeded this level, that it has come abreast of Russia's requirements in copper; for last year metallurgy and industry generally were active in Russia, and the increased use of electricity for light and power, which is becoming general throughout the country, would mean a largely increased consumption of copper as compared with that of 1911. So that, with the increase in the production there has been probably quite as large a ratio of increase in the consumption. Even today, therefore, Russia is not self-supporting from the copper point of view. A recent report, however, is as follows:

"Notwithstanding such a rapid rise in the national production of copper, it is not equal to supplying the current requirements of that metal in Russia; and 9,432,000 lb. of copper was imported from abroad in the first eight months of 1912, as against 11,628,000 lb. imported during the same period of 1911 and 17,172,000 lb. imported during the whole of 1911, and a total of 14,400,000 lb. imported in 1910. However, in view of the important work carried out in the production of copper in various districts of Russia in the form of extension of existing works, and in the erection of new copper plants, the national copper industry may be counted on to completely satisfy the national wants in the years 1913-1914 and perhaps (as has been so frequently foreshadowed in previous reports) become an exporter."

At this interesting juncture when Russia is, so to speak, apparently crossing the line from being an importing country to an exporting country, it will be interesting to refer once more to the parts taken by the various copper-producing districts of the country in relation to the total production. The Urals district stands *facile princeps*, as it has ever since 1906, when the total production was 290,000 poods,* rising to 785,000 p. in 1911. The proportion between the first eight months of 1911 and 1912, respectively, was as between 514,000 p. and 734,000 p. The Caucasus, which produced 237,000 p. in 1906, reached its highest point, namely, 493,000 p., in 1911, and in the first eight months of 1912 it far surpassed the production of the corresponding period of 1911. Siberia, with the Khirghis steppes, has likewise made immense progress, from 135,000 p. in 1906 to 229,000 p. in 1911, and 177,000 p. in the first eight months of 1912 against 142,000 p. in the first eight months of 1911. The production of the chemical works and refineries is relatively trifling; only 55,000 p. in 1911.

Importance of Kyshtim

Since the foregoing report was issued, the quantity of copper smelted in the Urals during the first nine months of 1912 has been reported, and reached the record figure of 793,144 p., or 202,326 p. more than in the corresponding period of 1911. The leading producing company is the Kyshtim Corporation, in its upper Kyshtim plant, where 337,201 p. of copper was smelted. The company next in importance is the Bogosloff, which produced 204,646 p. of copper. Next is the Visk works of the Demidoff Successors with 100,630 p., and finally the Pyshmensky-Klyuchevsky Co., with 79,821 p., and the Polievsky, with 70,836 p. Allowing for the increase in consumption suggested above by reason of the extraordinary activity in the establishment of works requiring copper equipment, such as electric lighting, power stations, and so on, if the rate of increase indicated in the figures given should be continued throughout the present year (and there is every reason to believe the rate will be maintained, if not increased, because some works were out of action last year on account of changes in construction), then Russia will be independent and perhaps a new factor in the copper markets.

Exports

If Russia exports copper it will most probably be from the Caucasus. The Urals and Siberian fields are too far away from the sea to be probable serious competitors for foreign trade: the more so as the various centres where copper consumption is extending are much more convenient to the Siberian and Urals districts than any exterior market would be. On the other hand, industrial development (notwithstanding certain important electrical undertakings in the Caucasus) is not so active far in the south, and should the present rate of increase continue there, the copper producers will be compelled to seek a market outside Russia. Even in respect to the purest electrolytic copper, Russia will hardly be dependent on outside markets. The foreign syndicates that have become important in Russian copper production have added enormously to the electrolytic plants in the country, and the peculiar operation of sending Russian copper out of the country to be refined and returned for consumption in the country will therefore cease to be a feature in Russian business.

*The pood equals 36.11 pounds.

A Tungsten Mine in Nova Scotia

By V. G. Hills

Tungsten in its various minerals, wolframite, hübnerite, and scheelite, is found in all of the provinces of Canada from Cape Breton island to British Columbia; but the only occurrence which has been worked on a commercial scale is the scheelite mine in the central part of Halifax county, Nova Scotia. The mine is 12 miles from the Atlantic coast, 34 miles from the nearest railroad point, and two miles west of the old Moose River gold mines. It is situated in a forest abounding in lakes and swamps. The country is nearly level and some 400 ft. above sea-level.

Geology of Nova Scotia

Nova Scotia has been a gold mining country for a half century, and there is plenty of literature on its geology and its peculiar vein formation. To understand the nature of the veins it may be well to recall briefly that the Nova Scotia peninsula is formed of granite, and Lower Cambrian quartzites and slates; the latter being in a series of folds generally parallel with the Atlantic coast. The quartzites are dark colored and evidently contain much feldspathic material. Layers of the hard pure type are rare. This impure quartzite is called 'whin' by the miners throughout the province; and while it is an inexcusable misnomer (whin being an igneous rock) use of the name is so general that it is unavoidable about the mines, and is often seen in print in articles concerning Nova Scotia mining. The name 'graywacke' fits this rock perfectly, but this term is now to be considered obsolete.

The ore is scheelite and the veins are of the same formation and character as the Nova Scotia gold-bearing veins. They are of quartz and interbedded or interealated with the sediments and generally parallel with them throughout their folds. Their like, I believe, is not known in the metal mining world excepting the famous 'saddle reefs' of Bendigo, Australia, with which they are practically identical in formation. A description of the Bendigo veins has been given by T. A. Rickard.[1] In the Summit mining district, Rio Grande county, Colorado, there are gold-bearing quartz veins which are interbedded between flows of rhyolite and trachyte and folded along with them.[2] However, this is not in a sedimentary formation and the veins have not the compound folding, later described, and the folding is local and not regional as it is in Australia and Nova Scotia.

Saddle Veins

The uniqueness of these 'saddle veins' makes a comparison of the Australian and the Nova Scotian formations most interesting. In both cases the country is composed of quartzites and slates which are crumpled and folded; in both there is developed a series of parallel antielines; in both the movements causing the folding seem to have a common origin with neighboring intrusive granite; in both the metamorphism of the sedimentary rocks is dynamic; in both the metalliferous deposits are in quartz veins, generally paralleling the original strata and folded along with them; in both regions are found other lodes crossing or connecting the regular interbedded veins; in both the most frequent ore deposit is gold associated with arsenopyrite; and in both cases the ore-shoots usually parallel the folds.

The points of dissimilarity between the two regions are that the antielines in Nova Scotia are from three to five miles apart, while in Australia they are only from a few hundred feet to one-fourth of a mile, and in Bendigo there is some show of igneous activity, while in Nova Scotia the metamorphism seems entirely dynamic. A prominent feature of the Nova Scotia formation is a peculiar compound folding; the veins themselves being crumpled within the larger folds of the original sedimentary strata. The illustration opposite shows a typical vein on its antielinal turn.

Origin of Veins

Two entirely different theories have been advanced to explain this most peculiar vein formation. The main point of disagreement is whether these corrugated quartz veins were formed before or after the folding. J. E. Woodman[3] and T. A. Rickard[4] contend that they are the filling of zigzag fissures formed after the folding of the strata was substantially completed. They account for the rounded outlines at the turns as the result of chemical action on the sharp edges. On the other hand, William Dawson, the veteran Nova Scotia geologist, and E. R. Faribault, of the Canadian Geological Survey, take the view that these veins were first formed as pancake-like lenses, during the earlier period of the regional folding, when slight openings between the horizontal beds naturally began to develop as a result of horizontal pressure exerted on the strata, and afterward deformed into the crenulated shapes by differential movement which caused the quartz to crumple in the soft slate beds which were crushed between sliding layers of the harder quartzite. My observation agrees with Dawson and Faribault; but a discussion of this question requires reference to numerous photographs and drawings and cannot be attempted here. The discussion has appeared in the *Proceedings* of the Canadian Mining Institute.

There are later quartz veins which constitute the cross-veins, spurs, and 'angulars.' These were unquestionably formed after the folding. They do not carry ore, but consist of pure white quartz only. The veins bearing the tungsten ore are in the same system and on the same anticline as the old Moose

[1] *Trans.* Amer. Inst. Min. Eng., Vol. XX, p. 463, Vol. XXI, p. 686, and Vol. XXII, p. 289.

[2] R. C. Hills in 1883, *Proc.* Colo. Sci. Soc., Vol. 1, p. 20.

[3] *Proc. Trans.* Nova Scotia Inst. Sci., 1903, Vol. XI, p. 67.

[4] *Proc.* Canadian Min. Inst., March 1912; also *Mining and Scientific Press*, April 6, 1912.

River gold mines, two miles distant. The scheelite veins had been prospected for gold years before, as shown by trenches overgrown with brush. A little scheelite was found in the old gold mines at Moose River, but no gold, more than a trace, has ever been noted from the tungsten mines.

The vein matter consists substantially of quartz, scheelite, ankerite, and arsenopyrite. There is a little pyrite and calcite, and a few slender black tourmaline crystals which appear in the other four common minerals.

The scheelite seems to be strictly a primary deposit. Not a particle of either of the black tungsten ores has ever been found in these veins. Further, no partly altered specimen has ever been found; where the scheelite occurs touching the ankerite there is a distinct line of demarcation between the two. That the scheelite and the mispickel were the earliest minerals deposited is plain; as they are frequently found brecciated, with the fractures filled with quartz. Occasionally calcite occupies the fractures.

made in the fall of 1907 by a trapper who picked up a piece of the scheelite in the bed of a small brook. He did not know the nature or value of his find. The property was purchased from the locators by a small group of men from Halifax, Montreal, and Ottawa. These good Canadian gentlemen performed the rare mining feat of buying, equipping, and developing a mine with their own money and without the aid of any stock-selling or other form of promotion; and the equipment does not include anything in the line of debts, bonds, or mortgage.

During the short summer seasons in 1909 and 1910 some buildings were erected and a little development work was done. In 1911 an air-compressor was purchased and systematic exploration begun. Also a small but neat and substantial mill was erected.

Considering the actual distances of Scheelite from Halifax, from tidewater, and from a railroad, it is really in a most inaccessible location. To reach Halifax, less than 40 miles distant, it is necessary to travel 34 miles over an indifferent wagon road and

CRENULATED VEIN IN OLD SEDIMENTS. THE SCHEELITE MILL.

The veins are numerous and small, usually from 1 to 6 in. on the flanks, with thicker deposits at both the anticline and the syncline turns. The Scheelite district shows several post-folding faults with throws of 10 to 70 ft. There is no ore in the faults.

On the question of the genesis of ore deposits, which has occupied so much of the discussion of the technical mining world for the past 15 years, and referring particularly to what may be called the controversy between the 'fire men' and the 'water men' as to which was the predominating agency in the deposition of orebodies, I have always regarded J. F. Kemp's 'The Rôle of Igneous Rocks in the Formation of Veins'[3] as being the nearest to a master key to the subject. It is certainly the exception to find an orebody far distant from some form of igneous activity. Consequently, while this district is miles from any surface exposure of granite, I should prefer to think that the granite is at no great depth below this deposit. Most of the tungsten deposits of the world are in granitic rocks or near a granite contact.

Discovery of Tungsten

The discovery of this tungsten occurrence was

[3] *Trans.* Am. Inst. Min. Eng., Vol. XXXI, p. 169.

then 40 miles by rail. Tidewater at Ship Harbor is only 12 miles distant, but there is no connecting wagon-road, not even a bridle path. In this forest-covered country, abounding in lakes and swamps, building roads is expensive and maintaining them more expensive. This condition accounts for the slow progress in the development.

Extent of Plant

In this little mine and mill, situated in Longfellow's "forest primeval," there are Holman drills and rolls from England, a compressor and Wilfley tables from Sherbrooke, Quebec, boilers from Toronto, engines from Moncton, New Brunswick, hammer-drills from Denver, a slime table from Indianapolis, Indiana, a magnetic separator from Milwaukee, Wisconsin, and a roasting furnace built at Truro, Nova Scotia. The hoists, pumps, and other general machinery came from Halifax, Truro, and New Glosco, Nova Scotia; Montreal, Toronto; and Hamilton, Ontario. The lumber was cut in the nearby woods. Sand for concrete and mortar was made by crushing quartzite boulders in an old water-power stamp-mill.

As the ore occurs in numerous thin rich veins the mining requires much cross-cutting, as at Cripple Creek, Colorado; and since the ore is plainly dis-

tinguishable to the eye, it is best stoped by the stripping method.

In milling, the scheelite being more friable than the quartz, the main loss is in the slime tailing, as it is in most cases of wet concentration. I planned a flow-sheet to take advantage of every inexpensive device to prevent sliming. The ore is dumped over a grizzly before going to the crusher; the roll feed is washed by a spray on a coarse screen-conveyor, so that only the clean coarse material goes to the coarse rolls. Rolls are used for crushing as undoubtedly better than stamps, or any other form of screen-faced pulverizing mill, to avoid sliming an ore of such high specific gravity. With this scheelite ore the slime loss is less than with the Colorado black ores.

Milling Methods

In milling this ore, since the scheelite and the mispickel have the same specific gravity (6.0), they, together, form the heads from the concentrating tables. The pyrite is just enough lighter to enable it to be largely thrown with the tailing. The raw concentrate consists of some 45% mispickel, coming partly from the vein and partly from the slate wall-rock. To get rid of the arsenic it is necessary to roast and treat with a magnetic separator. For roasting I built a Wilfley revolving hearth furnace, which roasts a layer one particle in depth with each revolution. It proved satisfactory. For treating separately numerous small lots of both coarse and fine material, and particularly where the furnace cannot be kept in steady operation, I know of no roaster that is more desirable. The literature on the subject of ore roasting seems to be notoriously meagre in reference to the degree of heat to be used and the time of exposure. I found that the mispickel was decidedly better prepared for the magnetic separator by a high temperature and short exposure. Thus. 1500°F. for 50 seconds gave better results, for example than 1100° for 90 seconds.

Character of Concentrate

Some former plans and tests which had been made on roasting this ore had evidently proceeded on the idea of burning off as much of the arsenic as possible; but that idea was all wrong; the best separation of the arsenic can be made by the least possible roasting that will render the iron magnetic; better depend on removing the arsenic with the iron. A Dings single magnet separator was used and made an excellent clean separation. The magnetic product carried an average of 0.72% WO_3, with some lots as low as 0.42%. The non-magnetic product carried only 0.34% arsenic. These returns could, if necessary, be further reduced by using a two-magnet separator or by running through a second time. The separator operated at 8 amperes.

The finished product carried, besides the 0.34% arsenic, a little sulphur and phosphorus. Otherwise the concentrate contained no deleterious elements. While no other tungsten ore in the world compares with the Colorado product for freedom from undesirable elements, this Nova Scotia product is quite within the general market requirements and compares favorably with tungsten concentrate from any part of the world. With my trial run the mill saving was 86.8%. This was afterward increased to 93%. Remembering that, besides the scaly slate gangue augmenting the slime loss, this concentrate has to be subjected to a second loss from flue-dust in roasting, and a third loss from magnetic separation, I regard this as a good saving. The market product carried 70% WO_3. That this is higher than the average of the black ores is of course due to the higher tungstic acid content of the lime tungstate. The coarse table products at Scheelite would run as high as 73% WO_3. The mill was planned to avoid complexity in operation. For this reason jigs were not introduced. They would increase the saving, as would more slime settling capacity; but it is the regular mill problem to determine whether the additional saving would pay for the outlay necessary to produce it.

The Wind-Furnace for Assaying

By George A. James

Physical conditions have such a vital bearing on the errors of the fire assay that they should hold first place in estimating the value of fluxes, and the method used for melting. In comparing the fire assay with the operation of the blast-furnace, these points are seen in exaggerated form. The amount of gold and silver retained in the blast-furnace slag, independent of the lead and matte particles containing these metals, is surprisingly small. Compared to losses in flue-dust and handling the ore, they are of no importance, yet the proportion of lead used to collect the gold and silver is many times less, and the character of the slag much inferior to that of crucible assay for this purpose. Improvement in the efficiency of the blast-furnace has been gained chiefly by recovery of the fine particles ejected from the furnace and the preparation of fine ore so that it is not carried by the blast from the furnace. The same principles should obtain in conducting the fire assay, and, where they are observed, it is surprising what increased accuracy and economy of time result.

Controlling Evolution of Gases

Comparing the contents of a crucible with those of a blast-furnace the gases evolved from fluxes and ore charge can be compared to the air-blast and should be controlled as far as possible if physical losses are not to result while melting. This can be done in two ways, either by preparing a fluxing charge containing the least amount of volatile, or by arranging the greatest possible filtering and vent space during the exit of the gases generated. The amount of gas evolved from an ordinary ½ assay-ton charge of ore and fluxes, in the crucible assay, exceeds 1 cu. ft. (at the temperature used in melting). It can be seen that if care is not taken, there will be mechanical loss by puffing of gas through the flux and ore charge, and by boiling if the gas is evolved after melting has commenced.

This is well understood by assayers, and is guarded against by using slow and cautious initial heating before bringing the fluxed material to the melting point. Even with the greatest precautions, it is

seldom possible to obtain ideal results, and it is usually found that the melt has lifted above the region originally filled by the mixed ore-charge. This is likely to cause loss, and should be avoided. To correct this, besides considering the method of conducting the melt, the character of the flux should be such as to give the least amount of volatile; for example, use Na_2CO_3 instead of $NaHCO_3$, which is commonly employed. Reducing agents containing moisture, hydrocarbons (starch, flour, etc.), or charcoal, which contain a large portion of water and occluded gases, are bad. Sulphur meets this requirement as a reducing agent and has a marked advantage in the case of limestone ores, as will be shown later.

The most important factor, however, is the method used in the melting operation, this in turn depends on the type of melting furnace used. I believe the ordinary gasoline, or gas-wind furnace, in which the crucibles are acted on directly by the flame, to be the best. The muffle furnace, where the melting depends on radiated heat, is the poorest in which to obtain the proper conditions.

Heat Penetration

It requires five minutes for the heat from the flame to penetrate the side of an ordinary clay crucible, and for the action of the heat to spread from this part of the crucible to the contents. It will be seen that if the crucible is introduced into a hot muffle furnace the melting will commence on the exposed top of the contents much in advance of any action in other parts, and a layer of melted material will be formed. The action of the heat will begin later in the rest of the mass, and the gases will then be forced through the melted top layer, which will cause boiling, and carry the ore particles up the side of the crucible, to remain after action has ceased. It might be assumed that this melted portion would act as a desirable filter during the course of the melt, but this advantage is more complete and better where the melting begins at the side.

In the gas-wind furnace the heat strikes one part of the side. The melting begins at this point and advances gradually around the crucible; this opens an adequate vent for the escape of gas in advance of the melting, and instead of boiling it will be found that there is no evidence of the melt rising above the level of the mixed contents, no matter at what speed the melt has taken place. Then, too, this portion of the crucible can be compared to the human nose, containing, as it does, a sticky mass to trap dust particles carried forward by escaping gas. In comparison to the thin layer where the melt commences from the top, its advantage is readily seen. I cannot see the advantage of using indirect heat where the fuel will permit wind-furnaces and direct heat, with their quicker action, greater economy in fuel, and muffles. It takes usually more than enough time to bring a muffle to melting heat for the first charge than to finish the first melt in the wind-furnace. Where muffle-furnaces must be used, the melting faults may be corrected in part, if not entirely. The borax cover operates in this direction. It becomes a spongy mass and a good non-conductor of heat during the first period of the melt and while the gases are to be eliminated, but a crucible cover is much more effective and almost duplicates the condition of the wind-furnace.

In the fluxing of calcium and magnesium carbonates, as before stated, sulphur as a reducing agent is almost essential if boiling is to be prevented. The melting point of the ordinary flux is below the heat required to decompose these carbonates. This results in a suspension of the decomposition until after the other flux is melted, but when the heat reaches a point sufficient to decompose the ore, the carbon CO_2 is evolved almost all at once and carries the melted flux to the top of the crucible. Where sulphur is used as reducing agent, a sulphide of calcium or magnesium is first formed, replacing the carbon CO_2, which escapes at a low temperature, much below the melting point of the flux, and the gases escape gently without lifting the charge.

Reduction of Time

In my office, where jeweler's sweeps and limestone ores that usually cause much trouble from boiling, constitute a large proportion of the work, no evidence is ever seen of a charge rising above the level of the original flux, although no special attention is devoted to the progress of the melting. It is possible to use 15-gram crucibles (even for assay-ton charges) and I have thus reduced the melting time and fuel costs much below what would be necessary were muffle-furnaces used.

Mining in New Zealand in 1912

What is known as the Auckland district of the North Island of New Zealand, in the Hauraki Peninsula, including Coromandel, Thames, and the Ohinemuri districts, which produce practically all of the gold and silver of the North Island, yielded bullion worth $3,744,000 in 1912. This is a decrease of $1,717,920 compared with 1911, caused by the miners' strike, which has been discussed in previous issues of the *Mining and Scientific Press*. The year 1907 was the highest in production, when it was $6,821,760, of which the Waihi and Karangahake districts yielded $5,958,240. The returns for 1912 were as follows:

District.	Tons.	Yield.
Coromandel	910	$ 51,880
Thames	[1]16,000	144,000
Ohinemuri	[2]340,000	3,548,120

[1]Tonnage from two mines estimated.
[2]Includes 94,100 tons of tailing treated.

Individual returns from the principal mines of the Ohinemuri district are as follows:

	Tons.	Yield.
Crown, ore	20,501	$ 196,270
Komata Reefs, ore	5,620	73,770
Talisman, ore	42,780	1,179,500
Waihi, ore	132,610	1,559,560
Waihi Grand Junction, ore	41,712	354,200
Waihi-Paeroa Extraction Co., tailing	94,100	162,280

Pig iron production of the United States in February was 2,582,739 tons, against 2,799,080 tons in January. Calculated on the number of days, the February output was 92,240 tons, and the January 90,293 tons per day.

Underground Timbering and Engine Repairs

By M. W. von Bernewitz.

An interesting bit of repair work was done last year to a Walker air-compressor of 60-drill capacity that has been working at the Associated mine in Kalgoorlie for the past 12 years. The steam and air cylinders of this compressor are 33 and 57 in., and 20 and 45 in., respectively, with a common stroke of 60 in. The maximum speed is 40 r.p.m. On the crank-shaft is a fly-wheel weighing 22 tons. Last spring, from some unexplained reason, a crack developed in the pillow-block on the low-pressure side, extending outward 6 in. from the brass bearing.

The crank passes very close to the block, making the job awkward. The first work was to fit on to the end of the pillow-block a piece of heavy plate. A **U**-bolt of nearly 3 by 1¾-in. size was forged and strapped around the plate and back of the block fairly low down, as may be seen in Fig. 1. When screwed up, this should hold fairly well. The top of the block is held to a certain extent by the cap; but not enough to be sure of. Various suggestions were made as to means for securing this part, but the compressor was in an awkward place and could not be stopped for any length of time. The general manager suggested pressure being brought on the top of the block by a 'tom' or brace on the same principle as holding walls apart, or holding up a roof underground, and this plant was adopted.

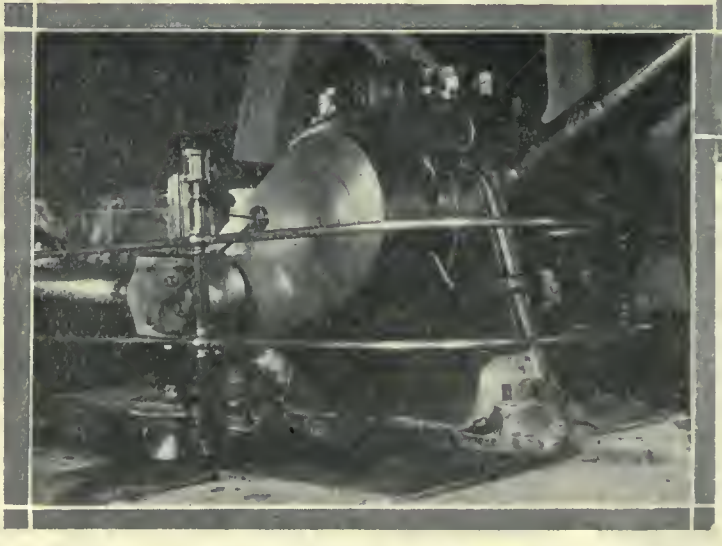


Fig. 1. Pillow-block with bottom of brace on the block. The crack is shown by chalk mark.

It happens that the end of one of the breaker storage bins of 500-ton capacity comes right behind the cracked pillow-block. The total height of this bin with under framing is 50 ft., it is constructed of 12 by 12-in. hewn jarrah, and generally contains 300 tons of ore. At this point there is no movement in the bin. A frame was bolted to the bin under structure, as shown in Fig. 2, and between this and the engine, a brace of salmon gum wood about 16 ft. long and an average of 11 in. diameter was let in, the ends being shaped to the engine block and to a hitch in the timber framework. Under this frame was bolted a piece of 60-lb. rail, and a clamp-bolt was fitted to the top end of brace and through the rail. By screwing this down, great pressure may be brought to bear on the pillow-block and to hold down the portion above the crack. The timber is out of the way, and the job was effective at small cost, without stoppage.

Fig. 2. Top of brace shown in opposite picture, with method of bringing pressure on blocks by clamp-bolt.

Absorption of gold by copper plates has been the cause of a good deal of interesting investigation, but may be prevented to a large extent by having the plates electroplated with silver. This type of plate also catches a larger amount of gold and keeps in better order than the ordinary way of just having one coated with quicksilver. Many large mills are using silver-coated plates, including those at the Homestake and Treadwell mines. On March 10, at the San Francisco plating works owned by E. G. Denniston, four plates of unusual width were coated. These are for the Los Gazabo mine, Round Mountain, Nevada. They are 6 by 7 ft. in size, and are made of No. 11 gauge sheet copper, weighing 5½ lb. per square foot. The plates were hung in the electrolyte solution, and with an electric current of 4 volts and 40 amperes it took 12 hours to deposit 3 oz. of silver per square foot of plate surface. After being drained, the plates showed an even surface, quite free from any globules or holes.

Water pumped from the Waihi mine amounts to 727,000,000 gal. per annum, and is handled by two compound Cornish surface condensing engines and two electrically-driven pumps, the latter lifting the water in two stages from the 1000-ft. level. These are of the 3-throw ram type, with plungers 12 by 30 in., working at 42 r.p.m., and capable of delivering 1500 gal. per minute. The motors are of variable-speed type, working at from 200 to 600 r.p.m., and each is rated at 420 horse-power.

Southern California Iron Ores

Iron ore deposits of the Eagle mountains are situated in the northern part of this range, Riverside county, California. The Arizona & California railroad passes about 35 miles northeast, and both ends of the area are reached by wagon from Mecca on the Southern Pacific railroad. The deposits cover an area of from ¼ to 2 miles wide and 8 miles long. The iron-ore deposits of the district may be grouped into five types, as described by the U. S. Geological Survey: (1) beds and irregular masses of hematite and magnetite, generally inclosed between quartzite beds or between quartzite and quartz monzonite, and generally of large extent, associated with an abundance of gangue minerals, and here and there containing masses of partly replaced or unreplaced crystalline dolomite and quartzite; (2) layers of hematite in crystalline dolomite beds and lenses, lying approximately parallel to the stratification of the dolomite and having great lateral extent compared with their thickness and exhibiting sharp contact with the inclosing dolomite; (3) small replacement deposits in sediments directly at the contact of minor quartz monzonite intrusions; (4) veins in quartzite; (5) veins in quartz monzonite. Analyses of the ores are as follow:

	Per cent.		Per cent.
Fe_2O_3	89.30 to 96.15	MgO	0.20 to 2.16
Al_2O_3	0.16 to 0.66	P_2O_5	0.064 to 0.132
SiO_2	1.80 to 6.70	MnO_2	trace to 0.27
CaO	0.25 to 1.04	S	0.38 to 0.169

These analyses show the percentage of iron to be 62.50 to 67.31%; phosphorus, 0.028 to 0.058%; and manganese, trace to 0.18%. The largest single deposit of ore occurs along the upper ore horizon at the east end group of deposits, and has been exposed, with breaks, for nearly 6000 ft. It has a maximum width of outcrop of about 500 ft. and a thickness of 325 ft., dipping north at an angle of 30 to 35°. The quantity of ore and gangue material is estimated at 40,000,000 tons, of which the latter would be one-third. Estimates of the other large deposits in the district have been made, and the total amount of ore may be set down as 75,000,000 tons, of which one-fifth may be assumed to be gangue material, and the rest ore, most of it high grade. About 100 pits, shafts, and adits have been sunk in development and assessment work, not including the workings of the Iron Chief gold mine.

No iron ore has been mined, and all the principal deposits belong to the Iron Chief Mining Co., only enough work being done to meet the requirements for patent. At present there is no way of utilizing the ore, and it is far from any railroad. Limestone and dolomite for fluxing purposes, though not abundant in southern California, occur at numerous parts of the Mohave and Colorado deserts, and in the San Bernardino mountains. The absence of fuel is the principal obstacle to the establishment of an iron industry in California, the nearest deposits of coking coal being in Colorado, and coal may be brought from Alaska later on, or electric smelting extended, as being done by the Noble Electric Steel Co., near Baird, in Shasta county.

Rapid Analysis for Copper in Furnace Slag

By R. White

*Weigh 1 gm. of slag in a 250-c.c. Jena beaker, moisten with H_2O and add 3 c.c. of H_2SO_4 (1:1). Keep in motion to prevent the slag sticking to the bottom of the beaker. Now add 10 to 15 c.c. of strong HCl and heat over a free flame until the silica is completely gelatinized. Add 1 c.c. of HNO_3, followed by a few drops of hydrofluoric acid, being careful that the hydrofluoric acid does not run down the side of the beaker. Continue heating until almost dry, then put it on a hot plate and fume strongly until all the fluorides are broken up. Cool and add 2 c.c. of dilute H_2SO_4 (1:1) and 3 c.c. of HNO_3; heat until everything is in solution, dilute to about 175 c.c. with cold H_2O, and plate with a rotating anode using 2½ amperes. It should be completely plated in 20 to 35 minutes. If too much HF is used it attacks the beaker strongly, but if care is used a beaker will last for 40 or 50 assays. Also be careful with the fumes, as they are very poisonous. This method has the advantage of being completed in the original beaker.

Mining Costs at the Montana-Tonopah Mine

Details for the year ended August 31, 1912, when 53,874 tons of ore was mined, are as follows:

Labor:		Maintenance and repairs	$0.001
Ore breaking	$0.579		
Mine machines	0.031	Total labor	$2.182
Hoisting and dumping	0.197	Supplies:	
Boilers	0.034	Water	$0.005
Shoveling and sorting	0.675	Ore breaking	0.292
Tramming	0.224	Compressed air	0.111
Timbering	0.209	Hoisting and dumping	0.059
Tool sharpening	0.026	Hoisting (electric power)	0.129
Surveying	0.028	Timbering	0.197
Foreman and bosses	0.078		
Sampling	0.016	Total supplies	$0.793
Storekeeper	0.011		
Assaying	0.016	Total mine cost	$2.975
Watchman	0.011		
Superintendence	0.046		

Potash Lands Withdrawn

The President has recently approved the withdrawal of three tracts of land of the desert-basin type in California and Nevada that are believed, as the result of investigations by the U. S. Geological Survey, to contain valuable deposits of potassium salts and brines. The aggregate area thus withdrawn is 133,829 acres. The first of these withdrawals covered Columbus marsh, Nevada, and was approved on January 16, 1913. The second included the famous Searles lake, California, and was approved on February 21, 1913. The third included lands in the Panamint valley, California, the acreage affected being 24,567 acres.

*Abstract from *Chemist-Analyst*.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Bolivian Mining Regulations

The Editor:

Sir—While going over back numbers of your journal my attention was called to the article 'Mineral Resources of Bolivia,' by Carlos Sanjines, in the issue of March 9, 1912. In this article, when writing on mining regulation in Bolivia, Mr. Sanjines states: "Any person having legal capacity to contract may ask as many as 30 mineral concessions (pertenencias). The measurement for each concession is fixed at 100 square metres (about 327 sq. ft.) in the direction desired by the applicant and extending indefinitely in depth. The procedure is as follows: Any person finding deposits, placers, veins, etc., has to make his application to the Prefect of the Department in which the claim is situated. The Prefect, after having published the application in the papers for some time to see if there is any opposition to the claim, shall issue the decree of concession, and the applicant becomes the owner of the mine, paying the annual tax of $5 Bol. (about $2 U. S. currency) for each pertenencia. An application is considered abandoned if the survey and setting of landmarks are not made within 70 days from the first publication."

In 1912 I went to Bolivia on a prospecting trip, and finding there some likely placer ground, I went through the procedure of taking it up, and my experience in regard to the above statements of Mr. Sanjines is as follows: (1) There is no limit to the number of pertenencias allowed to be taken up in Bolivia by any one individual; (2) the area of a pertenencia is 100 metres square, instead of 100 square metres. In canyons and where intermediate worthless strips are found this may be changed to 50 metres wide by 200 long, so as to keep the continuation required by law; (3) all applications for mining land, no matter where situated in Bolivia, must be made in La Paz, the capital; (4) the annual tax for each pertenencia is 2 bolivianos (80c. U. S. currency). The 70 days during which the surveying and setting of landmarks is required may on application be extended an additional 40 days.

J. J. DALLAND.

Fellows, California, March 12.

Taxation of Mining Claims

The Editor:

Sir—Your publication of criticism of Nevada for taxing patented mining claims opens a subject with many angles.

In 1903 the voters of Nevada balloted on the matter of taxing patented mining claims. In some cases estates and companies of the East had been holding large numbers of good patented claims in various parts of the state and doing no work toward any improvement, paying no taxes, and providing no market for the state's agricultural products, thus forcing all other property to pay high tax rates. As a result of this policy there was no incentive to undertake agricultural development, except in a few highly favored spots. Development even here was going along but half-heartedly, as had been true for many years, because of the generally low prices, the isolation, destruction of the sheep industry, and the effect of drought on the range and cattle. The voters saw fit to tax patented claims as a matter of justice to the few holding and using other property in the state. It was considered necessary in order to keep up the only industrial life that the state had. Also, the majority of the counties were in debt on account of their running expenses, though the latter were low at best. Nye county scrip had sold at 30 cents on the dollar, though receivable as cash for taxes. The Nye county district attorney received a salary of $60 per month in scrip.

With all the mining in the state at present few counties show as yet any improvement as to county revenue, and nowhere has it been proportionate to necessary expenses. It behooves the counties to look into every possible source of revenue. Of all the states in the Union, Nevada has perhaps the best chance to construct and maintain boulevards because of climate and suitable material lying about where wanted. But see what Nevada has! The people are more than willing, but where are the counties to get the money for road-making? If sufficient money were available for systematic instead of spasmodic work, the roads of Nevada would not be shameful. Distances are so great as to discourage individual effort, although something is done. While, therefore, Nevada's new scheme of taxation may seem to work hardship on the few who hold patented claims, or in fact any kind of real estate within the state and have not sufficient funds for such development as appears necessary to make it profitable, should the state take these few from the tax-roll?

However, Nevada does not tax unpatented claims. The bullion tax applies against the profits of all ores extracted within the state, whether from patented or unpatented claims or even from ground not located, and amounts to the local tax rate of each locality. The whole matter of taxing or not taxing patented mining claims seems to be one of balancing the depressing effect of those who can and will try to develop what may or may not be a gutted or otherwise discounted property, against the hardship of those who must pay $10 to $15 per claim annual tax. The latter could have put $100 per claim into property development, presumably to its benefit each year, but they preferred the expense of $225 to $300 for the patenting to do away with the development expense. Proof is afforded in Esmeralda county that many have patented claims to avoid annual expense. In fact, about 30 were not considered by past owners worth paying the tax. As soon as the law is amended to include with real estate all patented claims and to subject them to all the real estate laws, all patented claims whose taxes are allowed to lapse for eight months will be open to sale to any or the highest bidder as county

properties after 30 days' advertising. During six of the eight months the claims will be subject to ordinary tax sale, during which, of course, they can be freely looked over, except in rare cases. Back taxes and charges for 60 years will about equal the total cost of locating and patenting a claim.

GEORGE E. MCCLELLAND.

Blair, Nevada, February 24.

Miner's Liens and Leasing

The Editor:

Sir—In a recent editorial you approve the act of the Arizona legislature which relieves the owner of leased mining ground from financial responsibility for labor performed thereon, provided he has posted notices stating that the ground has been leased and that he will not be liable for wages. After many years of experience in the business, during which I have been lessor, lessee, and employed on leased ground, I cannot agree with you in approving the Arizona law. The growing respect for the rights of the wage-earner and the realization of the fact that he is often not in position to protect himself have brought about great changes in recent legislation. One of the most important and beneficial of these changes is that class of legislation which holds that the property upon which the laborer expends his efforts shall be held for his wages in case his employer fails to pay him. This law sometimes works hardship, but on the whole it undoubtedly makes for justice. The Arizona law is an indirect evasion of the mechanic's lien. Let us consider the conditions: the owner of a mining property does not desire, or is not able, to work the mine himself; he agrees to lease it; his object, of course, is purely selfish; he hopes the lease will open up a big mine, or pay him royalties, or both; he is bound to consider in some measure the character and financial responsibility of the lessee; he is in a position to do this; if he finds from due investigation that the applicant for the lease has no financial standing, he has no moral right, whatever the law, to allow such a party to employ laborers on his ground while he himself evades all responsibility by posting notices; he can protect himself by refusing the lease, or by demanding a bond, or by requiring the lessee to place sufficient funds in a bank to pay running expenses from month to month. Lessees who cannot meet these conditions have no right to be in the business. On the other hand, the laborer cannot investigate the financial standing of the lessee; he needs a job or he would not be looking for one; and he takes all the chances he ought to be required to take when he trusts the lessee backed by the value of the property leased; even then he is likely enough to get the worst of it.

The Arizona law, it seems to me, is a direct invitation to the owner of mining property to evade his moral responsibility; under authority of that law he could, and beyond all question he often would, lease his property instead of working, and for the very purpose of avoiding financial responsibility. Instead of taking the legitimate chances of mining, he would turn his property over to a lessee of no financial standing; if the property turned out well, the owner would gain; if not, the poor devils who did the work would lose; another instance of that antithesis of all legitimate mining, 'heads I win, tails you lose.'

F. N. FLETCHER.

Reno, Nevada, March 11.

[There is justice in our correspondent's contentions, and we heartily favor the growing disposition to protect more carefully the laboring man's rights. His first claim upon the product of his labor we believe sound, and should lie against shipments of ore, concentrate in bins, the winter dumps of the Far North, and similar products. That it should go beyond and rest against the mine itself is less certain. Leasing is a good system. It has rescued and rejuvenated many an old mine. It has given many a man his chance. Its virtue lies in the opportunity it affords for men with little or no capital to get a start, and its benefits flow from substitution of intelligent self-interest for the too often perfunctory performance of labor under a hired superintendent. If a mine-owner must back the lessees to the full extent of the value of the property, there is no sufficient inducement to grant leases. It is true he is in better position to investigate the standing of a proposed lessee than is the laboring man out of a job. In fact, he does make such investigation before he grants the lease. If, however, he must then stay on the job, day after day, and see that the lessee does not become insolvent, he loses one of the chief advantages of leasing, namely, the ability to arrange for the working of a small property during the absence of the owner. The laboring man being on the ground, watching the conduct of the business, should be able to protect his own interest by being given the right to levy on the proceeds of the mine. If, however, the men and local supply houses have always the final security of the mine itself, they become careless, take longer chances, and invite disaster. The posted notice, combined with the granting of the lease, says in effect to all concerned: "I the owner have investigated the resources and character of the one to whom I have granted this lease, and find both sufficiently satisfactory to warrant my turning over to him this property for temporary use. I refuse to be bound by his debts, but you, being on the ground and knowing the situation, are expected to keep watch and protect your interests from now on." This, as it seems to us, divides responsibility not inequitably, and opens the way to leasing mines. There will be some injustice under any system, and it is well to narrow the chances of fraud and failure as much as possible, but it is also important to leave the way open for working mines and developing new ones.—EDITOR.]

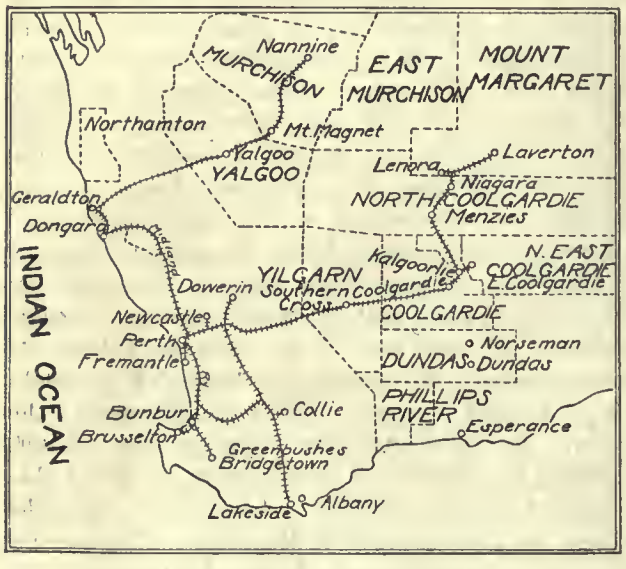
North and South America are the largest markets for our iron and steel manufactures exported. In a few articles, such as metal-working machinery, mining machinery, sewing machines, cash registers, builders' hardware, and steel billets, Europe is a large purchaser, but in nearly all of the other classes the Americas are the largest purchasers.

Special Correspondence

WESTERN AUSTRALIA

IVANHOE.—GOLDEN HORSE-SHOE.—YILGARN.—SOUTHERN CROSS.—VICTORIOUS AT ORO BANDA.—KYARRA.

After months of deliberation the various labor unions have finally decided to take a ballot as to whether they shall go on strike, or before the Arbitration Court. The majority of the men like the majority of the unions are so financially hard up that the result of the ballot is certain to be in favor of arbitration. The long uncertainty has done an immense amount of damage to the goldfields. The final decision will be made on January 26. The outlook of the big mines at Kalgoorlie is far from reassuring, one after another has suddenly reduced its output without warning. The latest is the Ivanhoe, which maintained an average grade since April last of $9.48 per ton, and an average monthly profit of $80,000. During December the grade fell to $8.91 and the profit declined to $52,800. The decline is ascribed by the management to Christmas holidays, but is really due to the fact that, in the three deepest levels, the lode is unprofitable south of the shaft.



WESTERN AUSTRALIAN MINING DISTRICTS.

The Ivanhoe has long been regarded as the most consistent mine in the district, and its impoverishment at depth is very disquieting. Up to date the mine has produced 2,607,750 tons with a yield of $35,839,970, and dividends aggregating $15,093,750 have been distributed. The reserve fund of the company amounts to $500,000. The original cash working capital of the company was only $200,000, and practically the whole of the present equipment and development of the mine have been paid for out of proceeds of gold won.

The Golden Horse-Shoe, which has been under a cloud for the past two years, has a chance of improving its position in the near future. Early in 1911 the directors arranged with the board of the Great Boulder company to bore from the 2500, 2650, and 2800-ft. levels of the latter mine to test the Horse-Shoe No. 4 lode at these levels. These bore-holes disclosed ore of high value at all these levels, the lode being found from 10 to 20 ft. inside the Horse-Shoe boundary. Cross-cuts were then driven and fully confirmed the bore-hole results. These cross-cuts were continued 200 ft. farther west to meet the Horse-Shoe shaft when sunk. The shaft is now completed to the 2480-ft. level (Boulder 2500 ft.), and is being pushed on to 2630 ft. (Boulder 2650 ft.), while a winze is already down 2630 ft. and is being continued to 2780 ft. (Boulder 2800 ft.). The cross-cut from the Boulder proved the lode at 2480 ft. to be 30 in. wide and to contain tellurides and free gold. A drift was started south and the first 10 ft. driven on ore assaying $119 per ton over a width of 36 in. The next 5 ft. improved to $319 per ton, at which point driving was stopped until work could be resumed from the Horse-Shoe's own shaft, which is now completed to that point. The Horse-Shoe has produced 3,087,300 tons, with a return of $42,557,000 and paid dividends amounting to $15,375,000. It has a nominal capital of $75,000,000, and outstanding debentures of $500,000 bearing interest at 6%. The capital was originally only $400,000 and was 'watered' to its present amount. The lease originally belonged to the Golden Link company and was passed on to the Golden Horse-Shoe company for $7500 in cash and $317,500 in fully paid shares of the latter company.

After long negotiations the Government has agreed to subsidize the Yilgarn Diamond Drilling Co., chiefly represented by Claude de Dernales, to test Frasers mine at Southern Cross by diamond-drilling. The terms are that the Government provide $10 for every $5 provided by the company, up to a maximum of $33,300, and also grant the use of a boring plant. A. Montgomery, government mining engineer, who is supervising the work, has selected two sites for the first two bores, and work has already commenced. The first hole is expected to pierce the lode at a depth of 700 ft., and the second at 500. The scheme was very strongly recommended four years ago by Harry P. Woodward, government geologist, subsequently supported by Mr. Montgomery. There are three gold-bearing lodes on the property, but only one has been worked. The mine was started as long ago as May 1889, before the cyanide process had been developed. The equipment was quite antiquated, and the 30-stamp mill had stamps of 650 lb. only and was hand fed. The ore-shoot has been stoped out for a length of nearly 4000 ft., and no work has been done below 300 ft. The mine has produced $3,622,500 from 325,600 tons, and in any other country would long ago have been further tested after such a splendid record.

Burbanks Birthday, six miles south of Coolgardie, has been let to tributers since August 1907. Prior to that date the mine produced $3,031,500 from 156,300 tons and paid $497,500 in dividends. From August 1907 to the end of December 1912 tributers mined and treated 26,750 tons for $369,000, but no less than 11,500 tons of this total, yielding $139,000, have been won since May 1912. The past two months, alone, yielded $38,600 from 3040 tons. After March the mine will be worked by the company on wages, but it will probably not pay. The company is in debt to the extent of $107,100, and the lode was found to be cut off by an intrusion of granite at No. 9 level as long ago as August 1905. All the gold won since then has come from the upper levels.

The Edna May, near the Southern Cross, found as a result of the Bullfinch boom, looks as if it might make a big record. The original prospectors mined and treated 581 tons with a returns of $20,000, and then sold the property for $400,000 cash to a Melbourne company with a nominal capital of $125,000 in shares of $2.50. This was in October, and already the company has treated 726 tons by amalgamation only, with a return of $30,000, with $8.75 per ton in its residue. The whole of the ore came from developing the lode at 70 ft., where a drift has been extended for a distance of 220 ft. The lode is 10 ft. wide, with bulges in places up to 17 ft. There is still nearly 1000 ft. to be driven to the east boundary of the lease, and rich ore is showing in the face of the drift in that direction. The lode in this property is in kaolin, but at each end the country changes to schist, and the lode breaks up into short lenses or shoots, becoming very erratic.

The Victorious, at Ora Banda, acquired by the Associated Northern a year ago at a cost of $110,000, looks as if it were to prove a good speculation. When bought, the ore was considered to be worth about $5.50 per ton, but recently the lode at the 370-ft. level has shown a marked improvement. It has been driven on for nearly 200 ft. and has ranged from $5.75 up to $60 per ton over a width of 60 in. The last 50 ft. driven averaged $60 per ton, and the face is in ore of this class. When the company acquired this property the shares were quoted nominally at $1.25. They have recently advanced to $3.50. During

December 7000 tons was treated with a return of $34,500 and a profit of $11,500, but during January it is expected that some 9000 tons will be milled for an enhanced profit. The property is in a district about 40 miles northwest of Kalgoorlie, and pronounced by geologists to be a continuation of the Kalgoorlie belt of country.

The Kyarra at Meekathara is turning out far better than expected. Before the mine was taken by an Adelaide company in April last, the owners had treated 758 tons for $39,500, broken from the 30-ft. level, water level. Since then the mine has been opened up to 200 ft., where the lode is 10 ft. wide, assaying $90 per ton at the bottom of the shaft. The north drift at this level is in 14 ft., in ore assaying $70, and the south drift 14 ft. in ore assaying $50. The mill started crushing in the middle of December and treated 304 tons for $7100, with an average in the residue of $10.50 per ton. This is a wonderful return.

PORCUPINE

HOLLINGER HAS GOOD YEAR.—DOME USING ELECTRICITY.—SMALL MINES ACTIVE.—SWASTIKA AND UNGAVA ATTRACTING ATTENTION.

The last report of the Hollinger mines shows conditions to be exceedingly satisfactory. For the last six months of 1912, the net operating profit was $600,664, notwithstanding the heavy additional expenses and losses incurred during the strike in November and December. For the two weeks ended February 4 and February 11 there was milled 2025 and 2122 tons containing $65,005 and $59,313, respectively. At that time there were 35 stamps in commission, but now all 40 are running and it is stated that the mill will have no difficulty in producing about $75,000 per week, as the additional stamp capacity will permit of treating a larger tonnage than formerly. When development was first started on the 300-ft. level, the grade of the ore was disappointing, but it was later found that the company had been working on a branch vein. A considerable amount of development has now been done on the main vein at this level, and the results to date show that the ore is of as high grade as on the upper levels, while the width is as great, if not greater. Despite the satisfactory statements of earnings, there is considerable criticism with reference to the length of time it is taking to attain any great depth. The company has now been operating for over three years, but the 300-ft. level has only been opened very recently and a small amount of driving accomplished. Notwithstanding the satisfactory grade of the ore and the number of veins, it is essential that a property of this sort, milling about 400 tons per day, should be proved at depth as rapidly as possible, and the slowness in this regard is one of the disappointing features. There have, of course, been many circumstances serving to retard the development of the mine, but it is believed that this is one of the points that should have had first consideration.

The Dome mine is now running on electric power at a considerable saving over former conditions. Steam-generated power in Porcupine costs in the neighborhood of $150 per horse-power year, while electric power costs about $50. On a property using about 1000 hp., as is the case with the Dome, this is a very important item. The development work at the No. 2 shaft has been satisfactory and a large body of ore, the presence of which was heretofore unsuspected, is now being developed. The question of increasing the capacity of the mill is under consideration, although nothing definite has as yet been decided upon. If the development of the mine during the next six months continues to be as satisfactory, there is every reason to expect that steps will be taken to double the capacity of the mill. While the metallurgical practice at this mine has in most respects been extremely satisfactory, it is thought that by making some changes, the cost of treatment may be cut down. Experiments are being conducted toward this end.

Among the smaller mines, there is pronounced activity, and indications point toward a good deal of construction during the coming season. The Jupiter mine is being unwatered and the company will start sinking the main shaft to the 500-ft. level. A new crusher and the other necessary machinery to permit of this work has already been ordered. It is expected that work on the mill will be started within a month. At the McEnaney, a 5-stamp mill is now in operation and satisfactory results are being obtained. Development on the 400-ft. level of this property has been so encouraging that the management has decided to increase the capacity of the mill. It is probable that 15 more stamps will be added, making 20 in all. Arrangements have now been completed for the financing of the bonds of the Vipond mine and the construction of the cyanide plant will start about the end of March. Although it has not as yet been absolutely decided, it is probable that the decantation process will be used. This is an entirely new departure for the Porcupine district. Good progress is being made with the construction of the Dome Lake mill, which should be in commission in about a month's time. As a result of the reduction of the capitalization from $2,500,000 to $5,000,000, the stock is now being sent in for transfer on the basis of 20 old shares for 3 of the new. There are 1,000,000 shares in the treasury and the balance is held by the General Assets Limited and a few industrials.

The Minister of Labor at Ottawa has instructed the sheriff at North Bay to release on ticket of leave, the three Porcupine miners who were convicted of offences under the Industrial Deputies Act and sentenced to terms of imprisonment at Sudbury in default of the payment of fines. The cases arose out of the strike of miners in the Porcupine district when the Hollinger company took action against the men for striking without notice as required by law. The cases are being appealed, and pending the results of the action, the men have been released. The Swastika district is still attracting considerable attention, and a good many sales of properties have recently been made. These sales are, however, in the majority of cases, to men who have no intention of operating the properties, but are simply holding them for a rise in price due to the speculative element attracted by the rich shipments from the Tough property. This company has shipped several cars of ore running between $400 and $600 per ton. The vein is, however, very narrow and it is doubtful if the property will ever make a large mine. There are other interesting prospects in the district, but the prices at which they are held do not permit of their development. So far, nothing has been discovered which will compare with the Tough claims. Alex Gillies, one of the stakers of the Hollinger mine, is getting up a party to go into Ungava in the spring. The party will consist of about eight men who expect to be gone four or five months. They have no particular objective, but are on a general prospecting trip and believe that the geological conditions warrant the expectation of discovering something of value. A start will be made as soon as the ice leaves the rivers.

SALT LAKE CITY, UTAH

COST OF LEAD.—TRANSPORTATION TO ALTA.—BINGHAM MINES REPORT.—ONTARIO CHANGES.

What does it cost the leading mines to produce a pound of lead? This question, asked some of the leading producers in connection with the prospective tariff revision, has shown a woeful lack of statistical records in connection with the lead industry, especially in the Rocky Mountain region. The fact is proving a great handicap in the fight to prevent a radical cut in the lead tariff. Some of the largest mining companies of America can give only a vague idea of what the cost of production is, or cannot tell at all. This stands in marked contrast to the custom of copper-mining companies in treating 'cost per pound' as one of the principal features of their accounting. As a result, the organization of lead producers which is preparing to combat before Congress any reduction in the lead tariff, is having difficulty. This is more especially true of the mines carrying silver and gold in association with the lead. A general call has been issued to mine-owners to furnish statistics for the aid of the committee,

of which Duncan MacVichie of Salt Lake City is chairman, but so far the call has brought almost no results.

Alta is soon to have better transportation facilities, if the plan of J. G. Jacobs is carried through. Mr. Jacobs, who built the Salt Lake & Mercur road a number of years ago, has secured from the Denver & Rio Grande a lease on the branch road from Midvale to Sand Spur, and the right-of-way extending beyond that to Wasatch, a summer resort in Little Cottonwood canyon. Another mile takes the road to some granite quarries, and two miles from Tanner's Flat, the terminus of the Michigan-Utah overhead tram. It is the intention to extend the tramway to the terminus of the road. The distance from Midvale to Wasatch is 10.1 miles. The completion of these plans will eliminate entirely the wagon haul between Alta and the smelters, cutting down the cost of hauling both ore and supplies.

The Bingham Mines Co., which has been working along quietly for some time, has issued an annual report which shows net earnings of $138,113, compared with $109,248 for 1911. This is in the face of a shut-down of the Dalton & Lark and Commercial mines in Bingham for several months on account of the strike. From this must be deducted $28,920 interest on first-mortgage bonds. During the year $81,000 par value of these bonds was purchased and canceled. Eagle & Blue Bell, of Tintic, which is controlled by the Bingham Mines Co., earned $91,912 for the year, the best it has ever done. The president, Mr. Graves, says that during 1913, there will be available for further reduction of bonded indebtedness $145,067. On account of the favorable contracts for smelting it now has, and of the hostility of farmers against smelter smoke, the company's smelter, originally built by Bingham Consolidated, has been sold and will be dismantled. The original cost was in the neighborhood of $1,000,000.

The annual report of the Ontario Silver Mining Co., of Park City, discloses the fact that property of the Park City Light, Heat & Power Co., all of the stock of which was owned by the Ontario, has been sold to the Utah Power & Light Co. for $180,000. The company now has $228,854 cash on hand and $62,500 in New York City and American Smelters Securities Co. bonds.

RHODESIA

GLOBE & PHOENIX.—EMPRESS PALMEIRA.—CAM & MOTOR.—OUTPUT OF SOUTHERN RHODESIA FOR 1912.

At last the directors of the Globe & Phoenix gold mine munificently have decided to accept lesser fees and to allow shareholders to have some representation on the board. This latter concession seems altogether ludicrous, but it is quite true that with a fine show of liberality the eight well paid gentlemen who constitute the London board of directors have agreed to allow a nominee of the shareholders in their midst. Unfortunately, the Globe & Phoenix is far from being the exception, as among Rhodesian mining concerns it is rather the rule among Charterland mining enterprises that those who have sunk capital in mining concerns are regarded as unimportant factors. As to the latest position at the Globe & Phoenix, the new roasting plant is operating successfully. Developments underground, on the whole, appear to remain fairly satisfactory, but there seems to be some reason for qualifying this statement somewhat in its application to the lowest levels. A third interim dividend of 1s. 9d. per 5s. share has just been declared.

At the Empress-Palmeira mine, owned by the South African Prospecting & Concessions Syndicate, the bulk of the machinery recently ordered to effect a duplication of the existing compressor and power haulage plant has arrived. The balance, light parts, and fittings, is due to arrive shortly. All possible sources of delay through flooded rivers have, so far as can be seen, now been avoided and the erection of the plant will proceed with all possible speed. The concrete foundations for the two new boilers, compressor, driving engine, and hoist were prepared in advance, and the last named is already in position for use. According to latest reports from the mine, all working faces in the east and west lodes are looking well.

The Cam & Motor company is preparing to commence productive operations at an early date and tenders are invited for the supply and delivery of wood fuel in the proximity of the main shaft. An enormous quantity has been called for, and it would seem that the company does not for the time intend to avail itself of any coal from Wankie.

While an increase of approximately £60,000 over the 1911 total is shown in the gold output of Southern Rhodesia for 1912, the dividend list was considerably less. The gold output of Matabelland and Mashonaland for last year was valued at £2,707,369, as compared with £2,647,896, and that of 'other minerals' at £257,230, as against £242,863 in the preceding year. The total value of the mineral output thus was £2,964,599, as compared with £2,890,759. So far as can be gathered at present, the gold mining, financial, and colliery companies paid out in respect of last year's operations £566,971, which is a long way below the 1911 distribution of £954,613. The amounts paid out last year are as follows:

	Per cent.	Value.
Bechuanaland Exploration Co.	4	£8,000
Charter Trust	7½	35,312
Charterland & General	5	8,190
Eldorado Banket	30	90,000
Gaika	5	13,675
Giant	32½	84,942
Globe & Phoenix	110	220,000
Lonely Reef	20	54,200
Mayo	10	15,201
Rezende	7½	8,881
Rhodesian Gold Ex.	15	805
Susanna mines	7½	2,437
Wankie colliery	12½	25,327

The decrease is due in a large measure to the absence from the list of the old Rhodesian Exploration & Development Co. (now absorbed by the Consolidated Gold Fields), which distributed £151,000 in 1911; Willoughby Consolidated, which returned £31,700; and the Enterprise G. M. & E. Co., which paid out £20,000. There also are reductions to be recorded in the declarations of the Charter Trust and of the Giant, while the Globe & Phoenix distribution is 10% less. The total sum paid out has not come up to expectation, but having regard to the absence of the Rhodesia Exploration & Development Co. through absorption by the Gold Fields, the total cannot on the whole be regarded as unsatisfactory.

NEW YORK

GERMAN FINANCIAL SITUATION BAD.—COPPER PRICES STEADY.—TUOLUMNE REPORT.—BUTTE CENTRAL LOOKING UP.—CANADIAN STATISTICS.—NIPISSING AND HEDLEY DO WELL.

General conditions in Wall Street have not changed, at least there has been no marked indication of a more hopeful tone. Some months ago and at a time when Germany was attracting more than her usual share of attention as a large user of copper, mention was made in these columns of the over extended position financially at Berlin, and the suggestion was made that when some degree of final liquidation was demanded, the German Empire would be found to be in need of real and substantial aid, if all of her many recently erected chimneys were to be kept smoking. The forecast so made has been more than justified, and while anything like talk of panic or any widespread financial disaster has been deprecated, the gold shipments sent from New York to Berlin, or to other points for Berlin account, have been matters of grave concern during the past fortnight. Nearly everyone is professing to believe that beyond the footing of the tremendous bills which have already been incurred, the European situation holds nothing of ominous portent for the future: nevertheless, the weight of the armaments is so tremendous, the appropriations for munitions, supplies, and even millions for aerial military machines—the exactions upon young men, who need to be engaged for their own good and that of their country in various lines of fruitful industry, are so large—that there is much more back of the

financial situation than appears at first glance. Beyond three or four days of semi-panicky conditions in which new low records for the year were made for several issues, market movements have been negligible and public interest as completely lacking as it has been during the past three or four months or longer.

In copper metal markets, the situation in Europe has been the governing factor. It is undoubtedly true that for the most part, in spite of all the various forms of agitation, Europe is still going forward industrially, but it is equally true that in reality the war of dollars and cents now being waged in the piling up of indebtedness must, in all prudence, be counted almost as much fraught with danger as the actual clash of arms. At home and abroad, there are a good many overwrought nerves. Copper metal has been steady at 15½c., with domestic consumers apparently willing to come in the market at 15c. Exports for January and February of this year are more than 33,000,000 lb. under the exports for the corresponding period last year. Whether or not this decrease will be overcome later will depend fully as much upon financial conditions as upon the eventual peaceful settlement in southeastern Europe. The annual report of the Tuolumne Copper Co. shows a production during 1912 of 4,716,047 lb. of copper, 131,867 oz. silver, and 259 oz. gold. The average copper content of the ore mined was 7.5%. The deepest working of the Tuolumne is now 2300 ft. The Tuolumne interests control the Pilot Butte Mining Co., and the latter is just developing into a shipping property which is expected to be a regular producer by the middle of June. The issues of both companies are held very largely in the East. Butte is to have another important producer soon in the Butte Central, which for the present is largely a silver producer. The ore is to be treated by cyanidation, and it is anticipated that the property will develop as have so many of the older properties in Butte with gold and silver in the upper levels, and copper at depth. The concentrator is now handling 125 tons per day, and from the present outlook this capacity can be at least trebled in the near future. Several examinations have been made of the property, and Butte will not be at all surprised if some of the important mining interests absorb the Butte Central. Apparently the final chapter has been written in the history of the Rudefeha-Ferris-Haggerty-Battle Lake-Tunnel Site-Doane-Rambler-North American-Penn-Wyoming Copper Co. A final decree of foreclosure has been entered in favor of the Continental & Commercial Trust & Savings bank. The history of the various promotions organized with the old Rudefeha property as a basis, if ever told in full, will read like one of George Randolph Chester's 'Wallingford' stories. None of the properties in the district has ever been able to produce enough copper to get on a regular paying basis, but various groups of promoters in succession have managed to sell to the public, millions and millions of shares in various organizations and reorganizations. Stock was sold when the mergers were put together and money was raised when they were taken apart, and again when reassembled.

The preliminary annual report covering the mineral production for the Dominion of Canada for 1912 has just been given out by the Director of Mines. The production of the more important metals as given is as follows: Copper, 77,775,600 lb., being an increase of 22,127,589 lb. as compared with 1911. The gold output was 607,609 oz., being an increase over the preceding 12 months of 134,450 oz. It is a little surprising to note that in spite of the recent revival in Cobalt, and the equipment which has been put in and which is handling low-grade ores so successfully, there was a decrease in silver production. The silver output amounted to 31,931,710 oz., being a decrease of 627,334 oz. Of the entire mineral output, the province of Ontario is credited with 38% and British Columbia with 22%. Speaking generally, the report says that "a feature of particular interest during the year was the continued and extended development of ore reserves. The satisfactory results from these operations, particularly in the case of copper-nickel ores of the Sudbury district, the Porcupine gold ores of Ontario, and a number of copper and lead deposits of British Columbia point to much greater annual output in the future." The City of Cobalt property has been sold by the City of Cobalt Mining Co. to Ottawa people for $750,000. The Nipissing Mines Co. of Cobalt has declared its quarterly dividend of 5%, with the usual extra disbursement of 2½%, payable April 21. The financial statement of the Nipissing company at the end of the quarter shows total cash assets of $1,202,257. The Nipissing company is not alone in its building up of a strong treasury position. The La Rose Consolidated Mines Co. reports on March 1 a cash balance on hand of $1,425,836; ore shipments in transit, $184,032; ore ready for shipment, $78,017; total, $1,687,885. It is understood that the balances being built up in the treasury of these two companies will possibly be reinvested in the first big enterprise to be undertaken by the Canadian development company which was organized a year or more ago by Messrs. Ambrose Monell, Percy Rockefeller, William E. Cory, E. C. Converse, and associates. The Hedley Gold Mining Co. has declared a quarterly dividend of 5%, being the regular distribution of 3%, with an extra payment of 2% payable March 31. The Hedley company has done particularly well in its dividend record; on the first of the year it distributed the regular 3% dividend with a Christmas donation for the shareholders of 12% extra; the shares are listed on the Boston Stock Exchange, but are so closely held that trades are rarely recorded. The Pato dredge belonging to the Oroville Dredging, Ltd., sank in February, but was promptly repaired and refloated. Only minor damage and small loss of time is reported.

AUSTIN, TEXAS

PROPOSED NEW MINING ACT.—A DEEP WELL.

Another effort is being made to secure the unreserved opening for the public lands of Texas to prospecting. The present law does not, it is thought, sufficiently do this, and C. B. Hudspeth and R. E. Burger of El Paso have respectively introduced in the Senate and House a new act. The proposed law provides for location of both placer and lode claims and gives exclusive possession, following discovery, staking, and survey, during such period as $100 worth of work shall be done annually on each claim. A royalty of 5% of the gross output is to be paid, and the number of claims that any individual, firm, or corporation may locate or lease is limited to five. A. M. Sivenson & Sons are drilling a deep test-well near Spur, in the 'panhandle.' It is now over 4000 ft. deep and will be continued until an adequate water-supply is found or drilling becomes too difficult.

DENVER, COLORADO

CONEJOS COUNTY REPORTS GOLD DISCOVERY.

Conejos county has recently been brought to the notice of mining men through a reported gold discovery, made by a new prospector in the district named Gilmore. The property lies three miles west of Platoro, and in a territory heretofore considered outside of this mineral belt. This new find is tellurium and free gold, in a 2-ft. streak of a well defined quartz, following a porphyry dike. It is reported to average about $700 per ton. The property is being worked by a force of men this winter, and ore is being sacked for shipment in the spring. Owing to Gilmore having Cripple Creek friends, large operators there have sent representatives to get hold of the property. While these men were on the ground in October, a heavy snow-storm came and covered the ground so that actual prospecting of the veins covered by the locations could not be undertaken. The Cripple Creek men are planning to return early in the spring.

The older properties in the district have produced large quantities of high-grade ore in the past. One has shipped $300,000 worth. The veins are large well defined 'fissures' carrying widths of 3 to 15 ft., and averaging $7 to $15 in gold and silver per ton. There is a good power site on the Conejos river a few miles below Platoro, which can be developed at small expense.

General Mining News

ALASKA

JUNEAU

The Alaska Gastineau Mining Co. will install a 200-hp. motor and three 100-kva. and three 150-kva. transformers, which have been ordered from the General Electric Company.

ARIZONA

GILA COUNTY

The old Champion mine was opened in 1875, and from that year to 1884 produced about $200,000 in silver and was then shut down. During the past week it was explored as far as possible, and old dumps have been looked over. It is now the intention to reopen the mine.

(Special Correspondence.)—At the United Verde Extension mine at Globe the work of clearing up the workings on the 800-ft. level still continues. Active development has been delayed pending the arrival of the air-compressor. There has also been some intended delay incident to acquiring the Jerome-Verde Copper Co. and also the Florence claim of which W. A. Clark owns one-third interest. These interests have now been secured. While the old company was working the property it was reported that more than the one ore lode had been discovered in the ground.

Globe, March 12.

During 1912 the Southwestern Miami Development Co. did 11,300 ft. of churn-drilling on claims adjoining the Live Oak. Five of the seven holes drilled show an extension of the Live Oak orebody, and, based on drill records, there is apparently 1,500,000 tons of ore in the claims. At Miami the slicing system of mining is gradually being superseded by the shrinkage-stope method. The new change-house at No. 4 shaft, to accommodate 860 men, is nearing completion. It is of steel and concrete and contains 100 shower baths, and steel lockers. During February, development at the Inspiration covered 5220 feet.

MOHAVE COUNTY

The Boundary Cone shaft is down 550 ft., and a drift is being driven east toward the ore-shoot found in the winze below the 450-ft. level, and is now in good ore. It is stated that rich ore has been opened on the 500-ft. level of the Gold Road mine.

PIMA COUNTY

(Special Correspondence.)—The Pioneer Smelting Co. is now handling about 180 tons of ore per day, of which 40 tons is derived from the Plumed Knight mine. The company's smelter at Corwin, originally built as an oil-fired blast-furnace, has been reconstructed so as to use coke in the ordinary way. The oil smelted the charge successfully, but it was found impossible to secure an even distribution of heat in the smelting column, so that the use of oil has been abandoned for the present, though it is planned to make further experiments later. As a result of the activities of the smelting company, which handles a good deal of custom ore, a number of promising prospects are developing throughout the country.

Tucson, March 10.

YAVAPAI COUNTY

(Special Correspondence.)—The Midnight Test mine on Groom creek is to be operated again at an early date. This property has good ore in its workings. The main shaft is down 450 ft. A revival of mining operations on Groom creek will be generally welcomed. The district is an old one, and in the past produced a great deal of rich ore, but these old properties have been lying idle for years. Many poor men made stakes on Groom creek: A rich find is reported from the Redman mine, near McCabe.

Prescott, March 10.

The Best Friend group of claims, in the Weaver district, 9 miles southwest of Kirkland, are opening satisfactorily. Three shafts are down 70, 100, and 150 ft., and ore containing copper and gold has been opened. The adit of the Nelson mine at Crown King is in 900 ft., and for a considerable distance 3 to 5 ft. of ore has been driven on, assaying from $20 to $100 per ton. Another adit is to be driven below this one. The Climax 10-stamp mill has started work. The adit in the Christmas claim, adjoining the Climax group at Hassayampa, is in 125 ft., and shows 18 in. of ore.

CALIFORNIA

CALAVERAS COUNTY

(Special Correspondence.)—The Utica Mining Co. has resumed operations at its Gold Cliff and Cross mines after a shut-down of about five months because of lack of water-power. The 40-stamp mill at the Gold Cliff is running on fair-grade ore from this property, and the Stickles plant is operating on quartz from the 1800-ft. workings of the Cross. Repairs are still under way on the flumes, ditches, and reservoirs of the company. Work has been resumed at the Reiner gravel property, on Bald hill, a mile from here. A new head-frame has been erected, and new machinery installed to replace the equipment destroyed by fire last fall. It is understood that Eastern capitalists have become heavily interested and that the mill will probably be rebuilt before the end of next summer. A. C. Wilson, formerly assistant superintendent of the Utica company, has been placed in charge of affairs. John C. Benson is president. The diamond-drill at the Waterman mine has intersected a promising ore-shoot. Samples of the quartz are currently reported to assay well in gold, and the management plans to sink a working shaft at an early date. The North Star mill is running on ore from the 600-ft. workings.

Angels Camp, March 16.

SACRAMENTO COUNTY

The report of the Natomas Consolidated of California for the year ended December 31, 1912, contains the following information: Results of the year's operations were

NATOMAS No. 8, DURING CONSTRUCTION.

highly satisfactory. No. 7 dredge went out of commission in May; No. 8, which was destroyed by fire, in October 1911, was being rebuilt during the whole year; and No. 10, which was not finished until October, only worked 3 months. The 'fleet' is practically complete, save No. 7, which is being reconstructed with a steel hull. During

the current year record returns are expected from this department. The rock-crushing department had a quiet run owing to inactivity in permanent road construction. In November a contract was closed with the State Highway Commission to supply 500,000 tons of rock. A washing plant was erected at No. 2 crusher plant, which will add to its general efficiency. The engineering department has charge of all mechanical and field construction; and in reclamation district No. 1000 three miles of levee was completed, and two miles is under construction. At the river levee a right-of-way was cleared for 18 miles, and 13 miles of core-trench and auxiliary levees were completed by drag-line excavators. In district No. 1001 the Yankee slough levees were finished, also those along the Bear, Feather, and Sacramento rivers. Land to be cleared, before the material was placed, to form these 33 miles of levees, was 750 acres. Ten thousand acres of land are ready for subdivision. In the irrigated land section, the Alder creek electric pumping plant, of 50,000 gal. per minute capacity, was completed. Other finished work in the distributing system covered approximately 21 miles of concrete-lined ditch, steel flume, siphons, main canal, and main and secondary laterals. The town of Citrus has been laid out and lands subdivided. The land department was formed in February 1912, and 3600 acres were cleared and 6300 acres prepared for grain and alfalfa planting. The production of table and wine grapes was 18,000 crates and 84,000 lb., respectively; also 9000 lb. of olives and 15,000 lb. of oranges. The whole of the company's agricultural property has been put on a producing basis, and the reclamation of land should be complete in 1913. The operations of the company during the past year may be summarized as follows:

Gravel dredged, cu. yd.	22,155,162
East side levee, material moved, cu. yd.	470,000
River levee, material excavated, cu. yd.	788,000
River levee, placed by suction dredge, cu. yd.	275,000
Material placed for Yankee slough levees, cu. yd.	3,500,000
Yield from dredges	$2,020,635
Revenue from rock-crushing, orchards, and other departments	323,406
Net income, after deducting all expenses, including loss on No. 8 dredge	1,013,683
Assets:	
Gold-dredging properties	$13,431,337
Reclamation properties	16,600,859
Irrigated land properties	4,044,426
Water department properties	4,551,042
Rock-crushing properties	1,047,772
Engineering department	1,154,542
Construction department, dredges	761,873
General equipment	90,872
Total capital assets	$41,682,724

Current assets total $735,679, and include cash, $132,176, and material and supplies, $455,502. The surplus at January 1, 1913, was $1,300,520. The capital stock of this company is 250,000 shares of $100 each, of which 160,688 have been issued, while bond issues total $17,467,000.

Shasta County

(Special Correspondence.)—Porter & Taylor have arranged to place a small electrically-operated steam-shovel on the Russell placers, near Igo. Prospecting with shafts is going forward rapidly, and gravel of good grade has been proved. The Noble Electric Steel Co. has completed most of the work at its new smelter, and expects to blow in two furnaces early in April. Each furnace has a rated capacity of 200 tons per day and will require 2000 hp. The Hazel Gold Mining Co. is disbursing regular monthly dividends of $9000, at the rate of 1c. per share. To date, the company has paid out $891,000 to stockholders. The company operates the Gladstone mine at French Gulch.

Redding, March 11.

Sierra County

A company is being formed to control the gravel properties of this county, covering about 7000 acres of patented land. The business is being negotiated by F. M. Phelps and is said to be the biggest deal in mining property in northern California for several years.

Tuolumne County

(Special Correspondence.)—Electricity is now the only power used at the Dutch mine, at Quartz, the last change from steam to electric power having just been made by the installation of a new hoist. A telephone system has also been put into the mine. The Rising sun mine, at Arastraville, owned by San Jose people, is being unwatered for further development. James Bennett and J. J. Beatty, of Carson City, Nevada, have secured a bond on the Hibbing ranch, at Blanket creek, and will shortly begin the development of some promising prospects on the property.

The Jamestown Exploration Co. was incorporated this week. Its capitalization is $100,000, with shares at $1 each, and Jamestown is the principal place of business. The directors are John Lane, J. P. Mangante, A. P. Azeredo, Ed. Parr, and A. Campora, all of Jamestown.

Gravel that yields as much as $30 per carload has been uncovered in a claim on the Stanislaus river, northwest of Tuttletown, by John Witney. The indications are that the gravel deposit is of great magnitude. Suit has been brought against the Central Mother Lode Mining Co. for $50,000 damages by Richard N. Magee for injuries received on January 14, 1913, while employed in the Mangante mine, near Jamestown. The names of James Watkins and F. E. Vickery, of Oakland, and F. M. Scammell, of Piedmont, appear as directors in the articles of incorporation of the Columbia Mining Co., filed in this county last week. The capital stock of the company is $300,000, with shares at $1 each.

Sonora, March 8.

(Special Correspondence.)—The Tonopah Belmont Development Co., which has been developing the Dreisam mine at Tuolumne, has stopped work, the property not having justified the payment which fell due on March 5. W. B. Chidester has been in charge and has returned to Tonopah.

Tuolumne, March 18.

COLORADO

Clear Creek County

(Special Correspondence.)—Work was resumed this week on the Oriental property situated on Lincoln mountain. August Swanson & Co., the owners, contemplate purchasing electrically-driven machinery this spring. Ore shipments have been started by S. Selander & Co., leasing at the Anamosa mine on Columbia mountain. The product is consigned to the Combination mill at Idaho Springs. The Pelican mill at Silver Plume is to be overhauled and repaired. H. B. Clifford & Co., of New York, will operate the plant under lease. Four sets of lessees are at work at the Conquerer mine on Covode mountain, and an average of 25 tons of ore is being mined daily. J. L. Wegrich is manager. Heavy shipments of concentrate are being made from the Pioneer mill, returning $25 per ton. Work has been resumed at the Little Giant mine on Red Elephant mountain. The 270-ft. shaft is to be sunk 100 ft. Timber is being delivered on the dumps of the Colorado Central mine, preparatory to starting development. The Marshall adit will be repaired, while the engine-room will be retimbered.

Georgetown, March 10.

Eagle County

The owners of the Lady Belle claim at Brush creek will ship ore to the Arkansas Valley plant, if the roads are good enough. Another adit is being driven about 100 ft. below the discovery adit, and is in 20 ft., in mixed sandstone and gypsum. J. Bucholz and associates have opened 2 ft. of ore in sandstone in their Flying Dutchman claim, which is about 1200 ft. east from the Lady Belle. The ore is highly mineralized, and samples have been sent to Leadville for assay.

Lake County (Leadville)

Stations at the St. Louis adit, Breece hill, interior shaft, have been completed and driving on the vein opened, when cutting a station at No. 2 level, has been started. From

the 360-ft. level of La Plata, Rock hill, lessees continue to ship the usual quantity of carbonate of zinc. Above the adit-level of the Bullion King, near Breckenridge, a 3-ft. vein has been opened, assaying 38% zinc and 11 oz. silver per ton. An 82-hp. electric hoist has been installed at the Pyrenees, Carbonate hill. A drift west of the Chrysolite shaft, Fryer hill, has been driven into what is like a white porphyry, carrying a fair percentage of silver, and the owners do not know what class of ore they have opened.

TELLER COUNTY (CRIPPLE CREEK)

The Gold King Mining Co. produced 4794 tons of ore in 1912 averaging $15.06 per ton, making $72,211, while the total to date is 91,453 tons, yielding $1,867,816. Dividend No. 19 absorbed $14,053, and the cash on hand at December 31 was $53,066. The suit of the Doctor-Jack Pot Mining Co. against the Work Mining & Milling Co., dealing with the value of the ore wrongfully mined by the latter company, is now being heard at Denver. The annual meeting of the El Paso Consolidated Gold Mining Co. was held at Denver on March 10, and with one exception all old officers were reëlected. The company will pay one-fourth of the cost of the new drainage tunnel for the district.

The last measurement of the flow of water from the Roosevelt tunnel showed 8030 gal. per minute, and there has been a steady drop in the water-level of the Elkton and Mary McKinney mines. T. R. Countryman, engineer for the drainage tunnel, is preparing a report in connection with the proposed lower tunnel.

The decision of the court at Denver is that the Work Mining & Milling Co. must pay the Doctor-Jack Pot Mining Co. $400,000 for ore extracted from the property of the latter.

IDAHO

CUSTER COUNTY

The Lost Packer mine and smelter, which are situated in the mountains about 112 miles from Mackay, the nearest railroad point, are to be operated during the present summer. The mine produces rich copper ore, and stoping is in progress. About 350 horses will be required for the season's work. This company is controlled by Utah people.

CANYON COUNTY

It is reported that a genuine discovery of rich gold ore has been made by E. Pennington eight miles west of Hanedale, with Caldwell as an outfitting point. An adit was driven 200 ft., and then 28 ft. was driven through ore which is heavily mineralized. A shipment will be made to Spokane.

SHOSHONE COUNTY

Deeds for an undivided quarter interest in 33 mining claims near Burke were filed on March 8 by E. R. Day to H. L. Day, president of the Federal Mining Co. At the Coeur d'Alene Vulcan property the adit is in 3192 ft., and two veins were cut on which development will be done as soon as the snow clears away from the district. Work at the Tamarack & Custer property near Wallace has opened ore in No. 4 adit at 700-ft. depth, 2000 ft. in from the portal. This is supposed to be part of the rich shoot mined in the upper workings of the Custer. The Culver Mining Co. has been dissolved and the Amy-Matchless Mining Co. has taken over its Pine creek holdings.

MICHIGAN

HOUGHTON COUNTY

During 1912 the Hancock Copper Mining Co.'s receipts totaled $232,977, and expenditure exceeded this by $34,565. Development was confined principally to sinking No. 2 shaft to 4000 ft. and cutting the necessary stations. Driving on No. 3 lode was done on No. 16, 18, and 27 levels, and cross-cuts driven east from No. 13, 18, 27, and 34 levels. Some work was done on a promising-looking amygdaloid lode cut by No. 18 level cross-cut 735 ft. east of No. 3 lode. It varies from 3 to 8 ft. in width, and is well mineralized 150 ft. south and 50 ft. north. Driving on this lode will be done on No. 13, 27, and 34 levels. As mentioned in these columns last week, a rich lode was cut at 3600-ft. depth. Arrangements were made for crushing 'rock' by the Lake Milling, Smelting & Refining Company.

Copper production of the Lake Superior mines in February was as follows: Baltic, 1,730,000 lb.; Champion, 2,150,000 lb.; Trimountain, 948,000 lb.; Mohawk, 1,320,000 lb.; Wolverine, 766,000 lb.; Franklin, 296,000 lb.; Calumet & Hecla, 4,794,235 lb.; Centennial, 153,010 lb.; Osceola, 1,162,810 lb.; Ahmeek, 1,061,995 lb.; Tamarack, 563,885 lb.; Isle Royale, 534,693 lb.; Allouez, 475,535 lb.; and Superior, 180,573 pounds.

MONTANA

LEWIS AND CLARK COUNTY

The annual meeting of the Barnes-King Development Co. was held at Butte on March 11. The manager, G. T. McGee, stated that the Kendall mine is opening satisfactorily, but the Piegan-Gloster has failed to show as good an orebody as was expected, and a serious cave-in had hindered work. An adit is being driven 400 ft. into the Norman claim to open the old Gloster workings. A 37 days' run was cleaned up prior to March 6, yielding $39,450. The mill at Kendall is treating 100 tons of North Moccasin ore per day, worth $9.71 per ton, with 92% extraction. The cyanide plant is to be further equipped at a cost of $10,000.

SILVERBOW COUNTY

During 1912 the Tuolumne Copper Co. produced 4,716,047 lb. of copper, 131,867 oz. of silver, and 259 oz. of gold from the treatment of 46,683 tons of ore. The first-class ore averaged 7.35% copper and 3.38 oz. of silver, while the second-class ore averaged 4.05% copper and 2.58 oz. of silver per ton. The gross value of production was $739,196, and net returns $415,528. The main shaft was sunk 206 ft. to 2080-ft. depth, and development covered 3353 ft. All ore was from the 1200, 1600, and 1800-ft. levels. On the 2000-ft. level a promising vein was opened, and stoping on the 800-ft. level is yielding good ore. In about 60 days the 2200-ft. level should be started. The new hoist installed is capable of working to a depth of 3500 feet.

YELLOWSTONE COUNTY

Drilling for oil is in progress at Hardin, southeast, and at Silecia, southwest of Billings. The well at the former place will be below 2500 ft. in May. Texas people are interested in the work.

NEVADA

NYE COUNTY

During the past week the Tonopah mines produced 10,735 tons of ore worth $228,424, making the year's total 120,095 tons and $2,521,752. The Tonopah Mining Co. is distributing $400,000 on April 21, making a total of $10,450,000. During February the plant at Millers treated 13,921 tons of ore yielding 208,400 oz. of bullion, and 102 tons of concentrate worth $35,325, the total yield being $200,075 and profit $95,407. The new Belmont mill treated 11,960 tons, yielding 287,700 oz. of bullion, with a profit of $130,147. On No. 7 level of the Jim Butler, a cross-cut from the winze cut 3 ft. of ore, which is thought to be the faulted section of the Fraction vein developed on No. 6 level. The February output was 1887 tons, yielding a profit of $20,393. At Manhattan the Big Four company will erect a larger head-frame and install an electric hoist. The new mill is treating 80 tons per day, and the recovery by amalgamation is 92 per cent.

WHITE PINE COUNTY

Lessees on the Metzgar claim of the Centennial Development Co. have cut high-grade copper ore in a drift from the bottom of its 50-ft. shaft. The vein is 18 in. wide and assays up to 30% copper. A shipment will be made as soon as possible.

OREGON

JOSEPHINE COUNTY

(Special Correspondence.)—The affairs of the Old Channel property, which is one of the largest and best equipped hydraulic mines in Oregon, and has produced steadily for

40 years, are now in a fair way toward settlement, J. F. Reddy, of Medford, having been appointed receiver. For four seasons this property has been in trouble. 'Open weather' has arrived early in southern Oregon this year, and machinery recently ordered for the Galice quartz mine will now be hauled to the property. The Ocean Beach Dredge Co., a Minneapolis corporation holding an extensive area of land, and which has been working at Gold Beach, near the mouth of the Rogue river, for several years, using old-type sluicing methods, is installing a new 'submarine' dredge. It will be equipped with a gasoline power-plant and weigh 50 tons, and is moved from place to place on wheels. Buckets carried on endless chains dip up the sand and deliver it to sluices. This system has been tested for some time past by the company.

Philomath, March 12.

TEXAS

(Special Correspondence.)—The Silver Hill property, adjoining the famous Shafter silver mine, has been purchased by the Presidio Mining Co. The property was recently under option to the Lewisohns, who drilled and sampled it, but did not, apparently, discover sufficient ore to warrant building an independent plant and so did not purchase. The Presidio company at one time operated the property on lease, but some years since abandoned it when the grade of ore fell below the profitable limit for pan-amalgamation. Now that the company is reconstructing its mill and has adopted cyanidation, the property is again valuable. Machinery for the new mill is arriving steadily and is being rapidly placed. The new De la Vergne engine continues to give a good account of itself, and for the past two months ran over 99% of the possible total time, with fuel consumption of 0.4 lb. of oil per horse-power hour.

El Paso, March 12.

UTAH

Juab County

At the Iron Blossom mine, a cage attached to the new hoist dropped 1100 ft., causing considerable damage. On the 1900-ft. level the drift is in quartz, iron, and manganese, and the vein should be reached in a few days. New chutes are being built on the 1000-ft. level of the May Day. Recent assays show the ore here to carry 22 to 30% lead, 7 to 8 oz. silver, and $3.60 to $4 in gold. The Colorado will not ship any more high-grade ore, but will wait the completion of the new Knight mill. The Yankee mine produces six cars of 37% zinc ore per week. Development on the 2000-ft. level is encouraging. Ore shipments from Tintic during the week ended March 15 were 186 cars.

Salt Lake County

The incline shaft of the Yosemite Mines Co., of Bingham, will be completed to the Mascotte adit-level early in April, having a total length of 2200 ft. The raise from the adit is now nearing the bottom of the shaft, which had been sunk to the 900-ft. level. The raise, which will be 1100 ft. long, is in the foot-wall of the Lark-Yosemite vein, and recently cut this 800 ft. above the adit. Lessees mined 932 tons of ore in 1912 and the company's royalty was $2832.

Utah County

According to J. M. Calderwood in the *Deseret Evening News*, there are a number of promising mines in the Santaquin district, which is situated in the Wasatch mountains between Spring lake on the north and York on the south. These mountains are high, and there is abundance of timber available. The rocks are limestone, quartz, and porphyry, and the veins carry lead, zinc, and silver. The active properties are the Peerless, Eva, Union Chief, Nebo, Big Nebo, United Metals, White Dragon, and Santaquin Surprise.

Tooele County

It is reported that within the next few days final operations will be started at the Consolidated Mercur mine, which has produced nearly $15,000,000 in gold and paid $3,445,312 in dividends. The waterworks will be abandoned and the machinery sold. About 200 men will be thrown out of employment.

The Ophir Hill Consolidated company, of Ophir, has just completed the erection of a new power-plant on South Willow creek, consisting of two generators of 400-kw. capacity,

MAP OF UTAH.

direct-connected to a Pelton water-wheel. The mine will now be operated full time.

Washington County

At a depth of 200 ft. the Bull Valley mine shows 2 to 9 ft. of ore carrying gold up to $200 per ton. No. 2 adit has been started in porphyry.

CANADA

British Columbia

The smelter of the Granby company, at Grand Forks, treated 24,485 tons of ore during the first week of March and shipped 433,000 lb. of copper. Philadelphia people have organized a company to operate the Corinth, near New Denver, and it is estimated that a 250-ft. adit will cut the vein. The Silver Hoard mine, of the Ainsworth district, is opening well and produces 10 tons of silver-lead ore per day, for the Trail smelter.

Ontario

(Special Correspondence.)—An interesting situation has been developed following the death of Thomas McAndrews, a miner at the Alexandria mine, who was killed a short time ago through being struck by a falling cross-head. Evidence given by the different witnesses went to show that a number of the regulations of the Mines Act had been disregarded, such as the use of a safety device on the cross-head and the posting of notices prohibiting the men from riding on the bucket. The coroner's jury brought in a verdict of criminal negligence on the part of the management, and immediately following the delivery of the verdict the coroner issued a warrant for the arrest of E. W. Beidler, manager for the company, on a charge of manslaughter. There have lately been a number of accidents at Cobalt, and stricter measures are being taken. Recently the Right-of-Way company was fined $250 and costs for using a cross-head not equipped with a safety device, while the Cobalt Lake company was fined $100 and costs on an action brought by the mine inspector for a breach of the act in using an open hook in hoisting.

Cobalt, March 3.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

D. W. SHANKS is in New York.

C. M. EYE is visiting Grass Valley.

CARR B. NEEL was at Ray recently.

F. H. GALE is visiting San Francisco.

THOMAS T. READ has returned from Arizona.

C. F. SPAULDING has gone to Oregon City, Oregon.

EDMUND JUESSEN has gone to Searchlight, Nevada.

ALFRED T. FRY is at Broken Hill, New South Wales.

J. S. LAWTON has gone to Paramaribo, Dutch Guiana.

NOEL G. HACKNEY is at Trinidad, British West Indies.

J. B. MESTER is at Edmonton, South Alberta, Canada.

H. A. RICHARDS has gone to Maraisburg, Transvaal, South Africa.

JOHN DERN and family have gone to Germany for a vacation trip.

FRANCIS O'BOYLE has gone from Pullman, Washington, to Luning, Nevada.

CLEVELAND H. DODGE is visiting the Phelps-Dodge properties in Arizona.

JAMES S. WROTH is with the Chile Exploration Co. at Chuquicamata, Chile.

CALVIN D. CRAWFORD, of Copper Cliff, Ontario, has gone to Cotint, Massachusetts.

L. M. HARDENBURGH, recently of Hurley, Wisconsin, is now at Ironwood, Michigan.

BERNHARD BRUHN is making a trip around the world, and will return to Honolulu next July.

GEORGE KINGDON will leave the Old Dominion mine to become mine superintendent at Cananea.

L. M. LOOMIS, who has been at New Brunswick, New Jersey, has gone to Philipsburg, Montana.

H. V. WINCHELL will sail from New York for Buenos Aires today to be gone three or four months.

W. J. CAREY and O. R. WHITTAKER are examining the Bonanza mine in Nicaragua for R. J. FRECHEVILLE.

B. A. BOSQUI recently resigned from his position as mill superintendent for the Montana-Tonopah Mining Company.

THE WESTERN PRECIPITATION CO., of Los Angeles, has removed to 1016 West Ninth street from 820 W. P. Story building.

JOHN GALLIVER, who has been at St. Helens, Lancs, England, is now at Fundicion de Huacracocha, Morococha, Peru, South America.

RALPH HAYDEN and ALBERT E. WIGGIN, who have been visiting concentrating and smelting plants in the Southwest, were in San Francisco this week.

E. H. WEBSTER has resigned as assistant manager for the Mother Lode Sheep Creek Mining Co., in British Colnmbia, and will return to Los Angeles in April.

W. B. CHIDESTER, who was in charge of the Dreisam mine at Tuolumne, California, for the Tonopah Belmont Development Co., has returned to Tonopah.

BASIL D. DAVIS and R. B. ROGERS have formed a partnership for general engineering and construction work, with offices in the Monadnock building, San Francisco.

S. F. SHAW had a fight with the rebels at Charcas, killing nine. One of his own men was injured, but he escaped with the women and children to San Luis Potosi.

J. S. DOUGLAS is to take over the active management for the Cananea Con. M. Co. L. L. RICKETTS will remain as consulting engineer for this and affiliated companies.

E. H. BENJAMIN, NEWTON CLEAVELAND, W. S. NOYES, and H. FOSTER BAIN are to represent the American Institute of Mining Engineers on the Board of Managers for the Panama-Pacific International Engineering Congress. Mr. Benjamin will be chairman of the sub-committee on local affairs.

K. ITO, K. SUOIMOTO, and D. MATSUZAWA, of the Nippon Oil Co., Ltd., have been visiting the California oilfields. They have engaged H. A. HARLEY, C. R. SMITH, C. C. FLETCHER, H. K. WHAT, and PERCY HARRISON to return to Japan with them and enter the service of the Nippon company.

GEORGE E. GUNN, who died at Salt Lake City, March 12, was a partner in the Gunn-Thompson mining partnership which is heavily interested at Ely and Mason Valley, Nevada, Inspiration, Arizona, and elsewhere. Mr. Gunn was formerly an ore buyer for the A. S. & R. Co., but went into business for himself when Ely came to the front. In the later development of the porphyry coppers he was an important factor and his firm dominated a number of the best properties.

Market Reports

LOCAL METAL PRICES

San Francisco, March 20.

Antimony	12—12¾c	Quicksilver (flask)	40
Electrolytic Copper	18—18¼c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, March 20.—Copper is easier on account of re-sale of metal. Lead remains quiet. Spelter prices are easier with a noticeable falling off of demand. Average daily prices for the past week, in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Mar. 13	14.75	4.33	6.03	57⅞
" 14	14.75	4.33	5.98	56⅞
" 15	14.75	4.33	5.95	57⅛
" 16	Sunday.	No market.		
" 17	14.73	4.33	5.95	57⅛
" 18	14.73	4.33	5.93	56⅞
" 19	14.73	4.33	5.90	56⅞

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. March 20.		Closing Prices. March 20.
Adventure	$ 3	Mohawk	$ 48½
Allouez	35½	North Butte	26½
Calumet & Arizona	62	Old Dominion	45⅝
Calumet & Hecla	450	Osceola	88½
Centennial	14	Quincy	65
Copper Range	43½	Shannon	10¼
East Butte	11⅜	Superior & Boston	3⅛
Franklin	6½	Tamarack	27
Granby	57	U. S. Smelting	40¼
Greene Cananea	7⅜	Utah Con	
Hancock	18	Victoria	
Isle-Royale	21	Winona	
Mass Copper	4⅜	Wolverine	

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 20.

Atlanta	$ .17	Midway	$ .53
Belmont	6.75	Montana-Tonopah	1.70
Big Four	.86	Nevada Hills	1.25
Buckhorn	.90	North Star	.23
Con. Virginia	.16	Ophir	.14
Crown Point	.25	Pittsburg Silver Peak	.58
Florence	.50	Round Mountain	.44
Goldfield Con	3.00	Sierra Nevada	.06
Halifax	1.15	Tonopah Extension	2.50
Jim Butler	.86	Tonopah Merger	.87
Jumbo Extension	.28	Tonopah of Nevada	5.72
MacNamara	.19	Union	.10
Manhattan Consolidated	.07	West End	1.37
Mexican	.68	Yellow Jacket	.26

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. March 20.		Closing Prices. March 20.
Amalgamated Copper	67⅛	Miami Copper	$22½
A. S. & R. Co	65½	Mines Co. of America	2⅛
Braden Copper	8⅝	Nevada Con	16⅜
B. C. Copper Co	3	Nipissing	9⅛
Chino	37⅜	Ohio Copper	⅝
First National	1⅛	Ray Con	17⅛
Giroux	3	Tenn. Copper	33
Goldfield Con	3	Tonopah Belmont	7
Greene-Cananea	7⅛	Tonopah Ex	2
Hollinger	16⅞	Tonopah Mining	5½
Inspiration	15⅝	Trinity	4
Kerr Lake	3	Tuolumne Copper	2⅞
La Rose	2⅜	Utah Copper	50½
Mason Valley	7⅛	West End	1⅛
McKinley-Darragh	2	Yukon Gold	2⅛

Company Reports

NEW YORK & HONDURAS ROSARIO MINING CO.

This company's mine and mill is situated 25 miles east of Tegucigalpa, the capital of Honduras, Central America, and the following notes are from the annual report for the year ended September 30, 1912. Early in September there was a general strike of native miners who demanded higher wages, and it was not until October 29 that everything was in full operation again. During the year, development covered 10,282 ft., against 13,353 ft. in 1911, this being due to shortage of water-power from March to July. The cost of this work was $6.90 per foot, against $6.10 per foot in the previous year. The Buena Ventura, Catalina, Culebra, North, Nueva, Northwest, and Socorro veins produced some good ore, and they are well opened, but as individual producers they can never be of much account. Work on the Candelaria vein has proved a shoot averaging $13 per ton on the lower 100, 200, and 300-ft. levels. The Capitana vein is of limited extent and has been developed 600 ft. above the Pena Blanca level, but has produced a large quantity of high-grade gold ore. The Colonia vein produces high-grade ore from a narrow vein, and the only development to be done is north of and above the lower 300-ft. level. During the year, the Concepcion vein was the source of much good ore from and above the Pena Blanca level. An adit is being driven to open country below this. Ore from the San Miguel vein averaged $15 per ton. The Rosario produces low-grade ore, and is 6 ft. wide for over 200 ft. in blocks 44 to 38. The Crucero crosscut has been stopped until the geologist shall have examined the rock. All the work done this year was in shale, and the last 300 ft. was badly crushed and soft, heavy timbering having been necessary. Stoping, tramming, and timbering costs were $3.76, and total mining costs $7.59 per ton. Ore reserves amount to 164,216 tons averaging $17.65, and 188,500 tons averaging $8.50 per ton. The new mill with 1800-lb. stamps, described in the *Mining and Scientific Press* of December 14, 1912, was started in June and is giving good results. It cost $473,055, and with other construction work a total of $615,043. The San Juancito power-plant, completed in 1911, is of great benefit for the mill, and electric haulage in the mine. Results of the year's work are as follows:

Ore treated, tons	39,258
Yield in silver, ounces	1,387,078
Yield in gold, ounces	6,739
Total value	$944,213
To date	$17,361,956
Mill extraction, per cent	90
Costs:	Per ton.
Mining	$ 7.59
Tramway	0.50
Treatment	3.46
Surface	2.39
Total	$13.94

The new mill operates at 62c. per ton less than the old plant, with about 5% additional extraction.

Net income	$ 179,890
Dividend	30,000
To date	3,090,000
Assets, cash, accounts receivable, bullion, supplies, loan	494,319

MONTANA-TONOPAH MINES COMPANY

This company's year ended August 31, 1912, and the delay in publication of the annual report was due to the financing of the Commonwealth Mining & Milling Co., a subsidiary of the Montana-Tonopah company, whose property is at Pearce, Arizona, and where a 350-ton mill is now being erected. Development at the Tonopah mine covered 10,076 ft., costing $1.35 per ton; and diamond-drilling 1047 ft. at a cost of $3.95 per foot. In connection with the latter work, No. 11 hole was drilled 615 ft., when 300 ft. of rods became fast and it was abandoned. Most of the development work was confined to the southeastern portion of the property, where several good orebodies were opened, while the most important feature was that of the Shaft vein, which produces a large tonnage of ore. It was cut on the 333-ft. level and junctioned with the MacDonald vein, and strikes southeast, dips northeast, and has been opened to the 765-ft. level. The rich shoot on the intermediate level is 300 ft. in length and is divided into two portions by a fault dipping east. The eastern portion of the vein is 5 to 16 ft. wide of rich ore, and the western portion 5 to 8 ft., of fair ore, and a large tonnage has been extracted. At 379 ft. a large stope, 200 ft. long, has been opened, and at 515 ft. the stope is 100 ft. long and 5 ft. wide. On the 765-ft. level low-grade ore was found, and the Shaft vein will be prospected to the northwest. The Martha, Triangle, MacDonald, and South veins produced a considerable tonnage of ore. No. 10 diamond-drill hole passed out of the later andesite into the lower rhyolite and proved this formation to be 1050 ft. thick. No. 12 hole passed out of the andesite into lower rhyolite at 152 ft. below the 765-ft. level. Ore reserves are estimated as 32,000 tons. Following are details of the year's work:

Ore treated, tons	53,874
Yield, gold, ounces	10,162
Yield, silver, ounces	905,032
Concentrate produced, tons	711
Yield, gold, ounces	3,712
Yield, silver, ounces	338,895
Total value of yield	$743,901
Average per ton	$13.80
Mill recovery, by cyanidation, per cent	56.7
Mill recovery, by concentration, per cent	33.3
Total per cent	90.0
Total costs per ton	$8.77
Total revenue	$779,733
Net realization	214,376
Dividends paid	160,000
To date	430,000

During the year, two Trent underfeed agitators were installed, and for the past four months shipment of concentrate to the smelter has been discontinued. This product is now treated direct with the mill product, without lowering the general extraction.

DEXTER WHITE CAPS MINING COMPANY

On January 29 a special meeting of the company was held at Tonopah, Nevada, to decide whether the company should amalgamate with the Associated Milling Co., and the White Caps Leasing Co. of Manhattan, and form a new company with increased capitalization. Of the 440,498 shares represented at the meeting, 50,865 voted in favor and 389,633 against the proposal, so it was lost. Operations of the company from May 1, 1911, to December 31, 1912, and those of the leasing company from May 1, 1911, to January 20, 1913, were given in the report.

The White Caps Leasing Co.'s work was as follows:

Ore treated, tons	9,120
Average value per ton	$23.75
Gross value of ore treated	$216,636
Loss in residue	33,773
Expenses of treatment	58,029
Net returns	124,834
Royalty	17,646
Lease	107,188

The White Caps Mining Co. had $9235 cash on January 1, 1913, balance after paying expenses from $17,646 royalty received from the leasing company.

A report on the property was made by C. D. Wilkinson, who made the following remarks in part: Lessees have opened the mine by three levels, and No. 4 station will soon be cut. The largest stopes are above the 165-ft. level, and the flow of water is about 50,000 gal. per day. There is no ore definitely blocked out, except an irregular mass in the east shoot; but below the 165-ft. level on the east

shoot there is about 4500 tons of ore, worth $12 per ton. Above this level there should be ore worth $40,000; and below the 225-ft. level in the shaft shoot there is 600 tons of $75 ore. All ore on this level is sulphide, and the present treatment at the Associated mill will not be suitable for it, and roasting, followed by cyanide treatment, would probably do. In summing up, Mr. Wilkinson states that the mine has no developed ore; the deposit is irregular and hard to count on in depth; and it is base at depth. There is no reason to expect lower values, and a large shoot should be opened in the shaft orebody. Work since done by the leasing company, whose lease expires on November 1, 1913, shows by winzes that the ore is improving in value at depth.

DALY-JUDGE MINING COMPANY

The report of G. W. Lambourne, general manager for the Daly-Judge M. Co., operating mines at Park City, Utah, for the year 1912 shows the property to be in satisfactory condition. During the year, 9784 ft. of development was accomplished. Production amounted to 62,606 tons, with a net value of $728,381. Dividends to the amount of $225,000 were paid and the year closed with a surplus of $524,570. Improvements in treatment and in the metal market raised the price received for zinc middling from $10.83 in 1911 to $27.93 in 1912. The Snake Creek drainage adit, in which the company is interested, has been driven 5700 ft. and is delivering 6300 gal. of water per minute. Flow of water from this source is expected to afford important power. The company accounts give the cost of concentrating 58,951 tons as averaging $0.72; general expense on ore produced is figured at $0.315, marketing at $1.08, and development, $1.88. The total cost per ton was $6.58. In addition to concentrates, 3655 tons of crude ore was sold. The total yield since incorporation of the company has been $4,343,678. An important feature of the report is a vertical projection in the plane of the Daly fissure. It shows apparently large areas still to be worked, but there are no definite figures of ore reserves.

LE ROI NO. 2, LIMITED

The annual report of this company, which owns mining property in the Rossland district, British Columbia, and an interest in the Van Roi Mining Co., Ltd., which was promoted in 1908 to acquire certain claims in the Slocan district shows that the company mines 40,112 tons of ore and smelted 18,257 tons averaging $20.10 per ton in gold, silver, and copper. Mining and treatment costs totaled $9.23 per ton. At the Van Roi mine, development covered 4488 ft., at a cost of $8.91 per foot. Production was 54,115 tons of ore averaging 15 oz. of silver, 3.66% lead, and 6.26% zinc. Mining costs were $2.58, and concentrating 95c. per ton.

MOTOR-TRUCK HAULAGE is rapidly coming into favor. The New York Telephone Co. has given data showing that the cost of operating single and double teams of horses and wagons is from $5.02 to $8.54 per day; and the cost of hired cartage equivalent to the service performed by a 3-ton motor truck totaled $6300, while that of a 3-ton motor truck, based on the average performance of 10 trucks averaging 10,900 miles each, was $3885. The motor haulage saved $2414 per year. The Eagle Rock Quarry Co. operates a quarry at West Orange, New Jersey, and delivers crushed rock to customers in a 7-ton motor truck. Costs of this haulage, based on 300 working days per year, covering 12,600 miles, with an average load of 6.3 tons per trip, averaged $7.80 per day for fixed charges, and $8.17 for operating charges, a total of $15.98 per day. The average cost per ton was 34c., and per ton-mile 11.4c. One of the heaviest items of expense is the tires, which wear out rapidly when driven over rough roads.

SIX SPIDERS are employed at the Gorgona shops, Panama canal, in spinning thread for the surveyor's transits. It has been found that although the spider web has served its purpose fairly well, when the instruments are used during damp weather, the threads do not remain taut, and platinum wire is to be used in future.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

COAL LANDS—ENTRY FOR BENEFIT OF OTHERS

There is no provision of law requiring an applicant for entry of coal lands to state that such entry is for his sole use and benefit, and such an entry by a qualified person is not invalid because made in part for the benefit of others who are also qualified to make the entry and where there is no purpose to evade the restrictions as to quantity.

United States *v.* Home Coal & Coke Co. (Colorado), 200 Federal, 910. Oct. 21, 1912.

TRESPASS—HELD NOT COMMITTED

Held in an action to recover damages and restrain a trespass on plaintiff's quartz-mining claim, that the evidence sustained findings that plaintiff's claim overlapped a portion of a conflicting placer claim, that the ore taken by the defendant was taken from the overlap, and that plaintiff had made no discovery at the time of his location of his alleged claim.

Olaine *v.* McGraw (California), 129 Pacific, 460. Jan. 2, 1913.

NOTICE OF APPLICATION FOR PATENT—PUBLICATION

The regulations respecting the publication of notice of an application for patent for a mining claim require that the notice shall appear in each issue of the designated newspaper published during the 60-day period prescribed, excluding the first day of publication; and publication in only one issue each week of a tri-weekly newspaper, for the period of 60 days, does not meet the requirements of the statute and regulations.

J. C. S. Mining Co., 41 Land Decisions, 369. Sept. 28, 1912.

CLAY AND LIMESTONE DEPOSITS

The mere fact that land contains deposits of ordinary clay or of limestone, is not in itself sufficient to bring it within the class of mineral lands and thereby exclude it from homestead or other agricultural entry, even though some slight use may be made commercially of such deposits. There may, however, be deposits of clay or limestone of such exceptional nature as to warrant the classification of the lands containing them as mineral lands.

Holman *et al. v.* State of Utah, 41 Land Decisions, 314. July 15, 1912.

SEVERANCE OF MINERALS FROM SURFACE

Where a conveyance of land excepts and reserves to the grantor all mines and minerals, it works a severance between the ownership of the surface, including the limestone thereon, and the minerals, including the gypsum beneath. The owner of surface has no right to remove the minerals without consent of the owner thereof, nor can he, by carrying on mining operations, acquire adverse possession of the minerals remaining in the land. The owner of the minerals, or an undivided interest therein, can maintain an action for injunction to prohibit their removal.

White *v.* Miller (New York), 139 New York Supplement, 660. December 1912.

COAL LEASE CONSTRUED

Where a coal lease granted to the lessee the right to mine coal from beneath three tracts of land, no right was thereby given to tunnel beneath and extract coal from a tract of the grantor's land, not included in the lease, but lying between two of the leased tracts, merely because the coal could be most economically mined in this manner. Such a lease does not authorize the lessee to dump slate and refuse upon the surface of the land unless that right be expressly stated therein.

Brasfield *v.* Burnwell Coal Co. (Alabama), 60 Southern, 382. (Nov. 19, 1912.)

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

GYRATORY ROCK-CRUSHERS use 0.5 hp. per ton of rock crushed per hour.

MERCURY consumption on the Rand is about 0.035 oz. per ton crushed, and at the Homestake mills 0.13 oz. per ton.

TIN-MINING CLAIMS in the Federated Malay States cover an area of over 280,000 acres, and in 1910 the duty on tin exports amounted to $4,002,668.

ASBESTOS SHIPMENTS from nine properties in Quebec in 1912 amounted to 111,175 tons, and the stocks on hand at the end of the year were 24,176 tons.

WOLFRAM occurs in quartz veins in diabase schist at Patterson creek, Lemhi county, Idaho, and a plant of 100-ton daily capacity is being erected to concentrate this ore.

JAPANESE figures of weight and measure may be easily translated by using the following conversion factors: 1 momme = 0.1325 oz.; 1 kin = 1⅓ lb.; 1 kan = 8.28 lb.; 1 koku = 39.7 gallons.

WASHING GRAVEL for diamonds, it is well to remember that hornblende, pyroxene, garnets, sphene, and tourmaline have approximately the same specific gravity as the diamond, namely, 3.52.

TAILING from the Kennedy mill, in Amador county, is to be stored in ponds near the old Bright property, and it is said that four wheels, having a diameter of 56 ft. each, will be used in elevating the pulp to the ponds.

HOISTING ENGINES have three main periods of operation, namely, acceleration, maximum velocity, and retardation. The Ilgner system provides for balancing or equalizing the power used, by means of the energy stored in a heavy fly-wheel.

BERM CRANE 'H,' working at the south end of the west wall of the lower chamber of Miraflores lock, Panama canal, mixed with two 2-cu. yd. mixers, and placed 954 cu. yd. of concrete in 8.33 hours on January 31. This gives an average of 1 cu. yd. each 31.5 seconds, and during one hour, 160 cu. yd. was placed.

RATIO of copper to nickel in the Sudbury deposits is 36.3 parts of the former to 100 parts of the latter in ore, and 83.3 parts to 100 parts in rock in the Creighton mine, based on a large tonnage mined. Analyses of slag and matte show the ratio of nickel to copper to be greater in the latter than the former.

THE MINT at Ottawa coined 494,621 gold coins, valued at $2,685,866, and 41,474,218 silver coins valued at $5,178,768, from January 2, 1908, to February 28, 1912. One result of the mint's operation is that foreign silver coin is being returned to the country of origin, principally the United States. During the year ended March 31, 1912, silver coin worth $1,791,187 was 'deported.'

STATIC HEAT ENERGY may be transformed into kinetic energy in a turbine in three ways: (1) by the impulse turbine, by the expansion of the steam in nozzles, impinging on buckets on the periphery of the turbine wheel, which turns the shaft; (2) by the reaction turbine, by the alternate passage of the steam through revolving and fixed blades the expansion is performed on both sets of blades, the fixed one acting as guides; and (3) by means of a turbine embodying a combination of the first and second systems.

WHEN SAMPLING mines it is necessary that the samples should reveal characteristics of the ore; for example, if in a vein a well mineralized section is found to adjoin barren-looking rock, these should be sampled separately. Alternating bands in a vein should also be so dealt with, and in such cases it is as well to include an inch or more of the apparently barren rock on each side of the more valuable portion. In this way, if there is any enrichment along the contact between the two classes of rock, the metals will be included in the class of material to which they rightly belong.

TUNNEL RIGHTS are dependent upon the work being prosecuted with reasonable diligence. What is reasonable diligence has not been passed upon. Failure to prosecute work on the tunnel for six months loses the right to all blind veins which may be cut later, but not to the tunnel, which may be continued. As the claimant is allowed 1500 ft. in any direction of all blind veins cut throughout the 3000 ft. of his tunnel, he practically commands an area in the shape of a racetrack, 6000 ft. long and 3000 ft. wide. Some have considered that the claimant's rights should be confined to 1500 ft. on each side of the tunnel, making a square 3000 by 3000 ft., but there is no direct reason why he should not receive his 1500 ft. of lode, even if found at one end of the tunnel and striking outside of the square.

AIR used by the blast-furnaces at the Copper Queen smelter, at Douglas, is blown by 11 blowers driven by tandem-compound engines, six blowers being of 300-cu. ft. and five of 200-cu. ft. capacity per revolution. The air from each is piped separately to one furnace, and the quantity of air delivered to a furnace is fixed by the speed of a blower, the pressure adjusting itself to the condition of the furnace. The average pressure is 26 oz. per sq. in. By means of valves, one blower can be used on either of two furnaces, and if necessary all blowers can be connected to a common main pipe. There are six blowing engines for converters, five of 6000-cu. ft. and one of 12,000-cu. ft. capacity per minute. These are cross-compound steam cylinders, and duplex air cylinders. They deliver air at 11 lb. pressure to a common main pipe, their speed being controlled by an air-governor, which varies the speed so as to keep a constant pressure in the main pipe.

AN ICE MINE in Sweden Valley, four miles east of Coudersport, Potter county, Pennsylvania, is a peculiar phenomenon, and has been a source of much interest. Some years ago, two prospectors at Sweden Valley sank a shaft 12 ft. deep, and then abandoned it, noticing at the time a cold draft coming out of the rock. Later on in the spring a considerable amount of ice was found in the 'mine,' and instead of melting in the summer, the ice increased in thickness, while next winter the ice almost disappeared. This peculiar thing occurs regularly every year. In *Popular Science Monthly*, M. O. Andrews explains the mystery of the formation of ice. The pit, 8 by 12 ft., is at the base of a steep hill, and in the spring, the snow on the hillside melts and the water flows into it and is at once frozen. The sides of the pit are of loose shale, in which there are numerous crevices extending back and up into the hill, the rock strata being rather sharply inclined. A draft of cold air, which in places will extinguish a small taper, issues from these fissures in summer, when the temperature of the pit varies between 25 and 32°F. The air must gain access to the fissures at a higher altitude than that of the pit, and it is evident that in winter the column of air directly over the pit is cooler, and consequently heavier than that in the rock passages. It therefore forces its way down into the pit and up through the rock strata, chilling the rocks to a great depth, and storing up a vast quantity of 'cold,' which depends on the character of the winter. In warmer weather the air over the pit becomes heated, and is displaced by the cold heavy air 'flowing' down out of the passages. This cold current freezes any surface water in the pit, and maintains a freezing temperature as long as the supply of 'cold' in the hill lasts, after which the circulation of air ceases, and the ice melts. The temperature of the air as it issues from the crevices remains practically constant throughout the summer, as proved by thermometer readings.

Book Reviews

DETERMINIATIVE MINERALOGY. By J. Volney Lewis. Pp. 151, ill., tables, index. John Wiley & Sons, New York, 1913. For sale by the *Mining and Scientific Press*. Price $1.50.

This volume is elementary in style, and has been prepared primarily for the use of students in mineralogy, although it will meet the needs of a geologist or mining engineer in many cases. The first 62 pages deal with laboratory work and apparatus, reactions of the elements, crystallography, and technical terms; while 68 pages of tables cover tests and details of minerals under the heads of composition, color, streak, hardness, specific gravity, fusibility, crystallization, cleavage, and reactions in testing.

ENGINEERS' HANDBOOK ON PATENTS. By William Macomber. P. 288. Ill., index. Little, Brown & Co., Boston, 1913. For sale by the *Mining and Scientific Press*. Price $2.50.

Over 1,000,000 patents have been issued to inventors in the United States, and the Patent Office is kept busy with fresh applications for others. The author of this volume maintains that the important inventions of the future must be made by trained graduates of engineering schools, with which we do not agree. This work has been prepared in the character of information for students, and presents the theories which underlie certain inventions, and tend to guide the inventor on successful lines, both as to the law and theory of patents. The matter of 'What is Patentable,' in chapter IV, is interesting; and 'Patent Litigation,' in chapter IX, which costs an enormous amount of money, often unnecessarily, will be read with interest. A man who is his own lawyer is a fool; and nobody should be his own patent attorney, so chapter VI, explaining the obtaining of patents, is especially valuable. In connection with the proposed patent law revision, G. H. Montague has written an interesting article for the *Harvard Law Review*, which should be read with the volume under review.

THE DOMES OF NOVA SCOTIA. By T. A. Rickard. Excerpt from *Transactions* of the Institution of Mining and Metallurgy. P. 55. Ill., map. London, England, 1912.

This is an interesting description of certain peculiar formations in the seaward half of the peninsula of Nova Scotia, compiled from the author's notes when inspecting the district in August 1905. The country is traversed by a series of sedimentary rocks into which granite has intruded. The former occur as highly altered beds of quartzite and slate of great age. The region has been subjected to much folding, and the gold-bearing quartz, in following the lines of the country rock, forms 'saddles' where the slate and quartzite have been bent into anticlinal folds; but the most pronounced development of ore is on the 'domes' formed, where folds cross each other. The 'saddles' of Nova Scotia are also remarkable for peculiar large and small corrugations of quartz, which the author has termed 'furrows' and 'crenulations,' respectively. The paper is well illustrated with maps and interesting halftones.

THE SMITHSONIAN INSTITUTION. Annual report of the Board of Regents for the year ended June 30, 1911. P. 688. Ill., map, index. Washington, 1912.

Although somewhat belated in publication, this volume contains a number of interesting articles. The report of the secretary, C. D. Wolcott, covers 91 pages, dealing with the administration of this well known institution, the many explorations and researches made, the library, and astrophysical observatory. An estate valued at $40,000 was given under certain conditions by the late G. W. Poore, of Lowell, Massachusetts; and during the year all structural work at the National Museum was finished. Among the articles published may be mentioned. 'The Gyrostatic Compass,' by H. Marchand; 'Radiotelegraphy,' by G. Marconi; 'What Electro-Chemistry is Accomplishing,' by J. W. Richards; 'Production and Identification of Artificial Precious Stones,' by N. Heaton; 'Some Recent Interesting Developments in Astronomy,' by J. S. Plaskett; 'Geologic Work of Ants in Tropical America,' by J. C. Branner; 'Greater Problems of Biology,' by D'Arcy W. Thompson; 'Some Useful Native Plants of New Mexico,' by P. C. Standley; and 'Discoveries of the Art of Iron Manufacture,' by W. Belck. Included are interesting biographical notices of Robert Koch and Joseph Dalton Hooker.

COAL, AND THE PREVENTION OF EXPLOSIONS AND FIRES IN MINES. By John Harger. P. 183. Ill., index. Longmans, Green & Co., London, 1913. For sale by the *Mining and Scientific Press*. Price $1.25.

The annual coal production of Great Britain is approximately 230,000,000 tons, and the number of men killed in 1911 was 1.18 per 1000 employed; and during the 10 years ended in that year the average number of deaths from explosions was 11% of the total men killed underground. Figures in connection with the coal mining industry of the United States also shows a large number of fatalities from explosions, and the work of the Bureau of Mines in investigating causes and preventives is well known. The subject is important, and both officials and miners should be instructed in the nature of coal, and the chances of accidents arising from mining operations. This volume has been written in a non-technical manner, and should be found of value. The nature of coal and its occluded gases is discussed in chapter I, with analyses of the former, and examples of the 'flow' of gas in certain localities. Chapters II and III deal with combustion and slow oxidation. Air which contains from 14 to 21% oxygen is as good as ordinary air, providing the amount of oxygen does not fall below the minimum required to form the normal amount of oxy-haemoglobin from the venous blood. The subject of respiration is thoroughly described in chapter IV. The succeeding five chapters discusses the rôle of coal dust in explosions, coal-dust explosions, and the prevention of the same. 'Gob-fires,' or the spontaneous combustion of coal, have been the subject of much research, and many mines have had to be shut down on this account. Their phenomena are explained in chapters XI and XII. An appendix contains a few notes on fire-proofing mine timber, and statistical matter in relation to coal mining.

Recent Publications

ELECTRON THEORY OF MAGNETISM. By Elmer H. Williams. Bulletin No. 62. P. 66; ill. University of Illinois Engineering Experiment Station. Urbana, November 1912.

MINING IN THE FEDERATED MALAY STATES. By D. C. Alexander, Jr. Special Agents Series, No. 59. P. 25; ill. Department of Commerce and Labor. Washington, 1912.

CEMENTING PROCESS OF EXCLUDING WATER FROM OIL WELLS AS PRACTISED IN CALIFORNIA. By Ralph Arnold and V. R. Garfias. Technical Paper 32. Petroleum Technology 3. P. 11; ill. Bureau of Mines. Washington, 1913.

SOUTH AFRICAN MINING DIRECTORY AND MONTHLY HANDBOOK OF MINE OFFICIALS. P. 208. Published by the South African Mining Directory, Ltd., 119-126 Exploration Bdg., Johannesburg. November 1912.

PEAT DEPOSITS OF OHIO, THEIR ORIGIN, FORMATION, AND USES. By Alfred Dachnowski. P. 242. Ill., map, index. Fourth series, Bulletin 16. Geol. Surv. of Ohio in coöperation with the U. S. Bureau of Mines. Columbus, 1912.

GEOLOGY AND PETROLEUM RESOURCES OF THE DE BEQUE OILFIELD, COLORADO. By E. G. Woodruff. Bulletin 531-C. Advance chapter from Bulletin 531, 'Contributions to Economic Geology, 1911, Part II.' P. 17. Ill., map. U. S. Geological Survey, Washington. 1913.

INDEX TO THE STRATIGRAPHY OF NORTH AMERICA. By Bailey Willis. Accompanied by a geologic map of North America. P. 894. Maps, tables, index. Professional Paper 71, U. S. Geol. Surv. Compiled by the U. S. Geol. Surv. in coöperation with the Geol. Surv. of Canada, and the Instituto Geologico de Mexico, under the supervision of Bailey Willis and George W. Stose. Washington, 1912.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen.	Charles Janin.
Leonard S. Austin.	James F. Kemp.
Gelasio Caetani	C. W. Purington.
Courtenay De Kalb.	C. F. Tolman, Jr.
F. Lynwood Garrison.	Horace V. Winchell.

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EDITORIAL

MILWAUKEE has been entertaining the American Chemical Society during the week, and it is safe to say that the discussion of the 150 or more technical papers presented at the meeting was at least not dry.

AT WASHINGTON the younger men on the United States Geological Survey maintain a particularly lively society, once known as the 'Association of Aspiring Assistants,' but later re-christened as the 'Pick and Hammer.' At the annual dinner of this association is worked off all the fun and human interest that naturally must accumulate during a year's writing of serious scientific documents. With a lively recollection of our own privileged participation in earlier dinners we are disposed to agree with the song writer that without the Survey

"Rocks, hills and plains would stew
And chaos reign."

COMPETITION of the Orient in manufacturing is a bugaboo frequently paraded. Having some experience in manufacturing a paper at least, with low wages and high wages, and having seen something of the Far East, we do not take this as seriously as do some of our friends. The old laws that man's wants increase with his earning capacity, and that wages and efficiency remain in at least crude balance, will operate to prevent more than temporary disturbance of conditions. Point to the argument is lent by negotiations now being conducted by Mitsui & Company for purchase of American pig iron for Japan.

TROPICAL conditions impose difficulties in building that are little understood by those of us who live in temperate climes. Mr. R. B. Rogers tells in this issue what some of these are and how they were met in building the new plant for the New York & Honduras Rosario Mining Company near Tegucigalpa. Steep slopes and sudden heavy downpours make foundation work especially difficult. It is related that one mill in the East Indies slipped down the mountain side a number of feet after a tropical storm. Fortunately it was well built and was soon running again. Recently Mr. C. M. Eye told our readers of the difficulties met at the Benguet in the Philippines, and it is said that the American engineers are about ready to abandon the valley route of the famous Baguio road and build on the old Spanish survey up the nose of the mountain. We learn much by travel and for those who must stay at home the careful notes of a traveler gifted with the seeing eye are the best substitute.

MINING for assessments is the title of a recent report on the Comstock written by Mr. Whitman Symmes, in which he describes the "intentional mismanagement" of a "clique of six crooked brokers" controlling the middle and north end mines.

FOLLOWING Mr. Howland Bancroft's general résumé of mining conditions along the west coast of South America, printed in January, we present this week the first of a series of articles on the 'Copper Mines of Chile,' written by Mr. Juan Blanquier, an experienced mining engineer now in the service of the Chilean government. A native of Chile, and a student of mining conditions both at home and abroad, Mr. Blanquier brings to the discussion at once an intimate knowledge of the subject and the point of view developed by answering many inquiries from ill-informed foreigners. The question whether Chile is to resume her place among the leading copper producing countries of the world is a fascinating one, and one worthy of close study.

LEASING the federal oil lands has been proposed as a solution of present and future difficulties. Since much of the petroleum production comes now from leased lands, the general suggestion is not unfavorably received by the oil men. Specific proposals, however, promptly run into difficulties, though they have the merit of focusing discussion. The San Francisco section of the Mining and Metallurgical Society has taken the lead in outlining a set of principles that might guide Congress in framing any leasing law. The plan, which we print this week, is now before the members for discussion. It would be helpful to have the widest criticisms and suggestions for amendment. While no one engineer or group of engineers may expect to evolve an entirely satisfactory system, certainly the engineers as a class will do better than if the framing of a law be left entirely to outsiders.

DISCOVERY of new orebodies at Butte has received much public mention, but of more general importance are the various metallurgical experiments which are now on trial in that district. The Butte & Superior Copper Company has erected an expensive zinc concentrator, and is trying to make a satisfactory saving of exceptionally stubborn zinc ores. A part of the plant is also arranged for flotation, but the progress there is not made public, as the process used is in dispute with the Minerals Separation Company. Electric zinc smelting was also tried in an experimental way, but has apparently been abandoned. The W. A. Clark interests are experimenting on the same problems with zinc ores, but have not yet erected a working plant. The Butte Central Copper Company has built and is operating a concentrator and cyanide plant for ores from the silver veins. Two electrolytic copper leaching plants have been built and are in experimental operation, and as usual the Anaconda company and the Boston & Montana have many experiments in progress. All these things keep Butte agog metallurgically, and if all or any one succeeds, the lease of life of this big mining district will be greatly prolonged.

DIVIDENDS to the amount of $23,839,067 have been paid to date by the Goldfield Consolidated Mines Company, as shown by the annual report reviewed on another page. The production of the company has amounted to $40,136,000, to which is to be added $11,200,000 produced by lessees and $2,700,000 by the constituent companies prior to consolidation. While *finis* is by no means yet to be written in the record, these totals are impressive. The future of the mine calls for especially careful work. The great high-grade bodies of ore have been largely mined out and it is now necessary to work around the edges and on the pillars of old workings. Mr. Albert Burch, who has recently gone to the property, will have no easy task, though one he is excellently qualified to complete. Doubtless a number of small bodies of high-grade ore will be still found and all will at least wish that some small stringer, carefully followed, will lead to a new bonanza.

Gold Production and Securities

The despondent attitude which has been so universal throughout Eastern financial centres during the winter has not begun to change with the coming of spring. On every side the impression seems to prevail and the opinion is expressed that until there is a general liquidation, until accounts are balanced, there will be no general relief. The continuation of gold exports, owing to strained conditions abroad, taken with the political and economic situation at home, has given the financial interests of the Atlantic seaboard a decidedly jangled set of nerves. This feeling has been shown by the disfavor into which a vast number of industrial securities have suddenly fallen. During the past two years, there have been floated in New York and Boston many stock issues, representing all kinds of manufacturing and industrial properties, nearly all of which have been made attractive to the buyer by being put out as preferred stock, returning 7 per cent per annum. It is something of a shock to the recent purchasers of these issues to suddenly find that the banks and bankers refuse to consider them as bankable collateral. There has resulted most disheartening declines, and great depression has seized the public at large. In some quarters it is hinted that the ban suddenly put upon these stocks, which were so popular a few months since, is due to the necessity of providing a market for railroad bonds that must be sold to provide the transportation companies with both new capital and money for refunding purposes. But whatever the cause, it is not a healthy sign that securities of the highest class go begging.

In the meantime the position of India with reference to gold is attracting much attention. During the past 11 months, that is, from April 1912 to and including February 1913, the net imports of gold into India show a total of £23,179,799. For the like period of the year preceding, the total net imports were £21,457,070. The fiscal year in India is from April 1 to April 1, and it is apparent that the imports for that period will total £25,000,000. India's gold absorption during the past two years comes near to being double what it was for the two years

preceding. Taking the past four years as a whole, India has absorbed and practically withdrawn from circulation nearly $400,000,000 of gold in excess of her exports. It is not altogether the loss of this amount of actual gold bars that is of so much importance to the banking forces of the rest of the world, as it is that the fact that this same amount of bullion moving through the regular commercial channels of the Occident would create and furnish a loaning power of $1,200,000,000. Perhaps the tremendous effect of this withdrawal can better be illustrated by saying that so far as the rest of the world is concerned, it is equivalent to the loss of two and a half years' output of the entire world. Mr. George E. Roberts, the Director of the Mint, in a recent annual report predicts that there will be no material increase in the production of gold during the next ten years. This forecast is presumably based upon the predominant position of the Rand. If the production of gold is to be confined to the known places of the world, this prediction might be accepted as conclusive. However, some of the greatest mines in the world have been made where prospectors had traveled the ground over and over, and it is rash to say that new fields as well as new mines will not be found.

Uniting the Institute and the Mining and Metallurgical Society

Plans for bringing the American Institute of Mining Engineers and the Mining and Metallurgical Society of America into union are shortly to be submitted to vote. The project has been repeatedly discussed, almost since the organization of the Society, and we believe that the general sentiment of the members is distinctly favorable. There are differences of opinion as to the best plan of procedure and as to details of the terms of a proper union, but on the whole these differences are surprisingly few. It is widely felt that no good purpose is served by having two entirely distinct national societies, and while the good sense of the officers of the two organizations has heretofore prevented any conflict, there would be abundant opportunity for controversy in the future. In the meantime, the Mining and Metallurgical Society, while doing excellent work, has attained but small membership, and its reports and publications have reached but few people. Its influence has been correspondingly limited. A society that hopes to mold public opinion within and without the profession, must not only formulate and express sound judgments, but must obtain for them adequate publicity. However desirable the *Bulletin* of the Mining and Metallurgical Society may be as a means for holding the membership together, it has been a dismal failure as a medium of publicity. The formal action of the Society has obtained much less recognition than it often deserved, because most men have not known what the action was, or even that any had been taken. The arrangement proposed, whereby the proceedings of the Society are to be printed in the *Bulletin* of the Institute, is therefore one that may well prove greatly to the advantage of the work of the Society.

The Institute has, and will doubtless continue to have, a much larger membership than the Society. We believe this to be right and proper. There should be one great national organization standing on a sufficiently broad base to take in, as Dr. Raymond has well phrased it, "everyone who has clean hands and is interested in mining." Such a heterogeneous membership cannot be expected to get together in any definite consensus of opinion upon either technical or public matters touching the profession. The interests of members are too diverse, and any active propaganda based upon such an opinion, assuming it could be formulated, would be certain to run counter to the welfare of some member. A smaller, more homogeneous body, one in which membership is determined by definite and uniform standards, may, on the other hand, occasionally reach a fairly unanimous conclusion, and, if it do so, the opinion will carry deserved weight. We believe that this is a field of real importance in a country where individualism is fundamental and commercialism is rampant. It is useful in a wide variety of circumstances for an engineer to have for his guidance the deliberately expressed judgment of a body of his fellows. It is well, however, to understand the matter, and such resolutions or rules as may be formulated should not be taken too seriously. In the nature of things they can have no binding force. They are to the engineer what the opinion of one state court is to another, not an obligatory precedent, but acceptable "for the reason that there lies in them." It is the character and the unanimity of the men back of it that gives weight to any opinion in professional matters. The Mining and Metallurgical Society finds its chief excuse for existence in that it affords a means for engineers to get together in the expression of such opinions when the need arises.

The proposed plan of union contemplates that the Society shall become a part of the Institute, but shall maintain its own organization, shall have the right to independent expression of opinion, and shall continue to elect its own members. In the future, however, only members of the Institute shall be eligible to membership in the society, all publication is to be by the Institute, and a part of the annual dues of members of the Society is to go into the Institute treasury. In the main the union is a business affiliation and each institution is left to do its own work in the technical field. As practically all members of the Society are now members of the Institute, the making of membership a pre-requisite is more a change in name than in fact. It is expected that under the new arrangement a number of Institute members who have heretofore held aloof from the Society will join the latter. On the whole we believe both organizations will profit by the union; if anything, the Society has the best of the bargain, but the committees in charge of the negotiations are, we believe, to be congratulated on the fairness of the proposed plan. Certain details have been criticized and some of these have been changed. Others perhaps will be amended before the final steps are taken. Essentially, however, the project is sound and the plan good and we urge all members to vote in its favor.

Building a Mill in Central America

By R. B. Rogers

The general location of the new 200-ton mill and cyanide plant of the New York & Honduras Rosario Mining Co. at San Juancito, Honduras, is shown in the panoramic view heading this and the opposite page. The plant was constructed under the charge of B. D. Davis, whose photographs of the work are here reproduced. The site was chosen with a view to the handling of material by gravity, as far as possible.

All ore broken in the mine is dumped into one of the several chutes in the old Rosario vein, and trammed to the surface, approximately a mile, by 24-in. gauge electric locomotives, on what is called the lower 650 or Rosario level. At the mouth of this adit there was formerly a sorting plant and the head station of a small Halliday single-cable tramway, carrying the ore in 100-lb. buckets to the old mill on the Escobales creek just above the town of San Juancito. The tramway was 6100 ft. long, with a drop of about 1200 ft. Several thousand feet of cross-cutting and sinking has failed to show ore below the Rosario level. The new mill was, therefore, so placed as to receive ore from this level by extending the electric haulage-way 1600 ft. on a ½% grade along the side of the ridge forming the north wall of the canyon in which the Rosario vein outcrops and was originally discovered. It was later found necessary to tunnel behind a particularly steep point where, as shown at the centre of Fig. 1, slides caused considerable difficulty in keeping this road open.

The necessity of building a new mill was taken as an opportunity for a general concentration of all the works. Previously, the main offices, warehouse, machine and electric shops, assay office, quarters for mill and office men, were in San Juancito about two and one-half miles, by road, from the mine. They are now on the side and top of the ridge.

Fig. 1. Electric tram from adit to millsite.

close to the mill, leaving only the two hydro-electric power plants in the valley below—one in San Juancito operating under 1350-ft. head and developing 1200 hp., and the other at Guadalupe, a mile below on the same stream, developing 800 hp. Comfortable houses for married employees were given the preference of site and occupy the top of the ridge, while on the extreme point on the level spot shown in Fig. 1, a large club-house and general mess-hall is to be built. The altitude of 5000 ft., and the isolation from congested native quarters make this a far more healthy location than was to be found in the town of San Juancito.

The general scheme of milling adopted includes no unusual departures from the customary treatment of a silver-gold ore containing sulphides. The varied character of ore found in the complex vein system of the mine has made it possible to keep the percentage of sulphides down below any danger of serious interference with the milling process.

The equipment is perhaps unusually heavy for so isolated a mine. Track scales, a revolving car-dumper, a grizzly, and two gyratory crushers are placed over a flat-bottomed steel ore-bin 500 ft. long by 20 ft. wide and 25 ft. deep. Twenty 1800-lb. stamps, dropping 6 in. 110 times per minute, and equipped with 7-in. cam-shafts, are driven in batteries of 5 and mounted on concrete foundations, a rubber mat coming between the concrete and metal. Wooden battery posts 15 by 30 in. are used. On the preliminary runs, the only vibration to speak of was caused by the jumping of the end of the cam-shaft in the bearing away from the bull-wheel. The anchor-bolts used in the five-ton mortars and the battery-post shoes are 2 in. diameter and extend down into a tunnel about 30 in. square, running lengthwise of the foundations. The roof of the tunnel is 5 ft. below the surface of the foundations. The bolts hang slightly out of plumb, converging toward their lower ends. Four-inch pipes were set in their proper places in the concrete and after the surface of the foundation was dressed down to as nearly a perfect plane as possible, and the mortars placed thereon, the bolts, with a 2-in. pipe sleeve which just fitted smoothly over them, were set and the space between the 4-in. and the 2-in. pipes was grouted in, making a rigid job and yet permitting the removal of a broken bolt. Four-mesh screens

FIG. 2. GENERAL VIEW OF MILL.

are used at the stamps of all the batteries.

Two Dorr classifiers receive the pulp from the stamps and the sand goes to two 5 by 22-ft. tube-mills, thence to a third Dorr classifier which feeds a third tube-mill. There is no classification beyond this, and no trouble has been experienced from sand getting through the last tube-mill. Two Dorr continuous thickeners 10 by 35 ft. and two Hendryx de-waterers 21 by 18 ft. are installed below the crushing machinery.

Eight conical bottom air-agitation vats 45 by 15 ft., connected in such a way that either continuous or intermittent agitation may be used, accomplish the actual solution of the precious metals. Below these are three more Dorr thickeners. Two 90-leaf Merrill slime presses receive the pulp from the thickeners. It was planned to charge the presses with the thickened pulp and run the overflow direct to the gold solution tanks. One of the thickeners has, however, been fitted up as a storage tank in which the pulp may be agitated to prevent settling if better results are obtained in the presses in this way.

Two gold-solution tanks, 10 by 20 ft., are provided and zinc-dust is introduced into the suction of the Aldrich triplex pumps, forcing the solution and precipitate up to the presses in the refinery, which is just above the ore tracks from mine to mill. Four Shriver precipitate presses and six Faber du Faure tilting melting-furnaces, charcoal-fired, are used in the refinery. Aldrich triplex pumps are used for circulating mill solutions. There are four tanks, 20 by 30 ft., for stock solution and water, besides a number of smaller ones used for wash water and sumps. All tanks are of steel plate and all piping throughout the mill was so put in as to give any desired combination for crushing either in water or solution. There is a sub-station in the mill, receiving current at 6600 volts from the power plants. Practically all machinery is individually motor driven; the only exception being the classifiers, thickeners, and machines that require too little power to warrant separate motors.

Difficulties of Construction

The construction of this plant on a slope averaging about 38°, and under tropical conditions of weather, labor, and transportation was begun 15 months from the commencement of active construction work. All the material except lumber and lime was brought in from the Pacific Coast port of Amapala, necessitating trans-shipping there to lighters which carried it to San Lorenzo, the terminal of the 75 miles of national road from the coast to Tegucigalpa, the capital of the country. Apart from the roads built by the Rosario company in the vicinity of the works, this is the only road worthy of the name in Honduras. It is, in general, a fair road and in spots it is a magnificent macadam highway, 30 ft. wide, supported by massive retaining walls, passing over well built masonry bridges, and commanding as beautiful a view of mountain scenery as can be imagined; in fact, well justifying its name of El Camino Real.

From Tegucigalpa to the mines is a distance of about 16 miles over the mountains by an exceedingly rough road with grades as steep as 30% and many 'hair-pin' turns, at which points the question of grade has been forgotten entirely, the object being apparently to turn about as quickly as possible and start on a new zigzag. All freight which is too heavy to come by two-wheeled carts has to be brought over the mountain by the use of block and tackle, time, many yokes of bulls or oxen, urged on by the pandemonium of howls with which the natives endeavor to arouse the animals to greater exertion. In its recent construction work, the Rosario company has not made use of sectionalized machinery, single pieces weighing up to six tons having been brought in for power plants or mill. About 1,500,000 board feet of lumber was delivered from the company's lumber concession 10 miles distant. What lime was used was burned on the property.

Handling Material

Receiving and storing material at the works proved to be one of the most annoying problems. Naturally, in so isolated a district, freight cannot be delivered as needed, and in spite of the greatest efforts to avoid a congestion of material on the hillside, the tube-mill liners and Merrill press parts were among the first items to arrive on the job. Rough platforms were built on the outer edges of the roads in all available spots for the storage of lumber and supplies. Cement and material which might be injured by the torrential rains of the wet season were stored in provisional warehouses. Masonry-lined drainage ditches were built to deflect water from the sites of the mill and other buildings.

Of the preliminary work, the provision of sand was a most serious consideration. The stream beds in the vicinity are so steep that little sand withstands the scouring of the yearly freshets, and the cost of packing sand by mule-back from the valley below was prohibitive, not to mention the poor grade of material delivered by native contractors when this had been tried in the past. Over 5000 tons of sand was required for the concrete and masonry work. Fortunately, there were known to exist long stretches of barren hard white quartz in one of the levels of the mine 450 ft. above the Rosario level, and an old balanced cable skipway on the surface, connecting the mouths of these adits, was in shape for use. A worn out 5-stamp battery from the San Juancito plant was set up at the foot of the skipway, no other foundation than mud-sills being used, and the quartz, mined on contract and lowered in the skips, was run through, using six-mesh screens. The slime in the resulting sand was washed out in a box and the product, which was a sharp, clean, perfect sand for the purpose required, was shoveled into cars and run over to the works as needed. A good quarry was finally located about three-fourths of a mile around the mountain from the sand plant, and track laid to it on the convenient grade of an old flume. Mules were used to deliver the rock, which was a tough, close grained andesite, to the electric haulage way. A ⅓ cu. yd. Smith concrete mixer and a rock-crusher were placed at the head of the mill. Excavations, and bins and chutes were built

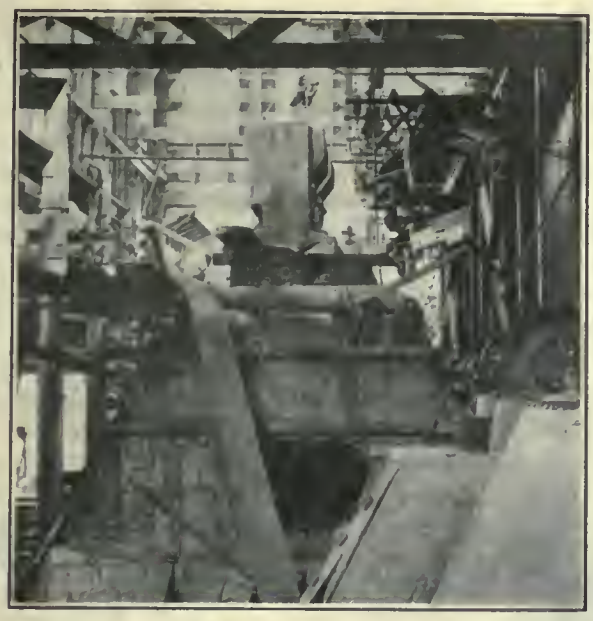


FIG. 3. CONCRETE FOUNDATIONS FOR STAMPS.

for the storage and handling of rock and sand.

The bedrock at the millsite is a shale, much distorted and broken by an underlying igneous rock. The excavation for the ore-bin encountered this shale, dipping into the hill, under about 8 ft. of overburden, and the bin was set far enough into the hill so that its top inner edge stands just on the ground line. A massive reinforced concrete wall 7 ft. thick at the bottom, tapering to 2½ ft. at the top, and flanked by 3-ft. wing-walls, partly surrounds the bin, the top girders of which extend to and rest on piers set upon this wall. The timber superstructure of the mill stands on these girders. The entire mill building is framed from 12 by 12 and 10 by 12 timbers, with correspondingly heavy floor-sills and roof trusses, it being necessary to figure on dry rot and climatic effects, as well as on original strength and stiffness. Corrugated iron roofing and siding is used throughout.

Stamp Foundations

The stamp foundation consists of two blocks of concrete each accommodating two batteries. They are battered on all four sides and heavily reinforced over the tunnel mentioned above. Their outer edge rests on the retaining wall behind the first tube-mill floor. Below this level the shale was found to lie at all angles, in some instances the stratification being exactly parallel to the hillside. Before a retaining wall could be poured, chunks of as much as 50 tons of rock would slip off from the top edge, necessitating the use of shoring, and, in some cases, the pouring of the wall in sections, the joint being made by building the end of the form like a section of stairs on edge, and leaving liberal reinforcing extending through. The base of each retaining wall is set in a footing ditch from 2 to 4 ft. deep and a foot wider than the base of the wall proper.

The old workings of the mine were stripped of half-worn rails with which all walls were heavily reinforced. Rails were placed vertically from 2 to 6 ft. apart, as the case might be, near the back of the wall, and were also laid in horizontally, overlapping at the ends, as the pouring proceeded. Wing-walls were built on both sides of the work to support the retaining walls and keep out mud and water during the wet season. The rapidity with which a torrent of rain will cut gulleys and carry tons of material down such a hillside is surprising.

The site for the cyanide plant was offset about 150 ft. to the east from the centre line of the mill because of the better character of the ground at that point. As originally planned, the agitation vats were to be placed on circular concrete foundations protected by a retaining wall and, in fact, this form of construction was intended for all the lower works. An effort was made to excavate for the first of these walls, that is, the one behind the agitation vats, but due to there being a heavier overburden here than higher up on the hill and without the concrete work above which had made it possible to get in the lower foundations of the mill proper, it was found next to impossible to hold the ground over the required length of 150 ft. The type of foundation shown in Fig. 4 was therefore devised and adopted. The vats, as shown, stand on an arched concrete platform or bridge. The pits for the vertical walls were sunk alternately so that the ground was disturbed no more than necessary, the sides of the excavation being supported through the soil by plank sheathing and 2 by 4-in. stulls, which were knocked out as the wall was poured. The pits were bottomed in solid blue shale, steps being left to avoid unnecessary excavation, and the bottom of the holes were flared out a foot on each side to give an added area of support. The forms were built up to the spring of the arches and when two alternate walls were poured to this level the intermediate pit was dug. It was just an easy day's work to pour one wall, so they contain no weakening joint planes. They are 3 ft. thick by 18 ft. long and of varying height, according to the depth of the pit. The spaces between them are 6 and 7 ft., alternately, the arches coming between two tanks being a foot wider than those under the centre of a tank. The arched floor was put on as fast as the walls were completed. It is 2 ft. thick at the thinnest point, and between each of the tanks, which are set 4 ft. apart, the floor is

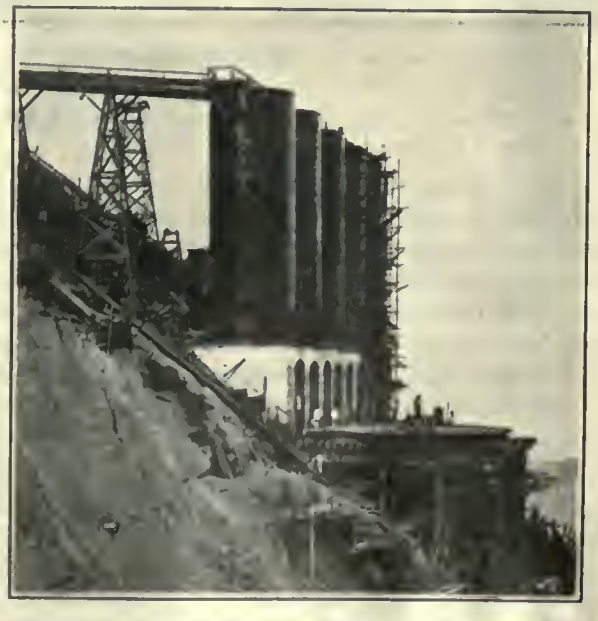


FIG. 4. AGITATING-VATS. NOTE STEEP HILLSIDE FOR BUILDING.

stepped down 4 in. to avoid loss of head by the piping arrangement for continuous agitation. The arches are heavily reinforced and they just clear the ground-line on the uphill side so that there is no tendency for water to accumulate behind the foundations and exert an overturning effect, as in the case of a retaining wall. Under the circumstances, this type of foundation is thought to have solved the difficulty satisfactorily. One American carpenter with several native assistants did the form work, much of which was so designed as to used several times. The completed foundations required a little over 1000 cu. yd. of concrete.

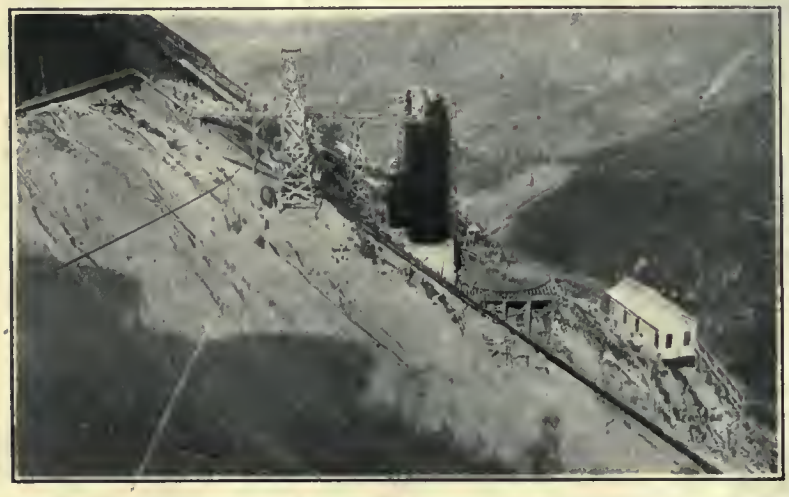


FIG. 5. AGITATING-VAT, FOUNDATION FOR THICKENER, WITH MERRILL PRESSES, AND PRECIPITATING-ROOM BELOW.

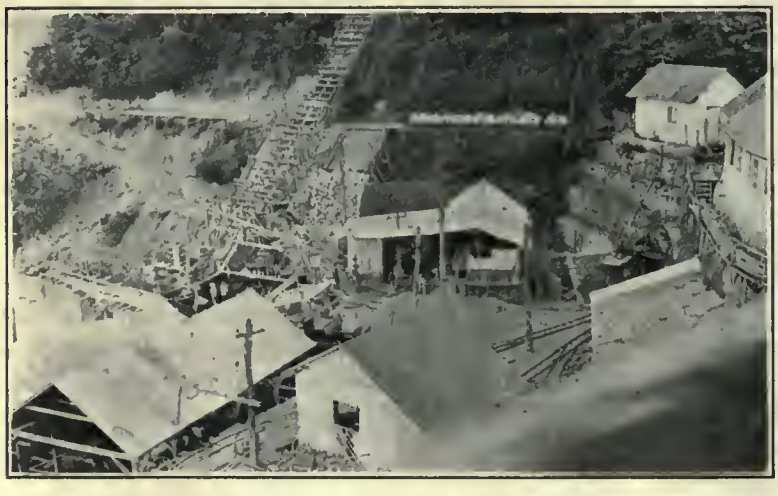


FIG. 6. MOUTH OF ROSARIO ADIT.

For the support of the three 10 by 35-ft. thickeners below the agitation tanks, four lines of concrete piers, resting on bedrock, were put in on 9-ft. centres from the face of the above foundation and in line with the centres of the walls, in the other direction. Posts 14 in. square were set on these piers and capped by 8 by 14-in. stringers running parallel to the hillside. Cross-stringers, 12 by 24 in., one end extending into a pocket left in the face of the wall, carry the 6 by 12-in. sills on which rest the vats. All of this work was heavily cross-braced and bolted to prevent swaying. A structure to carry the roof, tank mechanism, counter-shafting, and motor was erected on this platform.

Where the Merrill presses were placed, bedrock was found considerably nearer the surface. Rather than weaken the ground above by a heavy cut, the presses were set side by side on four piers similar to the vertical walls of the agitation vat foundation but tapering to 18 inches in thickness at the top. An 8-ft. cut was made in the bank for this building in order to reduce the height of the outer press from the ground, and a 7-ft. retaining wall with buttresses to each of the four piers, was put in to hold the bank and support the roof structure, the opposite side of which rests on posts standing on offsets in the main foundation piers. Concrete discharge and rich solution launders were poured, but the floor of the building is of wood. Owing to the alleged killing of cattle by cyanide solution from the old plant, it was necessary to provide for carrying the discharge about a mile by wooden flume to a point from which it will enter the creek below the town of San Juancito.

The two gold-solution tanks rest on a foundation of concrete piers and timber work similar to that built for the thickener tanks, as described above. The piers, however, are put down on 5-ft. centres; 12 by 12-in. posts and stringers were used, and 4 by 12-in. sills carry the tanks, the entire building being above the slope of the ground.

An interesting feature of the foundation work is the fact that all of the 6500 yd. of concrete poured was delivered through wooden chutes lined with old sheets of corrugated iron, from the original site of the mixer, without any handling whatever, except in the case of pouring a great number of small piers, when a receiving box was put in and wheelbarrows used. For all of the retaining walls and larger foundations, the chutes were extended so as to discharge concrete directly into the form. A rather wet mixture was used and a system of baffles was devised to be put in the chute near the point of discharge. This remedied any tendency to separate, which, however, was only noticed in the case of long, straight, steep sections of chute where the larger rocks would tend to leave the mass and roll ahead. Numerous angles in the chute and the baffles produced a well mixed concrete at the forms. Shovelers and tampers working in the forms, and careful supervision of all this work, resulted in exceedingly solid walls and foundations, with few voids. To reach the lowermost foundations the concrete passed through 600 ft. of chute. On all massive work, 'plums' were placed in the concrete. The sharp irregular surfaced rock used for this purpose was washed by hose and well worked into the wet concrete, effecting a considerable economy in cement without materially weakening the work. A mixture of 1-3-5 was used for all machinery foundations, 1-3½-6½ for massive work, and in a few instances as lean a concrete as 1-4-8 was used. This mixture,

however, is too resistant to receive 'plums' satisfactorily, so its economy in this case was doubtful. Rock and other material was lowered as needed, by a skipway built down the hill to one side of the work. The foundations for the 20 by 30-ft. stoek-solution tanks, several hundred feet to the west of the mill (see Fig. 1) were made of masonry, as were also the retaining walls for the refinery, warehouse, offices, and other buildings. Conerete vaults were built in the main office and in the refinery.

The great amount of 'fines' produced at the crusher was screened and used for mortar for masonry work. It was also used as a dressing for the roads about the works, which during wet weather became so slippery that without it, walking up hill was a slow process. As many as 600 natives were employed on the construction when they could be obtained, besides about 30 Americans, including mechanics, riveters, etc. The native labor in the vicinity of San Juaneito is, to say the least, above the average for Latin America. There are many skilful masons, mechanics, carpenters, and miners among the men, due probably to a couple of generations having grown up in and about the Rosario company's works. The recruits, however, who were brought in from the outlying country by scouting parties sent out during the shortage of labor exhibited comical ignorance of the use of a shovel.

Gold Dredging in Russia in 1911

ST. PETERSBURG CORRESPONDENCE

The annual statement has just been issued by the consultative committee of the gold and platinum producers of Russia on the operations of dredges in Russia and Siberia during the year 1911. These statements have been issued annually by the committee since 1906, but more than usual delay has taken place in the present report for which no explanation is given. The probability is that this greater difficulty was experienced in getting the information together. It is not always easy to persuade the dredging companies to furnish such statistics for obvious reasons, and some refuse them altogether. The Permanent Consultative Committee received replies from dredging companies operating 51 dredges. The following statement gives a comparative review for the past five years:

	1907.	1908.	1909.	1910.	1911.
Number of working hours per dredge	2259.23	2502.24	2771.57	2914.93	3026.67
Number of cu. yd. washed per dredge	139,300	166,400	188,805	182,486	212,268
Approximate recovery	$20,235	$25,380	$32,185	$31,357	$37,292

It is shown in the report that the number of working hours per dredge increased from 2914.93 to 3026.67. The average quantity of gravel handled increased about 30,000 cu. yd. and the average recovery about $6000 per dredge. This would indicate both a better manipulation of the dredge and also that the ground worked contained a higher gold content. The average value of the ground worked was 17.5c. per cubic yard, as compared to 16c. for 1910. Of the 51 dredges reporting, 5 produced less than $10,000 each; 15 each from $10,000 to $25,000; 14 from $25,000 to $40,000; 14 from $40,000 to $70,000; and 5 exceeded this latter figure. The dredge reporting the highest recovery produced approximately $160,000. The companies reporting and the number of dredges controlled by each is as follows: Alexandrovsky, 1; Amgun Gold Co., 2; Bogosloff Mining Co., 1; Borovinsk G. Co., 2; Verch-Isset M. Co., 1; Draga Co., 5; Trans-Ural M. Co., 1; Neviansk Factories, 7; Nizhne Tagil Works, 5; Novoudyl G. Co., 1; Platinum Co., 8; Russian G. Co., 2; Savelieff Co., 1; Spassky Co., 1; Sissertsk Co., 1; Fedoroff Co., 9; Shouvaloff Co., 2; Savinnich Co., 1.

The report does not give separate figures for the platinum and the gold produced, so the different amounts of the two metals cannot be obtained. The number of dredges working is less than for the preceding year, but according to the report, greater judgment was exercised in the selection of dredging areas as well as in closing inefficient dredges. The results also show that when the work has been under foreign management the operation has generally been successful. It would have been interesting had the report given the number of dredges of foreign construction, but on account of the high duty on machinery, most of the dredges are of Russian manufacture. The report claims that in addition to improvements in dredge construction the workmen as well as the dredge-masters have shown considerable improvement in their manner of handling the machinery, and that this, in part, accounts for the better results from operations. The production for 1912 will probably show a reduction below that of 1911, partly on account of the strike at the Lena Goldfields and partly because in the Amur region and the Urals the workmen have been withdrawn from the mines by the superior attractions of railway construction on the Amur railway, and the rewards offered by platinum production. Those interested in dredging will be surprised that the number of dredges has fallen off in Russia, where such an immense proportion of the gold produced is from gravel. While one may expect dredging to decline in the Urals where the gold-bearing gravel is approximately exhausted, in the east where practically all the gold produced comes from the placers, it might have been expected that the number of dredges in use would increase.

Southern iron ore deposits are extensive, as was shown by a map compiled by the U. S. Geological Survey for the Southern Commercial Congress. On it large areas were indicated in Missouri, Arkansas, Tennessee, Virginia, West Virginia, and North Carolina, and smaller bodies in Maryland, Alabama, Texas, South Carolina, and Georgia. The output from the ten producing southern states in 1911 was valued at $7,379,267. An estimate of the available iron-ore reserves in the southern states by C. W. Hayes, formerly chief geologist of the Survey, places it at 500,000,000 long tons, together with a much larger quantity of low-grade ore. Copper is produced in seven of the southern states; the value of the 1911 output was $2,455,363.

Copper Mines in Chile—I

By Juan Blanquier

Copper mines have been worked in Chile since the year 1601, and the output of copper kept constantly increasing up to the year 1876, when it reached 52,308 tons. At that time Chile was by far the largest producer of copper in the world. The statistics of the year 1879, for instance, show the following figures for the three largest producers: Chile, 46,422 tons; Spain and Portugal, 33,985; United States, 23,724. Since the year 1882 the United States has taken the lead in copper production, keeping the first place up to the present day.

The copper production of Chile has been without increase for a long period averaging about 45,000 tons per annum for the past five years. This is due principally to two reasons, the first being that no high-grade ore deposits have been discovered during that time, and that the attention of the miners has been turned to the deposits of nitrate of soda, borax, and similar deposits which are easier to work and give greater returns. This does not mean that the copper mines in Chile have been exhausted or that the country is not liable to resume its place among the foremost producers of copper of the world. On the contrary, the actual conditions are exceedingly favorable for an important improvement in the copper industry of the country in the near future.

Before commencing the discussion it may be useful to give some general idea of the country in regard to its geographical situation, climate, resources, and other matters. All the figures given in the present article are taken from official statistics and publications of the Chilean Government.

Constitution and Government

There are three powers in the state: the legislative, the judicial, and the executive. The legislative power is vested in the National Congress, consisting of a Senate and a Chamber of Representatives, both directly elected by popular vote. The judicial power is vested in a High Court of Justice in the capital, seven courts of appeal distributed over the Republic, Tribunals of First Instance in the capitals of departments, and subordinate courts in the districts. The executive power is exercised by the President, elected for a term of five years by indirect vote. The President is assisted in his executive functions by a Council of State, composed of five members appointed by the President, six members chosen by the Congress, and by a Cabinet composed of seven ministers. For the purpose of local government, the Republic is divided into provinces, and the provinces into departments, both under the charge of salaried officials directly appointed by the President.

Finally, I may point out very emphatically that the leading South American Republics, including Chile, Argentina, and Brazil, have strong and stable governments based upon the freedom and equality of their citizens. Revolutionary movements of any kind are unknown in these countries as they are in the United States and the leading European countries.

Area and Population

Chile forms the southwestern part of South America and is a long and narrow strip of land that runs from parallel 10°57′ to 55°59′ south latitude and is bounded on the east by the summit of the great Andes range and on the west by the Pacific ocean. The total length of the country is 2650 miles and its average width a little over 100; the area being about 290.000 square miles. The population is 4,000,000 inhabitants, including 150,000 foreign born residents and 100,000 Indians. The principal towns are Santiago, the capital, with 400,000 inhabitants, and the sea port of Valparaiso, with over 200,000 inhabitants.

Two important mountain ranges, known as the Andes range and Coast range, run parallel from north to south, the entire length of the country. Between the ranges there is a large longitudinal valley. This valley varies in width and is interrupted in some places by tranverse ranges running easterly and westerly. The Andes range forms the natural easterly boundary between Chile and the Argentine Republic. The altitude of the Andes varies considerably; it averages 13,000 ft. in the northern part between parallels 17°51′ and 31°30′ and rises to an average of 17,000 ft. between the latitudes 31°30′ and 34°, where some of the highest peaks are situated; among them being Aeoneagua peak, which is 23,000 ft., the highest peak in either of the American continents. Farther south the altitude of the range decreases gradually to the sea-level when it reaches the Strait of Magellan. The Coast range averages 3300 ft. in height in the northern part of the country. It rises abruptly from the sea coast and its continuity is somewhat broken. It decreases in altitude farther south, and finally ends at the coast in latitude 41°30′, giving origin to a number of islands still farther south.

The longitudinal valley previously referred to runs northerly and southerly between the two ranges above mentioned. It is interrupted by a number of transverse ranges between parallels 29°30′ and 33°, where it resumes its normal southern course again. The altitude of the longitudinal valley decreases from a maximum of 4000 ft. at its north end to 1600 ft. at latitude 33°, from whence it gradually descends to the sea-level in its southern end.

Rivers

There are a great many rivers in Chile, especially in the southern portion, the course of practically all the principal ones being from east to west. They have their sources in the Andes range, forcing their way through the Coast range and empty into the Pacific ocean. In the northern part of the country, down to parallel 27° there are only a few unimportant rivers. The region is desert and there is practically no vegetation with the exception of a few small cases. From parallel 27° down to 42° there are a number of important rivers of permanent

flow, some of them navigable for small steamboats. In this part of the country for a distance of about 1000 miles, 18 big rivers empty into the sea, besides a number of smaller streams. These rivers are more or less uniformly distributed over this 1000 miles.

The water flow is permanent during the entire year, increased, however, in the winter by the rains and in the summer by the melting snows in the mountains. These waters are extensively used in the irrigation of the longitudinal valley above referred to, the soil of which is extremely fertile. There is also practically unlimited opportunity for the development of hydraulic power in these rivers on account of the steepness of the water courses and permanency of flow. There are a few hydro-electric plants in operation, the largest being 24,000 hp., besides a number of smaller ones. The total developed hydro-electric power is estimated at 60,000 hp., 85% of which is used in the towns for lighting, electric traction, and power. Compared with the available water-power, the amount of power actually developed is insignificant. There is a vast field for investment in electro-chemical and other industries, requiring cheap and abundant power because of the existence in the same region of raw materials.

Climate and Natural Products

With the exception of tropical, the climate and natural products of this country are varied on account of the great difference of latitude from north to south and the enormous differences of altitude from east to west, varying from 20,000 ft. in the mountains to sea-level. Regarding the climate, agricultural products, and mineral resources, the country may be conveniently divided into three different sections, or regions, as follows: (1) The north region, extending between parallels 17°57′ and 26° 40′; (2) the central region, extending between latitudes 26°40′ and 40°; (3) the southern region, between latitudes 40° and 55°59′.

The north region is almost entirely a desert, being hot and dry, with rainfalls practically unknown. Agriculture in this region is insignificant. The weather is generally clear and sunny, the temperature being rather high all the year round. The climate is not pleasant, although it is healthy; tropical diseases and fevers being unknown. The mineral resources of this region include deposits of natural salts, especially nitrate of soda, borax, sodium chloride, different kinds of sulphates, potassium salts, etc., of which only nitrate of soda and borax are extensively mined, the output for the year 1911 being: nitrate of soda, 2,454,000 long tons; borax, 44,500 long tons. Gold, silver, copper, iron, manganese, lead, and zinc are mined to some extent, while large deposits of guano and native sulphur are known to exist.

In the central region rain precipitation increases from north to south, being abundant in winter (June, July, and August) and infrequent in summer. The climate is exceedingly mild and pleasant and is considered one of the finest and healthiest in the world. The mean annual temperature averages 59° F. in the valleys, with moderate variations. The weather is also clear and sunny. The soil is very fertile and a variety of agricultural products is grown, including grapes, oranges, and all kinds of fruit which grow in a temperate climate, cereals of every description, tobacco, flax, and others. The mineral resources of this region are principally in its northern part. Included among them are important deposits of gold, silver, copper, iron, manganese, lead, cobalt, zinc, sulphur, lapizlazuli, lime, and gypsum. In the southern part of the same region there are important coal deposits and alluvial gold. Of all the mineral resources mentioned, the copper, iron, lime, or cement rock, and coal deposits are objects of important exploitation, while the remainder are worked only on a small scale, although there are many important deposits known to exist.

Industries and Communications

The southern region is rather cold, with heavy precipitation through the year. Agriculture is carried on to a small extent, while natural forests cover extensive areas of land, the timber industry being important. Sheep are raised extensively in the southern part of the region, and the export of raw wool is considerable. The existence of coal deposits is known. Placer mining for gold is being done to some extent and prospecting for oil is now active.

There are 21,000 miles of serviceable wagon-roads and nearly 1000 miles of inland waterways. The total railroad mileage is 4500 miles, more than half of which is owned and operated by the state. International communication with Argentina and Bolivia are made by three distinct railroad lines. One transcontinental line about 1000 miles long runs from the Chilean port of Valparaiso in the Pacific ocean, to Buenos Aires, the capital of Argentine Republic on the Atlantic ocean. The other two international railroads connect La Paz, the capital of Bolivia, with the two Chilean ports of Antofagasta and Arica. There are three other trans-Andean railroads in course of construction which, when finished, will run from three points on the Chilean coast far into the Argentine Republic and will ultimately reach the Atlantic coast.

Communication with other South American nations, as well as with Europe and the United States, is made by sea. The shortest route between Chile and the United States is by way of the Isthmus of Panama. The trip from New York to Valparaiso takes a little over 19 days, and is made as follows: From New York to Colon (in the Isthmus of Panama), by steamer, 7 days; crossing of the Isthmus of Panama, by rail, 3 hours; from Panama to Valparaiso, by steamer, 12 days. When the Panama canal is open it will be possible to make the trip direct by steamer from New York to Valparaiso in 15 days. The distance is about 5300 miles.

Commerce

The total exports and imports of the Republic of Chile for the year 1911 amounted to $275,000,000 (American gold), of which $140,000,000 was for imports and $135,000,000 for exports. The imports consist principally of machinery of every description, coal, oil, steel, iron, and all sorts of manufactured products. The exports consist principally

of raw materials, including borax, nitrate of soda, iodine, gold, silver, iron and copper ores, blister copper, and agricultural products.

Mining Laws

Mining laws and regulations are liberal in Chile. Deposits of gold, silver, copper, platinum, mercury, lead, zinc, bismuth, cobalt, nickel, tin, antimony, arsenic, iron, chrome, manganese, molybdenum, vanadium, radium, iridium, tungsten, and precious stones may be acquired by location whether situated on public lands or on the private property of an estate. In addition to the metals above enumerated, all fossil deposits, including coal, may also be freely acquired by location if situated on lands belonging to the state or municipalities, but cannot be located if situated on private property.

The state has created a monopoly of all the deposits of guano which exist in Chile and no trade whatever is carried on in this particular product at present. The same conditions exist as to nitrates found on public lands and lands belonging to municipalities, with the exception that lands containing deposits of nitrates may be acquired from the state by purchase at public auction. All alluvial deposits, such as auriferous sands, may be freely acquired by location of claims. Any man or unmarried woman of 21 years of age can take up a metallic mineral claim containing an area of not to exceed 36 acres or an area of not to exceed 120 acres for a claim containing non-metallic minerals. No limit is fixed as to the number of claims which may be owned by corporations. Taxes on mining properties are as follows: For those containing metallic deposits, $0.80 per acre per year; for non-metallic deposits, $0.015 per acre per year: for auriferous sands, $0.082 per acre per year.

When the mineral deposits are located on a private estate, the locator is entitled to occupy and condemn all the land he requires for the convenient working of the mines, for accumulating ores and dumping requirements, for building mills and reduction plants, for accommodations for the workmen, and for wagon-roads and railroads. He is also entitled to use whatever wood and water and grass is required for the men and animals employed. The owner of the estate is, in return, entitled to be indemnified as follows: (1) For the value of the land occupied in the exploitation of the mines and the building of the mills and reduction plants; (2) for the wood, water, and grass used: (3) for the deterioration to the estate resulting from the above operations. Foreigners enjoy exactly the same rights as Chilean citizens for acquiring claims and working mines in this country.

Copper Mining

The total output of copper ore from Chile during an average year (1909) amounted to 500,000 long tons, of an average grade of 9.21%, containing about 100,000,000 lb. copper. This came from 775 different mines. Of this total number of mines, 100 of them produced 375,000 gross tons of ore, while the remainder, that is to say, 675 mines, produced an aggregate of 125,000 long tons. This gives an average output for each mine of 185 long tons per year. These figures give an idea of the great number of copper mines situated in different parts of the country and the insignificant development of each particular mine. Moreover, this number refers only to the mines actually producing, as the total number of copper mines producing and in process of development in the country is 10,821, covering an area of about 90,000 acres.

With the exception of a few important mines, the work is carried on in the most primitive way, no machinery whatever is used, all underground work as well as transportation and outside work is invariably done by human labor, and attention is paid only to high-grade ores. The reasons for the backward condition of the majority of the copper mines in Chile may be stated as follows:

1. Lack of interest of the native capitalists in mining enterprises, the reason for this being that they find investment for their capital in other fields which require less skill and technical knowledge, and which are considered by them to be safer, as for instance, real estate, agriculture, and industries derived from agriculture.
2. Deficiency of transportation facilities.
3. Lack of reduction plants for treating the ores.

Less than one-half of the copper output was actually reduced in the country during 1909, in which year 78,000 long tons of crude ore was exported to Europe or to the United States to be treated. The average grade of these ores was 24.09% and they contained about 42,000,000 lb. of copper. In the same year over 8000 tons of 50% copper matte, containing 9,000,000 lb. of copper, was exported, as well as 45,000,000 lb. of blister copper which was refined in Europe and the United States.

Labor

Over 15,000 men are engaged in copper mining, the average wage per day being $1 and the average work-days in the year 280. From these figures it will be seen that the output of ore per man per day is only 0.119 tons, and the cost of labor $8.40 per ton mined. The labor efficiency is exceedingly poor, due principally to the small scale on which work is conducted and to the fact that, on account of hand sorting, only the high-grade ore is shipped, resulting in sending to the waste pile the great bulk of the ore mined, which is not of sufficient grade to pay its transportation. For the sake of showing what can be obtained from the native labor, when the operations are properly conducted, I may quote some figures published by W. Braden, of the Braden Copper Co., relating to his mining operations, as follows: 174 men, in a 9-hr. shift, using 2¾-in. Ingersoll machine drills, drilled 5082 ft. at a cost of 2.025c. per foot; average drilled per man per day is 29.3 ft. Also, 1008 men engaged in hand drilling, drilled in 9 hr. 13,855 ft. at a cost of 8.2c. per foot: average drilled per man per day, 13.8 ft. The average of ore mined per man per day is 12 tons.

Freight on ores is generally high, due to deficiency in transportation facilities. The average cost for freight per ton of ore from the mines of the interior to the coast is $3.50.

Handling Material in Labor-Wasting Mills

By S. A. Worcester

An observing manager or engineer who pays particular attention to economy of labor can hardly fail to notice that in many mills of comparatively recent construction, much shoveling and hand tramming and other manual labor are practised, in places where simple automatic devices of the most obvious character would save the labor of one to ten or more men. The fact is noticeable that the most recent designs of some engineers of prominence evidence a lack of close attention to the careful reduction of labor costs to the lowest practical minimum. This is due in some cases to the manager's prejudice which prevents the engineer from adopting certain arrangements which he knows to be useful. In the majority of cases it is due to the designer's failure to keep up to date by the use of the best of all text-books, the current technical press.

Shovels v. Cableways

The use of the shovel should be practically eliminated in plants of any considerable size. I have in mind a 100-ton cyanide plant and a 75-ton plant at which the entire tonnage is shoveled three times, also one 75-ton plant at which it is shoveled twice. These mills are of recent design and treat low-grade mine dumps. The ore is first shoveled into cars of about 1600-lb. capacity, then trammed by hand to the mill, where it is shoveled into the crusher. In one mill the crushed ore is trammed to the tanks with a 1600-lb. car. The other two use conveyors for this purpose. In all three mills the charge is leveled with the shovel and shoveled out after leaching. At one 75-ton plant the tailing is shoveled into tram cars and trammed to the dump by hand. In winter, out-door tramming is often obstructed by snow and ice and the tracks need frequent extensions and moving in all weather.

At each of these plants a light cableway, using a drag bucket for excavating the dump and delivering it to the mill, would eliminate the out-door shoveling and hand tramming, track construction, and maintenance, saving about $15 per day at the 100-ton mill and $12 each at the others. At one cyanide plant of 125 tons capacity the ore is mined in an open pit. An inclined hoisting shaft runs beneath the pit, with one or more chutes into which the ore drops and is hoisted by skips. From the skip hoist the ore is trammed by hand to the mill. The situation of this mine and mill is such that a cableway with a digging bucket and a radially movable tail tower would easily excavate the ore and deliver it to the crusher, using one man's labor instead of three, and with a much less expensive plant, eliminating the shaft, raises, chutes, head-frame, and hoisting equipment.

One dump milling plant now in mind, of 500 tons capacity, began operations by running drifts under the dump with raises connecting to the dump and having chutes from which the ore was trammed to the main shaft. Here it is hoisted to surface bins from which it is trammed by electric cars to the mill. When the rock had caved to the angle of repose, it was necessary to have a crew of shovelers throw a large part of the dump into the chutes, thus handling the rock four times in order to deliver it to the mill. Later a drag scraper, drawn by two small single-drum steam hoists standing side by side, was installed for scraping the ore into the chutes. One drum pulled the head rope and the other the tail line which was passed around a movable sheave anchored in the dump. Hand labor was thus finally eliminated, but the system of machine operation is an expensive one. The hoist and scraper outfit are ill adapted to frequent moving, the expense of driving, raising, and chute-making is high, and tramming and hoisting are also expensive, and the system is complicated with many possibilities of break-downs and delays. A traveling cableway with a suitable drag bucket operated by one man would excavate this tonnage with ease and deliver it to the electric surface tram-car, eliminating all manual labor and all underground and hoisting expense.

Another plant of about 300-tons capacity uses a power shovel for excavating the dump, loading it in cars which are hauled by an electric hoist to the crusher. This system involves a constant expense for moving shovel tracks and car tracks, rope guides, and signal wires, and cleaning around the shovel. It employs at least five men in excavating rock and delivering it to the crusher. This particular dump is admirably placed for excavating and delivering the entire tonnage with the labor of one man, by using a radial cableway and suitable digging bucket.

I have in mind a number of concentrating plants designed by engineers of some prominence, in which table and jig concentrates are shoveled and wheeled or trammed from the machines to bins, where any of the simple conveyors now used in other mills for the purpose would do this work admirably and save the labor of one or more men per day. In many mills now employing a man for feeding the crusher, this attendant can be eliminated by using a hopper of ample size, the man who delivers the rock having time to pick out wood, etc., if the plant is well designed.

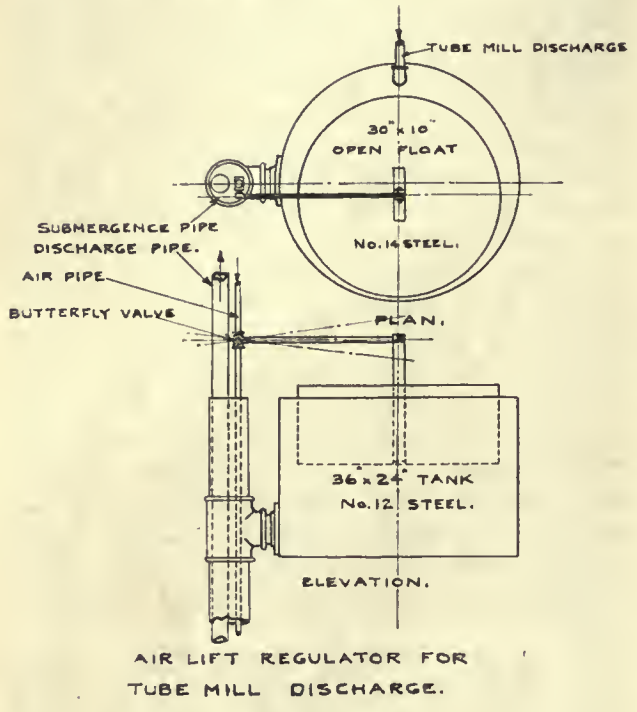
Belt-Conveyors

For delivering sands to leaching tanks, inexpensive belt-conveyors save hand tramming, and a simple excavator, now thoroughly tested, will level the charge automatically, and will discharge the nearly dry tailing through a central gate to a conveyor which will carry it to the stacker. The dry tailing system has the advantage over sluicing of retaining the tailing on the millsite for possible future use, and of avoiding all construction and maintenance of dams and accessories. It avoids damage to neighboring property by tailing, with attendant litigation: this latter item being in many cases one of

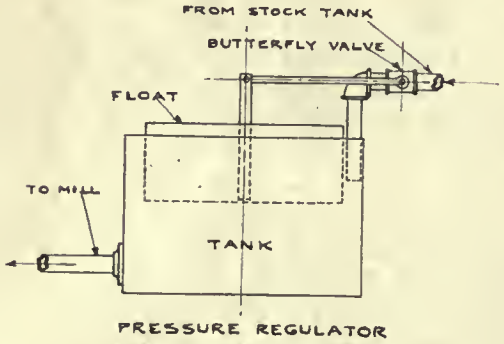
importance. One large plant, for instance, which sluices out tailing, has built several successive dams at great expense for construction and maintenance, and is in almost constant litigation with property-owners along the gulch below the mill.

Another plant discharges tailing having a large amount of moisture and uses dump-cars for carrying the tailing to the dumps. This mill, keeps a large force of men employed most of the time impounding tailing, extending and moving tracks, and building trestles. A well designed cableway would stack semi-dry tailing as high and steep as rock dumps will stand, and would require no track or trestle, and no considerable maintenance. The entire 500 tons per day would be easily handled by one man. The initial cost of the cableway for either of these two mills would be but a small fraction of the amount which has been wasted in labor and maintenance. Another item in favor of semi-dry tailing is the large saving in water, which is a large expense at all of the plants mentioned.

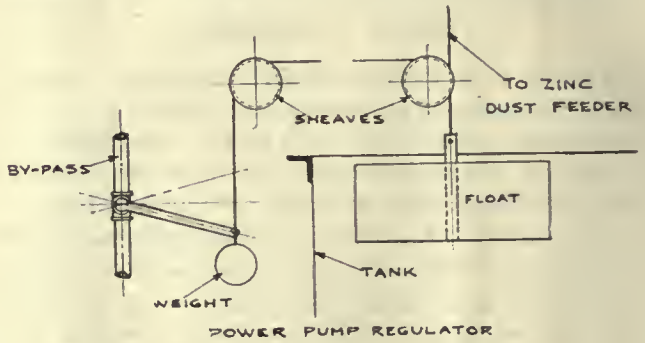
Careful attention to the use of minor automatic devices in and about the mill will often result in saving the labor of several men, besides effecting much more reliable and continuous operation. Floats, for instance, can be used to great advantage for automatically regulating variou soperations. A float which I have used in many places, and which is reliable, is shown above. It is a simple open pan or bucket. Its advantages over closed floats are chiefly that it is less likely to leak and leakage is easily seen and remedied. Also it can be loaded as desired, and is much cheaper than the closed float. The large float shown will carry a load of nearly 100 lb. and will give an effective maximum pull and lift of about that amount. It does not become waterlogged, like the wooden float. Used as a power-pump regulator, this float, placed in the gold-solution tank, maintains a nearly constant level in this tank by opening and closing the bypass leading from the discharge to the suction of the power pump, which has a fixed speed and constant delivery. Besides governing the quantity of solution pumped to the filter-presses for precipitation, this float may also accurately proportion the feed of zinc-dust by being connected to the feeder gate or equivalent device. If it is desirable to maintain the solution level within narrow limits, the bypass valve lever is made short, and if it is more important to have the work of precipitation nearly constant, the valve lever is made long and larger range is allowed for the movement of the float. The feeder connection or lever must, of course, be similarly proportioned.



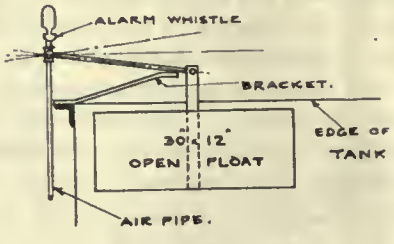
AIR LIFT REGULATOR FOR TUBE MILL DISCHARGE.



PRESSURE REGULATOR FOR MILL SOLUTIONS &c.



POWER PUMP REGULATOR



HIGH LEVEL ALARM.

Used for regulating air-lifts returning pulp in circuit from tube-mills to classifiers, this float economizes compressed air, using just what is necessary to elevate the pulp and preventing any overflow at this point. The float is placed in a small tank, into which the tube-mill discharges, and which in turn discharges to the submergence pipe of the air-lift. Where solution or water is used for classifiers and similar machines requiring careful regulation of the quantity delivered at each point, it is important to preserve a nearly constant pressure, regardless of the fluctuating head in the stock tank. For this purpose, the float, placed in a small tank, and connected to a butterfly or gate valve, as shown, answers admirably.

Where tanks are alternately filled and emptied, the high-level alarm, connected either to a whistle as shown, or to an electric bell, may be used to good advantage, saving many nasty messes and, at times, serious losses and possible stoppages of the plant.

It is obvious that by slight changes the same float can be made to act as both high and low-level alarm.

Inattention to keeping crushing rolls true is a very common cause of wasted power and loss of crushing capacity, with consequent overwork for the screens. If roll housings are provided with suitable openings, and a portable electric grinder of two or more horse-power, mounted on a convenient slide rest, is used frequently, grooving can be almost entirely prevented and the rolls kept up to capacity. This is particularly important for finishing rolls. An efficient dust-remover, such as an exhaust fan connected by pipes to all dust-making machines, and discharging into a dust-house of ample size, is a valuable labor saver, avoiding much sweeping and cleaning and much cutting of bearings in a dry-crushing plant, and necessarily keeping the mill in much better condition than where dust is allowed to fly freely.

One frequent power waste is the use of unnecessarily high pressure for air agitation. As compared with gentle agitation, a violent movement of pulp will not ordinarily give results proportionate to the increased power cost. Careful attention to this item is well worth while. Agitating-vats of large height and small diameter are objectionable on account of the great air-pressure required, also the greater mill height, pumping power, and stair climbing necessary. They require a special high building and cost more per unit of capacity than the tank having height equal to diameter. Experience with the lower agitator has shown it equal in efficiency and much more economical and convenient.

Sand-Filling Stopes at the Witwatersrand Deep Mine

*The sand-filling plant of the Witwatersrand Deep, Ltd., has been operating at full capacity for about five months past. Experimental work commenced 12 months ago, but for some time the quantity of sand lowered was small. About the end of last August, arrangements were sufficiently advanced to allow of despatch of all the current sand, and since then the plant has been handling about 22,000 tons per month, or the whole of the sand leaving the mill, which is about 60% of the tonnage milled by the Witwatersrand Deep, 38,000 tons per month.

The East Rand dike, which traverses the Witwatersrand Deep claims, virtually divides that property into two portions, which are known as the north and south sections. Sand-filling is proceeding in both these portions of the property. In the north section, sand is delivered through a borehole, and in the south section down a winze. Under each row of tanks, conveyor belts are installed, which deliver the sand to two sludge pumps. There the material is mixed with about four times as much water and pumped to the two dewatering stations at the surface. The pulp is pumped to the north station in an 8-in. delivery pipe. Here the sand, mixed with water, is passed into six Caldecott dewatering cones, and is gravitated down a borehole 750 ft. deep. The mixture is freed of much of its water by the Caldecott cones, and enters the mine workings with about 28% of moisture. The system at the south section is similar to that described. In order to guard against the lowering of free cyanide into the mine workings, tests are periodically carried out, and potassium permanganate is fed into the pulp as a neutralizing agent.

The whole installation is working satisfactorily and economically. The surface costs are about the same as those entailed in dumping residue, and the underground costs are only about 4.4c. per ton. Sand-filling has thus increased the ordinary working expenditure by an exceedingly small amount, while it has proved advantageous to the company in two or three ways. The most important gain has been that larger areas of ground have been rendered capable of being worked. By means of sand-filling, pillars and hitherto inaccessible blocks have been brought within the scope of mining. Sand-filling also has bettered the underground workings considerably in regard to safety. In a mine like the Witwatersrand Deep, where the angle of dip of the 'reef' is fairly steep, pillars which have withstood the strain of the superincumbent strata for some years show signs of crushing, and sand-filling assists them in supporting the hanging wall far more effectively than timber.

The amount of water to be mixed with the sand has to be more or less carefully determined. Without sufficient water, distribution underground cannot be effectively carried out, and an excess of water presents the serious disadvantage of having to be pumped out again. This latter consideration is of importance at the Witwatersrand Deep, where recent operations have been much hampered by the large amount of water encountered. At present the company is pumping about 1,500,000 gal. per day, as compared with 2,000,000 gal. a short time ago. It is hoped shortly to reduce this amount, as in a month or two the East Rand Proprietary Mines, adjoining the Witwatersrand Deep on the East Rand, will have powerful new pumping equipment at work, which it is anticipated will relieve the Witwatersrand Deep of much of its present water. This influx is considered to be due to the transverse dike which crosses a corner of the Knights Deep, the Witwatersrand Deep, and the East Rand Proprietary to the Angelo Deep. The management of the Witwatersrand Deep accordingly has had to guard against the accumulation of further quantities of water underground, and the present admixture of about 72 parts sand and 28 water per hundred has been determined to give the best results. The water is pumped back from the Caldecott cones to the sludge pumps in a 12-in. delivery pipe.

*From the *South African Mining Journal.*

Water consumption at Broken Hill, New South Wales, during 1912 amounted to 344,403,800 gal., an increase of 44,277,700 gal. The Broken Hill Water Supply Co. made a profit of $300,000.

Gold Recovery by Volatilization

By Ben Howe

*Most people in Western Australia who are interested in metallurgical problems know by repute the refractory nature of the gold ores of the Gwalia Consolidated mines in the East Murchison goldfield. Lately, a process, of which the application, at any rate, is entirely new to the metallurgy of gold, has been tried on these ores, and bids fair to solve a difficult problem. The process has already passed the laboratory stage, and is running with a small furnace. The results from this have been so consistent and the extraction so good—varying from 92 to 94%, that a large furnace is now being erected.

Briefly stated, the process consists in roasting the ore with a small percentage of salt, whereby the gold is volatilized and passes off as fume. The fumes are led through chambers and drenched with water, which dissolves lime, arsenic, and iron salts in the fume, and leaves the gold suspended in the solution as a black powder. This water is pumped through a filter-press before returning to the chambers to attack more fume. The black gold-slime remains in the filter-press, from which it can be removed at any time and smelted. It is not absolutely necessary to grind the ore very fine before roasting. Ore as coarse as 20-mesh has been successfully volatilized; but the finer the ore the quicker the volatilization. Thus the same ore ground to pass a 100-mesh screen is volatilized in 10 minutes, to 40-mesh in 30 minutes, and to 30-mesh in 50 minutes. It will, therefore, be found, in most cases, cheaper to grind the ore fine than to keep it for a prolonged time in a furnace at a high temperature. The salt may be mixed with the ore dry, or the ore may be wet-crushed in salt water from the mines or salt lakes, and subsequently dried. If the ore is given a rough preliminary roast before the addition of salt, 1 to 2% is sufficient for most ores; but if mixed with the raw ore, more salt, say, 3 to 4%, is necessary.

Type of Furnace

The furnace used is the simple brick-lined rotary type without ribs or other projections inside, with a constant feed at one end and a discharge at the other. The temperature required is about 1000°C., orange to yellow heat, the temperature, in fact, attained in a muffle furnace during cupellation. A higher temperature than this sinters the ore. This is no disadvantage if it occurs at the very discharge of the furnace, but if too high a temperature is carried back into the furnace the ore sinters at this stage and volatilization ceases before the ore is ready for discharge. Any high temperature up to this sintering point is not detrimental to good volatilization, and the sintering is easily observed by the workman and can be avoided. Sintering for even the last quarter of the furnace length only reduces the gold volatilized by about 5 to 7%. A low temperature is quite fatal to good results, as little action seems to take place below a bright red heat. It is advisable to use oil or gas-firing in the furnace; in the first place because the temperature is more easily under control; and again, because the fume, under this mode of firing, is not contaminated with soot as it would be from a wood fire. Only a small draught, just sufficient to carry the fumes through the furnace, is required. In this way the heat is well conserved within the furnace, and the great loss of heat carried into the flues, so characteristic of the many roasting furnaces, is avoided. The water used in breaking down the fumes becomes charged with sulphurous and a little hydrochloric acid, both of which are helpful in taking up the salts of the base metals into solution. Owing to the constant circulation of water, no great heat is experienced in the breaking-down chambers, and wood can be used in their construction.

Laboratory Tests

The laboratory tests to try the suitability of an ore to this treatment are very simply carried out. Two assay tons of the finely ground ore, of which the gold content is known, is mixed with 5% of salt. Either common salt or salt evaporated from mine waters may be used. It is advisable to commence experiments with 5% of salt and gradually work back to find the minimum amount of salt necessary for any particular ore. The mixture is spread out evenly to cover a 4 or 5-in. roasting dish, and then placed at the back of a muffle already heated to a good cupellation temperature. It should remain at this temperature for half an hour without rabbling, or any further attention, and can then be removed, cooled, mixed with the usual fluxes, and assayed in the ordinary manner. The percentage of volatilization of the gold is high, generally over 90%. The charge, on being removed from the muffle, should present the reddish appearance of roasted ore. It will probably have caked slightly by the action of the salt, but can be readily crushed up with a spatula. Should it appear hard and sintered the temperature has probably been too high, and a somewhat low volatilization result will ensue. Care must, however, be taken to keep the muffle hot enough, as low results are noted with a low temperature. The laboratory tests are as simple to carry out as the manipulation of the process itself, and have been found reliable when the ore is put to the test in the rotary furnace. A rabbled furnace of the reverberatory type is not suitable for this process.

Volatilization of gold from ores roasted with salt was noted in chlorination mills, but, as far as I am aware, no attempt to recover the gold was ever made by taking advantage of this action. A similar loss of gold was noted some years ago in the secondary roasting of highly arsenical ores with carbon, though in this case the loss was not so great as when roasting with salt. In 1910, A. T. Fry, a former assayer and chemist of these mines, first observed that the Gwalia ores lost their gold by roasting with salt, but no advantage was taken of this curious volatilization until I took charge of the mine in July last. During the past three months I have worked out the process described above, and have erected a small plant which is at present work-

*From the *Monthly Journal* of the Chamber of Mines, Kalgoorlie.

ing and giving good results. That such great advances have been possible in so short a time is due entirely to the extraordinary simplicity of the process. It seems highly probable that the method of gold recovery will cause radical changes to be made in many Western Australian reduction plants. All ores carrying even small quantities of arsenic and calcite, and these minerals are present in most ores, are amenable to treatment. All ores of this category readily yield their gold by volatilization with salt.

Leasing Oil Lands

The council of the Mining and Metallurgical Society has submitted to the members for discussion and vote the following plan for leasing the federal oil lands. The plan was prepared by a committee from the San Francisco section of the society, but has been modified in the light of discussion of the other sections. It is provisional only and intended to stimulate debate, but has the merit of being a definite and consistent proposal. It happens that M. L. Requa, chairman of the committee in charge, dissents strongly from section 4, and has filed a minority report.

1. There being no laws at present under which oil land can be acquired satisfactorily, a special federal law should be enacted, governing the acquirement of oil, gas, and asphalt lands, and all lands known or reasonably supposed to contain oil, gas, or asphalt should be disposed of only under the terms of the new law.

2. From time to time, as the desirability of maintaining a stable price for oil may in the opinion of the Secretary of the Interor demand, oil, gas, and asphalt lands now reserved or hereafter withdrawn shall be thrown open to entry in blocks of such size as he shall determine. In fixing the size and position of the blocks, he shall recognize the principle that the pioneer may properly be allowed a larger area than the one who follows.

3. Prior to the opening of any lands to entry, they shall be properly surveyed and suitably monumented, and they shall be divided into tracts of 160 acres.

4. Where two or more individuals or corporations desire to lease the same tract of land, the lease shall be allotted by the Secretary upon the basis of competitive bids, the proffers to be in terms of royalty offered, and all royalties to be chargeable and payable in terms of the product. Whenever a lease is thus allotted to a bidder in competition with others, it shall consist of such an acreage as shall be fixed in each particular case by the Secretary; but no lease allotted without competitive bidding shall contain more than 320 acres. No allotment shall be made of any lease or leases unless in the opinion of the Secretary the individual or corporation acquiring the lease shall be financially able to develop the property completely and to care for it during and after development in the manner best calculated to bring about its greatest production and least waste, with due respect to neighboring properties.

5. Successful entrymen shall file with the Secretary a good and sufficient bond to the amount of $10,000 for the faithful performance of the terms of the contract. The Secretary, in making these leases, is empowered, in cases where he thinks it advisable, to substitute for the aforesaid bond of $10,000 either a bond in a less amount or an annual rental for the acreage reserved.

6. Lessees shall commence drilling within a specified and agreed time, and all money expended upon the lease in a bona fide effort to develop oil, gas, or asphalt, or to operate for oil, gas, or asphalt, shall apply to the extinguishment of the bond, and when the total amount so expended equals the amount of the bond, the latter shall be canceled.

7. Transfer of leases shall be valid only upon approval of the Secretary, and he may refuse approval whenever in his judgment such transfer would be contrary to public interest; but he shall not use this power of refusal as a means to exact increased royalty.

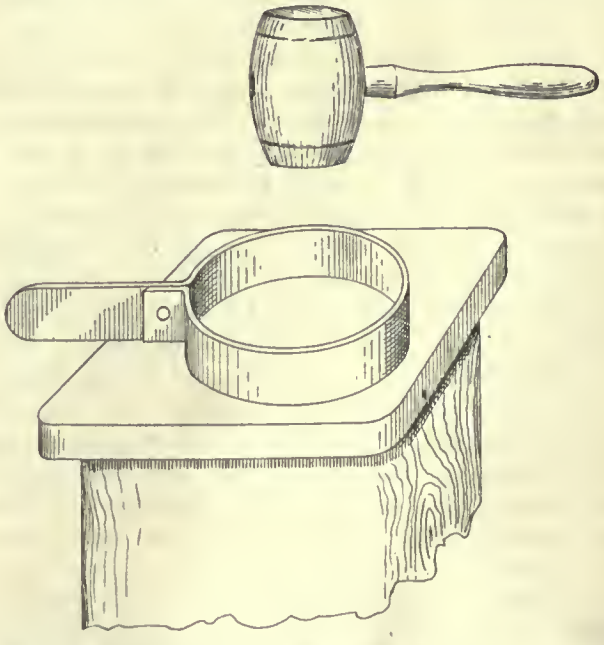
8. The lessee shall drill each year an agreed number of wells or shall keep in operation an agreed number of strings of tools, unless the local price of oil falls below a certain agreed price. If the lessee forfeits a lease, he shall retain his rights in all wells already drilled and may continue to produce from them so long as he pays the agreed royalty, and forfeited leases shall be immediately open to re-letting; provided no drilling shall be done within 300 ft. of an existing well.

9. Line wells must be drilled last, except where it is necessary to protect a lease against adverse drilling.

10. Net revenue from leasing the oil lands should go in large part to the state within which the lands are situated.

Crushing Samples

For breaking down samples, a convenient device is a ring made of strap iron and formed with a handle, as shown above. With this the larger pieces may be raked out and held while being cracked with a hammer.



Gasoline Locomotives for Hauling Ore

By Jesse Simmons

*The ore transportation problem of the Trojan Mining Co., Lawrence county, South Dakota, was that of moving not less than 200 tons of ore per day a distance of 4000 ft., the track to be outdoors, and the ore-bins at the mill at an elevation of 21 ft. above the tracks at the mine. Ore was also to be secured at two other points between the one mentioned and the mill. The problem was solved by H. S. Vincent, manager, who adopted gasoline locomotives, the first to be employed in this service in a gold mine in the United States. Gasoline locomotives are cheaper in first cost of installation than electric or compressed-air machines, the former requiring, in addition to the usual track, an overhead wire for the trolley, or a third rail, and a return circuit, usually effected by bonding the rail joints. When power is purchased from a custom power plant, peak loads are a consideration of importance. In using compressed-air locomotives an air-compressing plant must be provided capable of delivering air at 1000 lb. pressure per square inch, and heavy receivers and pipe-lines must be maintained for its storage and distribution. Small steam-engines probably do not develop the efficiency of the larger machines. That Mr. Vincent's decision was sound is evidenced by the fact that after having one gasoline locomotive in service for the better part of a year, a second was ordered and is now in service. In all essentials it is a duplicate of the first and was manufactured by the Milwaukee Locomotive Co., of Milwaukee, Wisconsin. It is of 7 tons weight and 35 hp. The cylinders are four in number, 6-in. stroke by 6-in. diameter, developing above horsepower at 800 r.p.m. The weight of the engine is 925 lb. Crank-shaft and connecting-rods are of forged steel, with 5 long bearings for the crank-shaft. The main frame is of steel, and the engine is enclosed within a housing of removable steel-wire screens. The drive-wheels are 21 inches in diameter, wheel base 40 in., length over all 11 ft., width 48 in., height 48 in. The working drawbar pull is 2340 lb. at low speed. The transmission is of the enclosed type, having two speeds, 4 and 8 miles per hour, forward or backward. The engine is provided with a hand brake, operating simultaneously on all four wheels, hand or foot operating gong, sander, and a chemical tank for absorbing the odors. The usual load for the locomotive to haul in actual service is 12 carloads of ore, each car being of 22 cu. ft. capacity, or 1 ton of Trojan ore. This load the engine handles over the 2% maximum grade, at high speed, or 8 miles per hour. At 4 miles per hour the load has been increased to 24 cars, which has been easily hauled. Table I gives details of operations of one of the locomotives for a portion of a month.

In addition to the ore handled over the railroad, from the siding a considerable quantity of the supplies for the mill are hauled. These are delivered to the siding over a tramway 1500 ft. in length,

*From the *Pahapasa Quarterly*.

TABLE I

Locomotive Operation for 16 Days in September 1912

	From Decorah...	From siding.....	Total	Average per day.	Per car hauled...	Per ton mile.....
Cars hauled 3297	218	3515	220	.....	.....
Ton miles traveled	..	2580	161.25	.....	.....
Cost of operating:						
Labor .....$		56.00	$3.50	$0.016	$0.021
Supplies:						
Gasoline, 200 gal. @ 22½c		41.00	2.56	.....	.....
Engine oil, 22 gal. @ 30c		6.60	0.41	.....	.....
Black oil, 5 gal. @ 15c.		0.75	0.05	.....	.....
Cup grease, 4 lb. @ 15c.		0.60	0.04	.....	.....
Waste, 6 lb. @ 15c.....		0.90	0.05	.....	.....
Total supplies		49.85	3.11	0.014	0.019
Repairs:						
Material		8.80	...	.....	.....
Labor		11.40	...	.....	.....
Total repairs		20.20	...	0.006	0.009
Total operating cost.....		125.95	7.87	0.036	0.049

conneeting with the C. & N. W. railroad on the hill above. Cars are operated over this tramway by means of an electric hoist. Practically 50% of the mill supplies and repairs are taken to the plant by this means. Owing to the irregularity of deliveries it was impossible to compute the cost of hauling these supplies, henee no account is taken of them in the table. Gasoline for the engine is hauled from Deadwood, a distance of 8 miles, in wagon tanks holding 365 gal. The gasoline is stored at the mine in a buried tank, 54 in. diam. by 10 ft. long, of steel construction.

Grades of Trojan Ore Railroad

Distance, ft.	Grade.	Remarks.
200	level	Decorah mines.
400	+ 0.8%	
800	level	
400	+ 1.0%	
300	level	Siding station
1000	+ 2.0%	
500	− 1.25%	
400	level	Mill-bins; elevation, 6111 ft. above sea-level.

From this table it will be seen that the heaviest grade is 1000 ft. of 2%, and after passing the head of this grade the loaded train strikes 500 ft. of track with a down grade of 1.25%, which is the only grade on the line in favor of the loads. The track is 18-in. gauge, laid with 25-lb. rails on 4 by 6-in. sawed ties spaced 2 ft. apart. Some of the older switches are turned off on a 20-ft. radius, but most of these have been replaced with less abrupt curvature, as the sharp curves were probably a little too much for the locomotive to negotiate without causing strains. At the machine-shop at the top of the hill near the ore-bins, a pit is provided enabling repairmen to get under the machine and make necessary repairs. This is done each Sunday. The locomotives in cold weather are run into a tunnel near the mill where frost cannot reach them during the night.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Extralateral Rights and the Prospector

The Editor:

Sir—I have read with much interest L. C. Campbell's article in your issue of March 8 on the American mining law. It expresses the natural view of the honest lawyer, well and forcibly. But is it the view of the thoughtful miner, or of the mining engineer armed with a proper knowledge and appreciation of the circumstances connected with the search for and location of mineral deposits? I think not. Laws, to operate satisfactorily, must be suitable to the conditions they are intended to control. Mr. Campbell, being a lawyer, and not a miner, cannot be expected to have a correct concept of the individual called a prospector, or of the rôle that he performs in the mining industry. This is clear, for he writes: "The supporters of the extralateral system argue that it is unjust that a prospector should spend his time and money in prospecting for and finding a vein, only to learn later that by its dip it passes beyond his sideline, at which he must cease working."

The advocates of extralateral rights do not hold such an opinion. Far from it. With them the matter is not one of justice or injustice, but of comparative expediency. For they know that the prospector never spends any money working on his claim, because he never has any. And so he never reaches his sideline. In other words, he is an explorer, and not a developer. No; their argument runs about as follows. The prospector is the individual who will wander over the country and search for undiscovered mineral outcrops. He will do it only if the laws governing the location and tenure of mining claims are so arranged as to lead him to think that he can make some money in the occupation by *selling his claim*. The simple and inexpensive method of location of the American mining law, coupled with its apex rights, produces such beliefs in his mind, and he goes out on the search. That is all there is to it. Take away these attractive features and he declines to go. He adopts some other way of gaining a livelihood, and as a consequence the industry of mining languishes because there are no new discoveries except such as are made by pure accident during the progress of work of another kind, such as making a railroad grade or excavating a cellar. That is the way the mining man looks at the problem. Now let us see if the facts in the case will support this view.

There are just two mining regions in the world where a mining title can be initiated in a simple and inexpensive way, and where also the claim carries extralateral rights. These are, in the United States, west of Texas, Oklahoma, Kansas, Nebraska, and the Dakotas, and in Alaska. Are there any prospectors in these places? Yes, thousands of them. Can you find them anywhere else? No. Here is a clear cut issue. Can anyone give the name and address of a prospector (of the class with which we are so familiar in the West, or anything like him) that is at work in Canada, in the United States east of New Mexico, Wyoming, and Montana; in Mexico, Central America, South America, Europe, Asia, Africa, or Oceanica? No. He does not exist in those lands. They have not even a name for him, for the mental conception of his occupation has not yet been formed.

The inference then is plain. Either we must continue to give the prospector his inducement in the way of a simple and inexpensive location procedure, and extralateral rights (or their equivalent in some other form, like bonuses) or else we must say goodbye to him. In such an event exploration will cease as it has elsewhere, and new discoveries will only occur by accident. Will such an outcome be of advantage to the country? There are several other points in Mr. Campbell's excellent paper that I would like to traverse, but time will not permit.

THEO. F. VAN WAGENEN.

Denver, March 12.

[Our readers hardly need the assurance that we dissent strongly from the position taken by Mr. Van Wagenen, which is in effect that there can be no mining development without the special inducements to 'prospecting' that have heretofore been given in the Western United States. Especially do we dissent from the implication that there are no prospectors in Canada, Mexico, Australia, and other great mining countries where the steady development of mines has been as active as in our own country. We shall leave to our Canadian friends the giving of names and addresses, fully assured that they can do so. Once before we printed a letter from Mr. Van Wagenen in which he stated there were no prospectors in Canada, and our mail was a burden for weeks after. As to Australia, our special correspondence letters have repeatedly detailed facts that show that while prospecting is not so active as a few years ago, it needs but the rumor of a 'strike' to bring them in by hordes. Among those still active and hearty is Patrick Hannan, discoverer of Kalgoorlie and still hopeful of finding another goldfield. In Australia it is to be remembered that all boundary planes are vertical, but the absence of extralateral rights does not operate to deter prospectors, nor do they esteem such absence any injustice. Conditions are temporarily unsettled in Mexico, but, while we have never personally prospected in that country, we have listened by the hour to tales of prospecting there told by intimate and veracious friends, and in many countries of South America staking and prospecting is as active as in the United States. One needs but a short stay at any hotel in Lima, Santiago, Rio de Janeiro, or even Toronto to learn that the man with a claim to sell is much in evidence. It is a common fallacy to assume that the old way is the only way and that things cannot be different because we have never known them to be. It is into this error, in our judgment, that our correspondent has fallen.—EDITOR.]

Labor in the Mines of Western America

The Editor:

Sir—I note with interest what H. F. Davis has to say in regard to the college men and miners, in his article on 'Labor in the Mines of Western America,' published in the February 1 issue of your paper. Under this heading he says that "It is neither neeessary nor desirable that the graduate should learn to be a praetieal miner. It is unneeessary beeause the duties of superintendent or manager, for which he has prepared himself at the expense of several years work and some thousands of dollars, do not require it; undesirable beeause to learn 'praetieal mining' well enough to properly do the work of a shift boss in any kind of a mine it will require not less than from four to five years actual underground work in several mines."

In order to more thoroughly understand the position which I take, that a superintendent should be a praetieal miner, it may be as well to define the duties of a mining superintendent as I see them. A superintendent should have absolute eontrol over all mining operations, from the time the ore is drilled up to the time it is shipped to the mill or smelter, and should eontrol all attendant operations as well. This, of eourse, is aeeomplished through bosses in the various departments. For instanee, the maehinery and men neeessary for the operations of hoisting, air eompressing, blaeksmithing, and maehine and other repairing, will be under the master meehanie; all earpenter work, under the boss earpenter; the ore-house under the head sorter; and lastly the underground work under the foreman.

The underground labor and attendant expenses amount to 80% or more of the total eost, the amount varying aeeording to the hardness of the roek, width of stopes, and other factors, and on this aeeount it is desirable that the superintendent should devote the greater part of his time to this work. In order to be sueeessful in his position he must be thoroughly aequainted with his work and should have had enough praetieal experience to know a shift's work when he sees one and should proeure a good foreman to look after the details of the work for him. He should also be able to fill the position of foreman at any time if that worthy should be siek or quit unexpeetedly. The superintendent who relies upon his foreman for all his praetieal knowledge is going up against a hard 'row to hoe,' as model foremen are hard to get and hard to keep; most of them oeeupy a superintendent's position.

The green 'Sehool of Mines man' knows nothing about handling labor, and the only way of seeuring this knowledge is to work with the miners and get their views upon shift-bosses, foremen, superintendents, and mining affairs in general. This in itself is a great eduеation, and the man who follows it will graduate with a greatly reduеed opinion of his ability and, in nine eases out of ten, a more truthful one. Then, too, the miner has a greater respeet for the man who has had a thorough praetieal training, as they know he understands and makes allowanees for the diffieulties and drawbaeks ineident to their ealling.

A eertain superintendent, who had never worked underground, but who had been in the superintendent's offiee for some time, went into a stope in his mine and said to the maehine man, "Why did you drill so many holes today, you know that it will shake up the whole eountry when you shoot," not realizing that the holes would not be shot all at the same instant; as a result the footage drilled per man per shift was greatly reduеed in all parts of the mine and the superintendent beeame a butt for all kinds of jokes among his men.

Of eourse if a superintendent eares to delegate all authority for underground work to his foreman, the position he oeeupies would easily be filled by a 'Sehool of Mines' man or any person with eommon sense and a little business ability.

Mr. Davis also says that the superintendent should hire no men for use underground without consulting his foreman. I believe that the superintendent should always hire the men working under him, taking adviee from his foreman as he sees fit, for in this way he has an aeeurate knowledge of the personnel of the erew and avoids a mine filled with men of one nationality. This is a eommon fault with the ordinary foreman, if he happens to be a Cornishman the erew is mostly eomposed of Cornishmen; if a Swede the Swedes are the predominant miners in his foree, and so on. The shift-bosses should have power to diseharge any man in the erews working under them, and no appeal from this deeision should be eonsidered exeept in ease of manifest injustiee to the miner, and then it is time to look for a new shift-boss. E. A. Colburn, Jr.

Vietor, Colorado, February 27.

Water-power now going to waste at The Dalles of the Columbia is to be utilized by a plant whieh it is proposed to eonstruet 90 miles east of Portland and 180 miles above the mouth of the Columbia river. A report by J. H. Lewis, State Engineer, estimates 300,000 hp. eontinuously, and 236,000 hp. additional, available for 8 months in the year. The present ehannel of the Columbia is to be elosed by a dam 300 ft. long and 180 ft. high, and a new channel exeavated in solid roek 1400 ft. wide. The drainage area at this point is 236,800 square miles, and available water averages 235,000 see-ft. with 73 and 42-ft. head at low and high water, respeetively. The power-plant would be on the Washington side of the river and eontain 21 turbines supplied by a canal 20 by 300 ft., 15 miles from the dam. Turbines would be of maximum eapaeity of 32,000 hp. each at 80 r.p.m. of the vertieal type with generator on top. The eost is estimated at $77 per horse-power for 300,000 hp. and eost of produeing low-tension power at the station, $6.90 per year.

Gold production of Queensland in January was 20,591 fine ounees; Vietoria, 27,232 oz.; Western Australia, 104,705 oz., and New Zealand, 30,942 oz. The value of minerals, other than gold, exported from Western Australia in 1912 was: copper, $290,000; tin, $335,000; silver, $76,000; silver-lead ore, $105,000; eoal and other minerals, $485,000. The February output of Western Australia was 100,987 ounees.

Special Correspondence

LONDON

CORNISH TIN MINING.—CHINESE ENG. & M. CO.

Cornwall mining is passing through a period of low-grade ore production. The Dolcoath report for the half-year ended December 31 provides several 'records.' The amount of ore treated (60,631 tons), the total receipts (£119,487), the profit (£46,569), and the average price received per ton of concentrate (£137 10s.) are all the highest; while, on the other hand, the yield of black tin per ton is the lowest, being only 32 lb. The reduction in the working cost per ton from 25s. 3d. to 21s. 1d. is welcome; it is due chiefly to the greater amount of ore raised and also to the efficiency of the new hoisting and crushing plant. The report of R. Arthur Thomas shows that developments at depth are disappointing, and that the deep levels tapped by the Williams vertical shaft have not responded as was expected. The Carn Brea & Tincroft has also a tale to tell about a record low content of the ore mined during the latter half of 1912, the figure being 21 lb. of black tin per ton. E. S. King, who has introduced so many wholesome reforms during the past eighteen months, and provided the funds therefor out of revenue, at the same time earning a divisible profit for the shareholders, has not had fortune on his side in the way of useful discoveries of high-grade or even medium-grade ore. What would have happened to the mine if the price of tin had not been maintained continuously at a high level, is more than even Mr. King would care to contemplate. However, the yield per ton is greater than that of two other active mines, namely, East Pool and Falmouth Consolidated. But the greatest event that has happened in Cornwall within my recollection is the provision of the capital for an entirely new plant for Carn Brea & Tincroft by the ground landlord, Lord Clifden. It was due to his action, as advised by his agent, John Gilbert, that a clean sweep of old-fashioned ideas was made two years ago, and a modern manager, E. S. King, appointed. He has shown what he can do, as recorded above, and the time has now arrived when he is to be provided with an up-to-date plant for crushing and concentrating. Lord Clifden owns much property in Cornwall, and derives a handsome income also from the china-clay industry, which, by the way, pays far better than tin-mining. He and his agent study the principles and practice of mining keenly, from the world-wide point of view, and are cognizant of the mechanical and chemical improvements whereby low-grade ores of all sorts from gold to tin can be made to yield a profit. The money is to be advanced as a loan at low interest, and the fact that it is not to be raised by stockbrokers is another matter for congratulation.

MAP OF CORNWALL.

The South Crofty is also passing through a period of disappointing development, and at the meeting of shareholders, both the chairman, Francis Allen, and the manager, Josiah Paull, had the uncomfortable duty of confessing that, in spite of vigorous exploration, the ore recently disclosed had been of low grade. The returns for 1912 showed a decrease in the yield of all the metals, tin, wolfram, and arsenic. The presence of specular iron has caused trouble in obtaining a high-class wolfram concentrate, but Mr. Paull has been able to remedy this. The high price of tin was sufficient to maintain the total yearly profit. The figures for 1912 are so interesting that I quote them in detail. During the year 66,076 tons of ore was raised and treated, yielding 627 tons of black tin, 130 tons of wolfram concentrate, and 986 tons of arsenic compounds. The receipts from the sale of these products were £82,481, £11,147, and £9886, respectively. The yield per ton was 21.28 lb. black tin, 4.42 lb. wolfram, and 33.45 lb. arsenic compounds, and the receipts per ton were 24s. 11d., 3s. 4d., and 3s., respectively, or a total yield per ton of 31s. 4d. The production shows a decrease all round, as compared with 1911, when 63,882 tons of ore yielded 677 tons of tin concentrate, 148 tons of wolfram concentrate, and 1008 tons of arsenic compounds. The income per ton in 1911 was 31s. 6d. The working cost per ton in 1912 was 22s. 6d., as compared with 20s. 2d. in 1911. The total income during 1912 from the sale of produce was £103,071, and the net profit was £25,201. Out of this, £20,000 has been distributed as dividend, being at the rate of 40% on the nominal capital, though it must be remembered that the bulk of shareholders who subscribed in cash paid £4 for each £1 share. The sum of £5000 has been transferred to reserve, which now stands at £25,000. The directors have invested £6839 of this reserve fund in bonds of the Chinese Engineering & Mining Co., and in bonds of the Cuba Railroad Co., but they have refrained from any further investment of such funds until a resolution has been passed by shareholders enabling them to invest in any security they may select. At the meeting they were badly beaten and were instructed to put their reserve fund in future to deposit with bankers.

TORONTO, CANADA

MINERAL PRODUCTION SHOWS INCREASE.—MEETING OF CANADIAN MINING INSTITUTE.—DEMANDS MINISTER OF MINES. NEW OFFICERS.—B. C. COPPER.

The preliminary report of the mineral production of Canada during 1912, by John McLeish, chief of the Division of Mineral Resources and Statistics of the Canadian Department of Mines, issued subject to revision, shows an increase of about 29% over the output of 1911. The total value was $133,127,489, as compared with $103,220,994. Of last year's output, $61,177,989 was metallic and $71,949,500 non-metallic. The only new camp of importance contributing largely to the year's output was Porcupine, the gold production of which was $1,745,292. The total gold production was $12,559,443, as compared with $9,781,077 in 1911. Silver showed a slight decrease in quantity, the output being 31,931,710 fine ounces, as against 32,559,044 oz., but owing to higher prices the value showed an increase from $17,355,272 in 1911 to $19,425,656. The total shipments of ore and concentrate from Cobalt and the adjacent mines were approximately 25,684,082 oz., in addition to which 4,773,878 oz. was shipped as bullion. There is practically no recovery of refined copper in Canada, the production being represented by the copper contents of smelter products, matte, blister-copper, and the amount of copper contained in ores exported but which is estimated as recoverable. On this basis the production was 77,775,000 lb., valued at $12,700,311, as compared with 55,648,011 lb., valued at $6,886,989, in 1911. Quebec province is credited

with a production of 3,225,523 lb., as against 2,436,190 lb., due to increased production from the pyritic ores of the eastern townships. Ontario's production was 22,250,601 lb., as compared with 17,932,263 lb. in 1911, mainly derived from the nickel-copper ores of the Sudbury district, where mining and smelting were carried on with greatly increased activity. The total production of nickel-copper in 1912 was 41,925 tons, valued by the producers at the smelters at $6,303,102, an increase of nearly 20% over the output of the previous year. The nickel contents amounted to 44,841,542 lb., valued at $13,452,463. The total production of lead was 35,763,472 lb., valued at $1,597,554, as against 23,784,969 lb. of the value of $827,717. The shipments were practically all from British Columbia mines. Complete returns of iron-ore production had not been received, but shipments from Canadian mines were estimated at about 175,000, as compared with 210,344 tons in 1911. Shipments from the Wabana mines, Newfoundland, by the two Canadian companies operating there were 1,331,912 tons, of which 956,459 tons was shipped to Sydney, N. S., and 375,453 to the United States and Europe. The production of pig iron in Canadian blast-furnaces was 1,014,587, valued at approximately $14,550,900, as compared with 917,535 tons valued at $12,307,125 in 1911. Of last year's output 256,191 tons was classed as bessemer, 544,534 tons as basic, and 213,862 tons as foundry and miscellaneous. There was also a production in electric furnaces of 7834 tons of ferro-alloys valued at $465,225, as compared with 7507 tons, valued at $376,404, in 1911. The production of coal showed a very large increase over 1911, as in that year production was considerably reduced owing to a protracted strike in western Canada, and exceeded all former outputs. It amounted to 14,699,953 tons, valued at $36,349,299, as against 11,323,388 tons, valued at $26,467,646, in 1911. The output of oven coke was 1,411,219 tons, valued at $5,352,520, as against 935,651 tons, valued at $3,630,410. The production of petroleum has shown a steady decline for the past five years, the output for 1912 being 243,336 bbl., valued at $345,050, as compared with 291,092 bbl., valued at $357,073. Cement shows a considerable increase, the production being 7,120,787 bbl. of the value of $9,083,216, as compared with 5,692,915 bbl., valued at $7,644,537, in 1911. The report notes that a feature of much interest during the year has been the continued and extended development of ore reserves. The satisfactory results from these operations, particularly in the case of the nickel-copper ores of the Sudbury district, the Porcupine gold ores of Ontario, and a number of the copper and lead deposits of British Columbia point to much greater annual outputs in the future.

The annual convention of the Canadian Mining Institute was held at Ottawa March 5 to 7, with a fair attendance, A. E. Barlow of Montreal, the president, occupying the chair. The Duke of Connaught opened the convention with an address congratulating the delegates on the growth of the mining industry and the good work done by the Institute. During the convention many valuable papers were read and discussed. The most important question considered was a resolution in favor of making the Department of Mines independent under its own minister instead of its being as at present subsidiary to the State Department, which was negatived after a full discussion. The following officers were elected: president, Alfred E. Barlow, Montreal; vice-presidents, Thomas Cantley, New Glasgow, N. S., and G. G. S. Lindsey, Toronto; councillors, M. L. Baker, Kingston; J. A. Bancroft, Montreal; W. R. Brock, Ottawa; D. H. Browne, Copper Cliff, Ontario; E. T. Corkill, Toronto; T. Denis, Quebec; F. Dulieux, Montreal; James McEvoy, Toronto; Lewis Stockett, Calgary; and W. A. Williams, Grand Forks, British Columbia.

Among copper stocks the weakness in 'British Columbia' has been something of an unexplained feature. The financial statement to be presented at the postponed annual meeting is understood to show a balance in the treasury available for dividends of more than $425,000. To pay the regular dividend requires a little less than $300,000. There seems to be no reason to anticipate any change in the rate of the distribution to the stockholders, and while the market weakness has been pronounced, there has on the other hand been some good averaging by holders thought to be connected with the Newman Erb interests in the company.

FAIRBANKS, ALASKA

WILLOW CREEK MINES ACTIVE.—TOLOVANO MILL CRUSHING.—LITIGATION.—DOME CREEK FIND.

By tracing rich float, Moore & Meyers have discovered a very promising vein on Willow creek, a tributary of upper Ester creek. A shaft has already been sunk 50 ft., with the vein still showing up well. Cross-cutting and driving on this level will be carried on now to prospect the ore-shoot. While the new mill is not yet in operation, steady development work on their Ester creek property is being rushed by the Hudson Bros. and other owners of the property, including Mike Beegler, Charles Koegley, Jim Elwell, and Tommy Hilling. Ted Hudson reports the showing as promising at present, although the mill will not be started until constant operation is assured by ore reserves. Last week Keegan & Cole, lessees on the Wild Rose, of upper Dome creek, brought in their first clean-up since work was started. This amounted to $930, showing the ore crushed to average $40 per ton in free gold. Better rock

TOLOVANO MINE.

has been opened up lately, and the next clean-up is expected to be much larger. The operation of the new 2-stamp mill has been hindered by lack of water and improper placing of foundations for building and machinery. What was thought to be solid formation proved to be but frost. This lease adjoins the one being worked by Mr. Spalding, from which considerable money has been taken the past season. Alois Friedrichs has resumed work lately on his Ridgetop property and has already tapped the ore-shoot found on the surface. Driving on the 50-ft. level has uncovered a good width of ore, assaying from $44 to $120 per ton. A shipment will probably be made soon, as considerable ore has been broken and the property is crossed by the railroad. After a shut-down of several weeks, the Tolovana mill is again crushing steadily on ore taken out by lessees who are opening up a new vein some distance from the main workings. While much good ore is available in the old workings, considerable water has made the directors decide to wait until summer before continuing work.

Suit brought by Fred Fey against Graham, Bosh & McDonough to quiet title to the property claimed by both at the head of Fairbanks creek has been set for next April. It is to be hoped that some settlement will be reached, as the property is a promising one and should not remain idle. The suit to quiet title of the Keystone Fraction between Smith Bros. and owners of the Happy Home Association is now being tried. This rich piece of placer ground lies between the Daly Bench and that part of the Happy Home Association worked by Ed. Homer last season on Eva creek. Above the old Homer lay, a rich block of ground is now being taken out by the present laymen, who

are assured of a successful season by the richness of the ground and the benefit of former experience in handling heavy thawed ground.

The same number of pay-streak extensions seem to be showing up as usual this season. The extension of the rich pay on 4 Above Fairbanks creek has been found by Freeman & Larson. The ground is said to go $2.50 per square foot of bedrock, and the depth of 17 ft. makes it a good open-cut proposition with cheap costs of working.

Extension of the Dome creek pay has been evidently picked up on the Shakespeare Association at the mouth of Dome creek. Pay-ore has also been found at last on Happy creek in the Ester district on the other side of the divide, and several lays have been let. Cripple creek also promises to produce considerable this season, as the Keystone drill has found good pay and several sets of laymen are now bedrocking their working shafts. Some pay has been found on 28 below Goldstream, and although water was not available for sinking last fall, several hundred dollars has been rocked out during prospecting operations. Good indications are also showing on No. 27 Below, where a hole is about to be bedrocked.

JOHANNESBURG, TRANSVAAL

INCREASED TONNAGE.—STAMPS IDLE.—COAL RATES AND PRODUCTION.—COPPER AND TIN MINES.

According to the figures issued at different times during the year by the Chamber of Mines, no less than 29,163,802 tons of rock was mined on the Rand in 1912 and 25,486,361 tons sent to the mills. This is another marked increase in the tonnage milled as compared with the previous year, when the total was 23,888,260, and, judging from what is likely to occur in the Far East Rand and along the Rand generally in the rearrangement of the mills during the current twelve months, an even higher tonnage may be expected. The number of stamps at work during the year on the Rand averaged 9449, but stamps are not increasing as rapidly as tube-mills, which on the average are given as numbering 262. It is not long ago that 30 stamps to one tube-mill was considered a fair proportion, but at one mine today one tube-mill serves only a dozen stamps, and one of the principal groups, after experiments, has adopted as the best proportion one tube-mill to 15 stamps. The duty per stamp under these circumstances must be expected to increase, and last year averaged 8.39 tons per stamp per day throughout the whole of the Rand. The Chamber of Mines figures give the output of gold on the Rand as 8,753,568 oz., value £37,182,795, the recovery being thus 6.82 dwt. per ton milled. The working costs for the whole of the year averaged 18s. 8d. per ton, an increase of 8d. as compared with the previous year. Several of the new producers and others who have contributed largely to the increased production during the year have not worked cheaply by any means, such as, for instance, the City Deep and Bantjes, while working costs at the Geldenhuis Deep have been abnormally high. Then none of the three principal amalgamated producers—Randfontein, Crown, and East Rand Proprietary—have been able to work as economically as last year; in fact, the last named was some five shillings per ton higher, and this will explain why working costs per ton during the year on the average have been higher. It was officially anticipated that the August reduction of railway rates on coal would make a marked difference on the working costs at the gold mines, and December at 18s. per ton constituted the lowest working cost for the year, but the costs of working have so consistently risen during the past three years despite the increased tonnage milled, that it seems difficult to foresee how the costs are likely to be reduced below those for December. The working profit per ton is given at 10s. per ton and the total profit as £12,678,095, but then the whole of this working cost is not available for dividends, some portion of it being utilized to meet capital and other charges.

Among the miscellaneous minerals produced in the Transvaal, after gold and diamonds, coal ranks first in importance, the feature of the Transvaal coal trade being that as output increases year by year prices as steadily decline. Last year the collieries produced 4,340,219 tons of saleable coal which sold at an average pit top price of 4s. 4d. per ton. In the previous year the output was 3,997,130 tons, and the average selling price, as published by the Chamber of Mines, was 4s. 11d. per ton. Both copper and tin show marked declines during the year, for in 1912 the shipments of concentrates only amounted to 1343 tons, as compared with 2090 tons during the preceding year. There is only one copper mine at work in the Transvaal. It is the Messina and is situated in the northern extremity of the Transvaal, close to the southern bounday of Rhodesia. It is without any means of railway transport, but as a line is now under construction to the mine, attention during the year has been given more to development than mining, hence the smaller output. The Messina mine is a promising property, and is opening in a satisfactory manner. Whether the Messina district will ever become a large producer of copper it is difficult to say. Indications of the existence of copper are numerous in the northern Transvaal, but outside the Messina, wherever so far opened, they have proved disappointing. Last year's tin mining in the Transvaal was also anything but satisfactory, the shipments having fallen from 3373 tons in 1911 to 2726 tons last year and the value from £395,472 to £338,897 despite the rise in the market price of tin. For some of the decline the unusual drought is responsible, but more is probably due to the erratic mode of occurrence of tin in the Zaaiplaats district, and to the fact that in 1911 the Zaaiplaats output was unduly forced. The erratic method of the tin occurrences in the Waterburg district militates considerably against successful tin mining; many are the instances of failure, and it almost looks as though tin mining in the future in this district will make but little progress. The Transvaal Consolidated Lands have been at work for years prospecting their different farms along what is known as the tin belt, but although they have erected a mill, have not yet succeeded in finding a permanent payable tin deposit either in the shape of a lode or pipe. Rich deposits have been found frequently, but nothing permanent either in width or value and the predicted boom for Waterburg tin seems more distant than ever. The Rooiberg field, farther south, has more permanent features, and in that neighborhood the prospects of establishing a tin mining industry are far more encouraging.

NEW YORK

CHILEAN IRON.—CANANEA CHANGES.—DIVIDENDS.

The week ended March 22 with a despondent tone prevailing throughout the East, part of which was undoubtedly due to the Easter holidays and the unwillingness to risk committments for a four-day interval.

The iron ore properties recently mentioned as having been acquired by the Bethlehem Steel Co., of which Charles M. Schwab is the head, are to be operated by the Bethlehem Chile Iron Mines Co., recently incorporated under the laws of Delaware. The new concern is already in the market to make a long time contract for the transportation of the ore, but it is anticipated that in view of the present demand for bottoms of all kinds, the new company will be obliged to construct its own fleet of steamers. It is interesting to note that part of Mr. Schwab's recent statement in regard to the property, in which he says "the valuable and extensive iron ore lands obtained by the company [the Bethlehem Steel Co.] in Chile contain about 67% of iron, or 17% more than the average of the present Lake Superior ores." The officers and engineers of the Bethlehem Steel Company consider this acquisition one of the most important developments in its history."

The C. K. N. Mining Co. of Cripple Creek, originally known as the Cripple Creek Gold Mining Co., has a new executive head in one of the society leaders of the old town of Mount Vernon, N. Y. The new president of the company is Miss Olive L. Granfield, whose father, the founder of the company, was fatally injured in an automobile accident in Colorado a short time ago. The new president will find

one of her chief duties, as such official, the defending of a suit for $1,000,000 brought by the El Paso company, the head of the new $25,000,000 merger recently formed, the stock of which is now being distributed throughout the East. The recent report of the El Paso company just available shows a net profit for 1912 operations of $218,914.

The continual tendency of the copper interests to narrow the circle of the controlling factors and to make closer relationships between the various groups, is instanced in a rather important manner in the recent acceptance by James Douglas of the vice-presidency and general managership of the Greene-Cananea Copper company. Mr. Douglas is the son of the James Douglas, who has for so many years been identified with the Phelps-Dodge organization, and who is in fact a chief among the men who have made history in the development of the copper industry in the United States and Mexico. The staff of the Greene-Cananea is to be further augmented by the appointment of George Kingdon as assistant to Mr. Douglas. Mr. Kingdon has been for many years mining superintendent of the Old Dominion. L. D. Ricketts continues as president and consulting engineer of the Greene-Cananea organization. The Black Hills Copper Co., controlled by Pittsburg interests operating properties in Yavapai county, Arizona, is about to make a $250,000 bond issue, in order to provide working capital and enable the management to resume and push development.

The copper market is mostly marking time. The Amalgamated people are said to have recently sold 50,000 tons at 15c. for export, cleaning up its production to the first of May. Practically all the business done during the week was at the price mentioned. Regular dividends have been declared by the North Butte Mining Co., which will pay 50c. per share April 4; by the Ahmeek Mining Co., which will pay $7 per share April 10; by the Osceola Consolidated, which will pay $3 per share April 30; by the Phelps-Dodge Co., which will pay $2.50 per share March 28; by the United Globe Mines, which will pay $7.50 per share April 7.

MIAMI, ARIZONA

FEBRUARY PRODUCTION.—NEW CONSTRUCTION.—BLACK WARRIOR SHIPMENTS.—MOLYBDENUM AND VANADIUM.

The Inspiration Consolidated Copper Co.'s development work for February amounted to 5220 ft. for the Inspiration division and 600 ft. for the Live Oak division, a total of 5820 ft., showing an increase of 520 for the Inspiration and 110 for the Live Oak over the January footage. At the Inspiration division a total of 20,400 tons of ore was mined, of which 9000 tons was hoisted at the Joe Bush shaft. At the Live Oak division 2430 tons of waste and 370 tons of ore were hoisted at Live Oak No. 2 shaft and 2100 tons of waste at Live Oak No. 1 shaft. A total of 360 men are employed in the mining department, 300 at Inspiration and 60 at Live Oak.

The further development of the Miami orebody is being carried on by two churn-drills and diamond-drilling. The site for the new lumber yard and warehouse which is being constructed necessitates a fill of 2000 cu. yd. At the Southwestern Miami, drilling is steadily progressing, and the management expresses complete satisfaction with the results of the past developments. Hole No. 4 is now 755 ft. deep, No. 11 is 870 ft. deep, and No. 14 is 500 ft. deep. All three holes are bottomed in schist.

The Old Dominion is making the steady progress which has characterized this company under the present management. Ore reserves are being constantly increased and extensive development is being carried on. Late shipment of steel is retarding the construction program of the new units to the mill. At the Buckeye, one of the outlying properties of the Old Dominion which as yet has made no underground connections with the older workings of the property, ten men are at work raising and driving. At the Arizona Commercial Co.'s Copper Hill shaft work is progressing favorably. The shaft has now reached a point below the 900-ft. level, and sinking is being continued. Development is being carried on by driving on the 700 and 800-ft. levels. Driving on the 700-ft. level has not as yet reached the boundary of the orebody previously discovered. There are 50 men in the employ of the company.

At the Superior & Boston, drifts are being driven east and west on the sixth level. The vein is over 40 ft. wide and is ore bearing throughout, with 15 ft. of ore that averages better than 7% along the foot-wall side and 25 ft. on the hanging that will probably run 2½ to 3% copper. A car of ore per day from the raise and the sixth level drifts is being shipped to the El Paso smelter. Mining conditions are excellent. J. A. Thomas, formerly in the employ of the Old Dominion, has made an examination of the property and has reported favorably.

At the Black Warrior work is being carried on at a steady pace. Shipments are being made at the rate of about 100 tons of ore per day to the El Paso smelter. The ore is silicious and runs about 7% copper. The working force, recently curtailed on account of bad weather, has been increased to its normal number of 50 men. The new Inspiration branch railroad to the main Inspiration shafts passes

MAP OF ARIZONA.

within a hundred feet of the Warrior ore-bins, and, if satisfactory shipping concessions can be arranged, should materially increase the shipping capacity of the Warrior company.

The Jahns Mining Co., about 12 miles west of Miami, is soon to resume operation. The property is in a faulted zone showing lead, silver, gold, and copper. The country rock consists of limestone, quartzite, and granite, which has been shattered by intrusions of diabase. The group consists of 31 claims, being bordered by the Continental on the northeast and the Castle Dome on the east. H. Jahns is general manager for the company and is now at the property.

The shaft of the New State, in which high-grade lead ore carrying molybdenum and vanadium was discovered last year and which was the cause of much favorable comment throughout the district, is reported to have been sunk on patented ground of the Continental group. The Continental group is the property of the Old Dominion. The Old Dominon option on the Castle Dome, adjoining the Continental, expired on March 1. The option was for $200,000. The Gibson Copper Co., which has been curtailing output on account of lack of fuel, caused by the recent stormy weather, will use oil burners. The fuel used at present is of wood hauled by Mexican wood-choppers from the Pinal mountains. Development is daily exposing and materially increasing the present ore reserve. It is reported that the high-tension power line that is being strung from Roosevelt to Superior may be utilized at the Gibson, thus reducing the present cost of production.

General Mining News

ALASKA

Cordova

Congress at Washington has voted $100,000 for the construction of a Federal building at Cordova, in which will be all the administrative offices.

Arrangements have been made to ship copper ore next winter from the property of the Mother Lode Mines Co., which is situated about a half-mile northeast of the Bonanza. A tramway and receiving-bin are to be built, timber having arrived for this purpose. The Kuskalina Copper Co. has two shifts working in No. 3 adit, which is 6 by 8 ft. in the clear. The ore in this adit is equal in copper content to No. 1 and 2 adits. The Great Northern Development Co., Alaska United Copper Exploration Co., and others are preparing to resume work at their mines. The Kennecott Mines Co. is erecting a building near the mine and repairing its tramway. It is stated that over 600 men will be employed during the summer. Trains are now running regularly to Kennecott.

Fairbanks

Fairbanks creek and tributaries are busy, and about 30 different parties are taking out gravel and getting ready for extensive summer work. The Tolovana mill of 2 Nissen stamps crushed about 70 tons of ore from a new vein opened to 100-ft. depth in the Tolovana holdings. The Chena stamp-mill crushed 300 tons, averaging $16 per ton, from the 100-ft. level of the Rainbow mine on Skoogey gulch. This level has been driven 300 ft. At a depth of 156 ft. coarse gold has been found in the Alabama claim, and there is yet a width of 200 ft. to prospect. A one-eighth interest in the Reliance Mining Co. has been sold to L. C. Hess by D. Cascaden, this being the first big deal in quartz claims this year. The Spalding mill on 9 Above, Dome creek, is crushing rich ore from the 50-ft. level of the Soo and Waterbury claims. Fourteen tons of ore from the Foster-Hungerford lease on the Empire group, on Chatham creek, averaged $40 per ton at the Pioneer mill. A shipment of 25 tons of ore will be made from the Homestake claims on Wolf creek, to either the Rexall or Newsboy mills. A drift off the main adit has been driven on the vein for 210 ft. The adit cut it at 315 ft., and has since been driven to 750 ft. The last crushing averaged $77 per ton. J. Paulsen, on lower Dome creek, passed through gravel at a depth of 161 ft. The Rexall property on Wolf creek is being operated again with Allan Cunningham in charge. A vein 3 ft. wide is being driven on. Gravel yielding up to $30 per square foot has been found by Adolph Bock on Sullivan creek in the Hot Springs district. The gravel is said to be 100 ft. wide.

In the Koyukuk region there are about 300 men at work, and all are doing fairly well. Returned prospectors state that nothing has been found in the Novi country to warrant favorable mention.

Juneau

During February the Alaska Treadwell mills crushed 65,912 tons of ore, yielding $84,894 from amalgamation and $71,727 from cyaniding 1295 tons of concentrate. Operating expenses were $78,309 and construction $3568, and the net profit was $72,741. The average per ton milled was $2.37. Development covered 580 ft. and the stock of broken ore increased 3887 tons.

The Alaska Mexican mill crushed 17,598 tons of ore during February, yielding a total of $32,086 from amalgamation and cyanidation of 372 tons of concentrate. Operating expenses were $21,761, and construction, $1561, leaving a profit of $8763. Development covered 218 ft., and the stock of broken ore decreased 9961 tons.

Ketchikan

The Princeton Mining & Milling Co. has installed a mill at its property near Ketchikan. The plant consists of a crusher, 5 stamps, slow-speed Chilean mill, and Deister tables. The ore to be treated is low grade, and the mill will be started early in April. A 100-hp. boiler and 8-drill air compressor were also installed.

Nome

On the southern end of the claim at No. 3 Holyoke creek, Nylander and partners have opened 'pay' from 4 to 5 ft. thick and 35 to 40 ft. wide, averaging 3 to 4c. per pan. This 'strike' is considered of importance, and a continuous run of 700 ft. is expected. It is 40 ft. below the surface and 20 to 30 ft. above bedrock.

The 100-mile dog-team race from Solomon to Council, one of the features of winter life in this district, was run in 12 hours, 41 minutes.

Valdez

Congress at Washington has voted $50,000 for the construction of a dike at Valdez as a protection against the waters of the glacial stream which has always been a menace to life and property of the town.

ARIZONA

Cochise County

No. 1 cross-cut on the 300-ft. level of the Shattuck-Arizona mine is in 11 ft. in ore averaging 29% lead, 11% copper, 30 oz. silver, and 60c. gold per ton. The total length is 29 ft., all in high-grade ore. On the 400-ft. level, No. 21 and 22 cross-cuts are in high-grade copper and lead ore, respectively. No. 24 has opened copper ore, while on the 500 and 600-ft. levels good copper and lead-copper ores are being opened, respectively.

The Calumet & Arizona smelter produced 4,050,000 lb. of copper in February, as against 4,780,000 lb. in January. The Shattuck produced 1,136,080 lb. copper, 109 oz. gold, and 13,323 oz. silver. The Copper Queen company continues its churn-drilling and sinking the Wade Hampton shaft, which is in new country. The lighting voltage at the works has been changed from 220 to 110 volts. During 1912 the Superior & Pittsburg produced 36,118,399 lb. copper, 361,227 oz. silver, and 13,815 oz. gold, valued at $9,131,967. Dividends amounted to $1,919,734. An average of 485 men was employed.

Pinal County

The old Silver King mine, 3 miles from Superior, is reported as again being bonded for $75,000. The property has been idle for many years and is credited with a production of $15,000,000. The Copper Butte mine, near Cochrane and Ray, will probably be worked again. An incline shaft has been sunk 400 ft. Minnesota people are interested.

Yuma County

The French company at Swansea has shut down its mine and smelter, as it has been losing about $20,000 per month. It is said that there are two rival factions in connection with the company's stock, and also that more Frenchmen have started from Paris and the works may soon be operated again.

CALIFORNIA

The February oil production of the state totaled 6,789,000 gal. from 5862 wells, shipments amounting to 6,517,000 bbl. Stocks on hand at the end of the month were 47,968,490 bbl., of which the Kern river field held 30,045,998 bbl. In cementing off the water in the well of the K. T. & O. company in the Coalinga field, 18 tons of cement was used, and the work was successful.

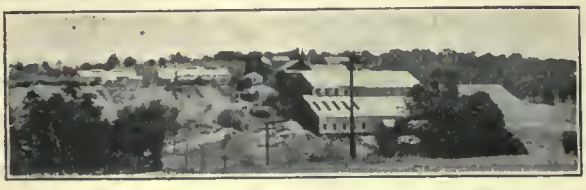
Nevada County

The gold production from quartz mines at Grass Valley is estimated to be about $89,680,000. The Golden Center of Grass Valley Mining Co. has been incorporated with a capital of $300,000 by C. A. Brockington and others, and has acquired from the Berriman estate the old Dromedary property, situated in the centre of Grass Valley. This mine has been shut down since 1871 on account of litigation, but the new company has 40 acres of continuous country under the town, containing the Dromedary, Hill, Ledge, Whiskey, and Church Hill veins. The Dromedary shaft, which is 300 ft. deep, is to be equipped and pumped

out, then the four veins mentioned are to be developed and a mill erected if warranted.

SAN JOAQUIN COUNTY

A compromise was filed at Stockton on March 22 in an injunction suit involving thousand acres of land in San Joaquin, Sacramento, and Amador counties, recently filed against eight large mines by the Valley Farm & Stock Co. and 26 other land-owners. By the terms of the agreement the Kennedy Mining Co., the Zeila company,



SOUTH EUREKA MINE AND MILL.

the Argonaut company, the South Eureka company, the Central Eureka company, the Original Amador company, the Bunker Hill Consolidated, and the Fremont Consolidated are to be exempt from litigation until December 1914. If by that time certain steps are taken to protect the plaintiffs' property, exemption is promised forever. It is the charge of the land-owners that the mining companies have allowed tailing and other débris to accumulate in Dry creek to such an extent that the stream has frequently overflowed and inundated the surrounding territory. Several of the companies have already taken steps to impound and stack their tailing.

TUOLUMNE COUNTY

(Special Correspondence.)—The recent find of gold-bearing gravel at the Leap Year mine, on Table mountain, southwest of Jamestown, was made in a raise started lately 50 ft. from the face of the 1000-ft. adit. It is confidently believed by the Nautilus Gold Mining Co., which is operating the property under bond from Joseph Hopkins, the owner, that the ancient river channel so long searched for has been found. The find of auriferous gravel in the Leap Year claim has greatly encouraged the operators of the Punch Bowl mine, who have been driving from the opposite side of the mountain in search of the old channel. Another contract has just been let for driving the adit at the McCormick mine, near Jacksonville, an additional 100 ft. The adit, which will expose at depth the rich shoots from which former operators took out much gold, will be 1150 ft. long, when the contract just awarded is completed. The property consists of several claims and is being developed by Andrew McCormick and others. The Jamestown Exploration Co., recently incorporated, will shortly begin development at the Carlin mine, situated near Jamestown. Machinery is being installed at the Stanislaus gravel mine for operating with electric power. The adit at the Sonora mine, near Stevens' Bar bridge, has entered into a body of fine ore, gold being visible to the naked eye in much of the rock broken.

Sonora, March 15.

(Special Correspondence.)—R. J. McCann has 12 men employed at the Longfellow mine, at Big Oak flat, and rapid progress is being made in the work preparatory to the complete resumption of operations. It is the intention to sink the shaft to a much greater depth, simultaneously extending the east and west drifts at the 800-ft. or present bottom level. The ore-bins are being filled and the mill put in working order, and the ditch and flumes that convey water to the property are being repaired. The old Chilano mine, situated between Sonora and Jamestown, which has yielded $150,000 to date, is being reopened by John Ryan and associates. A steam-hoist is being installed, and the present force of five men will soon be increased. The Santa Ysabel mine, situated between Quartz and Stent, was examined this week for prospective purchasers.

Sonora, March 22.

COLORADO

BOULDER COUNTY

The coalfields in this county have been disturbed by labor troubles since April 1, 1910. The American Fuel Co., which has 8 mines, has been favorable to the unions, and when in January 1912 the company was in financial difficulties the miners agreed for a while to work two weeks out of four without pay. On March 15, 1913, the company was to have paid all back wages, amounting to $20,000, but failed to do so, and the United Mine Workers of America called out 1000 men from the mines. The Rocky Mountain Fuel Co. has been employing non-union men since the strike was called, April 1, 1910.

CLEAR CREEK COUNTY

About 50 men are employed at the Capital mine, and the company's mill is concentrating 130 tons of ore per day. The old Williams & Tong lease, being operated by the company, shows 16 in. of ore worth $35 per ton in gold, lead, and copper. The Pike Leasing Co., operating below the adit-level, has made a shipment of good ore. Hummer & Son, in a block west of the main adit, have opened 2 to 7 in. of ore assaying 3.66 oz. gold, 13.75 oz. silver, and 29% lead. Their regular mill ore returns $9.50 per ton. The Capital company has a number of men on the 300-ft. level mining ore.

GILPIN COUNTY

Lessees at the Alps mine, on Quartz hill, have opened good ore on the 800-ft. level, and are sinking a winze 50 ft. One shipment of 2.3 tons returned 8.10 oz. gold, 14.60 oz. silver, and 7% copper, while 3 tons of second-class ore yielded 2.63 oz. gold and 5.70 oz. silver per ton.

The Golden Flint Mines Co. acquired an old property in the Independence district, in the northern part of the county, in November 1911. Since then the mine has been pumped out, development done, a 2000-ft. tramway constructed, and a 100-ton mill erected at a cost of $83,000. The mine shows three veins from 2 to 11 ft. wide, worth from $135 to $8 per ton in gold. Steam or electric power can be used. The mill consists of Chilean mills, copper plates, concentrators, and cyanide plant. J. H. Elspass, of Denver, is in charge.

LAKE COUNTY (LEADVILLE)

The prosperity of certain metal-mining districts is generally determined by the number of furnaces a local smelter is able to keep in blast, and the Arkansas Valley plant has five blast-furnaces in operation, with plenty of ore in reserve. Interest is still centred in the work being done at the Mt. Champion claims at the head of Half Moon and Lackawanna gulches. The ore-shoot opened is of peculiar shape, and has been the cause of some discussion. A recent shipment of 15 tons of sorted ore netted the company $9670, but the run-of-mine ore is worth from $100 to $130 per ton.

OURAY COUNTY

During February the Mountain Top adit was extended 341 ft., making a total of 969 ft., leaving 1101 ft. to be driven to the vein. A dike 17 ft. wide was driven through, it being good breaking rock, and extra progress was made. The Brown Mountain Smelting Co. has been financed with a capital of $300,000, and the smelter plant at Ouray is being overhauled preparatory to being started before May. A good supply of ore will come from the Wanakah and other mines, and about 35 men will be employed. The smelter is on the Denver & Rio Grande railroad.

SAN MIGUEL COUNTY

The Tomboy mill worked 27 days in February and crushed 10,500 tons of ore, yielding $32,500, and produced 1600 tons of concentrate worth $54,500, the total value being $87,000. Working expenses, not including $850 on aerial tramway, were $47,500, leaving a profit of $39,500. The tramway is in full operation and doing excellent work. After working at reduced capacity, due to a broken piston in the air-compressor, the Ophir mill is again treating 150 tons of ore per day. A hoist at the Smuggler mine had a brake band broken on March 12, but was soon

repaired. The Liberty Bell mine and mill is in full operation, 80 stamps being at work.

TELLER COUNTY (CRIPPLE CREEK)

The annual report of the El Paso Consolidated Gold Mining Co. states that development covered 6039 ft., and gross ore sales amounted to $820,960. Mining cost $186,912; shipping and marketing, $233,022; lessees were paid $129,593, and the total expenses were $610,548. The net profit was $238,757, and four dividends were paid, totaling $122,500. On January 1, 1913, cash on hand amounted to $131,556. On March 31 a dividend of 2½c. per share, equal to $61,250, will be paid, making the total to date $1,658,545.

In connection with the proposed fourth drainage tunnel, it is estimated that from 5000 to 7000 gal. of water per minute, with a head of 700 ft., would be available from the Roosevelt tunnel, giving about 800 hp., which could be partly used in driving the next tunnel.

It is stated that 31 tons of ore from the new shoot in the Vindicator mine was worth $21,000, or $700 per ton. The main shaft of the Commonwealth mine, on Raven hill, may be soon sunk deeper. Four well known Victor men were captured on March 16 at the El Paso mine, heavily armed, and are at present in jail for carrying concealed weapons, but their presence at the mine is supposed to be for high-grading. There are now 27 sets of lessees in the Isabella mine. The 12-in. drum-shaft of the hoist at No. 2 shaft of the Portland broke during the past week.

IDAHO

SHOSHONE COUNTY

The Hecla Mining Co., operating the Hecla mines at Burke, has declared a dividend of $70,000, making the current year's total $110,000, and to date $2,760,000.

IDAHO COUNTY

The Center Star mine has been bonded to Pittsburg people, and D. C. Livingston, of the State University at Moscow, is making an examination. About three years ago New York people took an option and did considerable work, but did not buy the property. The lower adit cuts the vein at 150-ft. depth, and has been driven 400 feet.

OWYHEE COUNTY

Crowds of people are rushing to Homedale, on the Oregon Short Line, which is 8 miles from the new gold-bearing district recently discovered. Assays show the ore to be of high grade, and there are about 1000 men there already.

MONTANA

BROADWATER COUNTY

At the Radersburg district, suitable buildings are being erected at the Keating mine for a 50-ton plant to employ a new process to extract 90% of the gold and silver contents. During the summer the Keating company will enlarge its mill to 300 to 400-ton capacity, to deal with ores from other mines, there being large quantities of ore worth from $5 to $12 per ton in gold. It is expected that within 6 months there will be 600 men employed by Radersburg mines.

SILVERBOW COUNTY

(Special Correspondence.)—The new concentrator of the Boston & Corbin company at Corbin has been put into commission, and is now treating 250 tons of ore per day. The construction of the mill was commenced last fall, and work on the buildings and the installing of machinery was carried along throughout the winter. The mill is giving every satisfaction, and the first shipment of concentrate has been made to the Washoe smelter at Anaconda. The completion of this mill, and its successful operation, has created more interest in mining affairs, and several properties are making preparations to start work, among them being the Blackjack, Hidden Treasure, Corbin-Pennsylvania, and the Butte Consolidated.

The High Ore mine, of the Anaconda company, which is now down to a depth of 2800 ft., is going to be extended another 500 ft. The High Ore, which is now one of the deepest mines in the district, is also one of the best, and the idea in carrying the shaft down another 500 ft. now is to conclusively prove that at depth the property is even richer than on the upper levels.

Butte, March 24.

The East Butte Copper Mining Co. will add to the equipment of its plant a 150-hp. motor and control apparatus recently ordered from the General Electric Company.

NEVADA

EUREKA COUNTY

The Buckhorn Mines Co. has been developing its property for 2½ years, and has a large tonnage of low-grade ore opened. The 1800-ft. tunnel which is being driven to connect the lower levels with the mill ore-bins, is nearly completed. An electric power-plant will be erected at Beowawe, 18 miles from the mine, on the Southern Pacific railroad. Work on the new mill is in full swing.

HUMBOLDT COUNTY

At Rochester, J. A. Causten and others declined to make a payment on their option on the 'Big Lease' on Lincoln hill, as the rich shoot 'pinched' out. Soon after, it is stated, the owners opened more rich ore, and Rochester people are looking happier. On March 19, J. Nenzel bought out George Wingfield's entire holding in the Weaver claims for $65,000; $10,000 having been already paid. At the Big Four lease of Crown Point No. 1, 300 sacks of ore is being shipped per day. At a depth of 117 ft. in the Codd lease on the main Nenzel vein, at the head of Rochester canyon, 12 ft. of ore has been opened, assaying $35 to $69 per ton. J. P. George, S. Stevens, and P. C. Stevens allege that they were partners of J. Nenzel in all of his claims and holdings at Rochester, and have brought suit against him, the Rochester Mines Co., and the Crown Point Mining Co., to recover half of the 500,000 shares owned by Nenzel in the former company, and a half in the latter company, and the El Finato claim.

LYON COUNTY

During the week ended March 20 the Mason Valley smelter received 2243 tons of ore from the Mason Valley mine, 1894 tons from Nevada-Douglas, and 631 tons from other properties. Ten carloads of matte were shipped.

NYE COUNTY

During February, 9 mines at Tonopah produced 43,881 tons of ore worth $886,400. The yield during the week ended March 22 was 11,910 tons, worth $251,970. At the

MILL OF MANHATTAN ORE MILLING COMPANY.

West End the north cross-cut on the 800-ft. level opened a low-grade quartz vein. In No. 7 level of the Jim Butler the south cross-cut passed through 8 ft. of ore assaying

from $30 to $50 per ton. Driving east and west on the shoot shows good ore. Earnings of the Tonopah & Goldfield railroad for the seven months ended January 31 were $422,520, of which $108,528 is net profit.

At Manhattan, at 150-ft. depth in the Kendall-Douglas lease of the Manhattan Consolidated, a winze has opened 5 ft. of ore which assays up to $2492 per ton. The Big Four mill is now treating 100 tons per day.

STOREY COUNTY

During February the Ophir cyanide plant treated 2400 tons of tailing yielding $3949 in gold and $6502 in silver, with 89.84 and 74.45% extraction, respectively. The cost of transportation was 32c. and treatment $1.52 per ton, and profit $6022.

NEW MEXICO

GRANT COUNTY

From the Pinos Altos mine, G. Utter has shipped a carload of ore assaying 40% iron, 20 oz. silver, and $10 in gold per ton to El Paso. He has about 2500 tons of ore of a similar character. Two opal claims have been staked 9 miles east of Silver City.

OREGON

JACKSON COUNTY

(Special Correspondence.)—S. S. Bullis, of New York, who recently bought the famous old Sterling hydraulic mine, near Jacksonville, is making preparations to develop and equip the property for much larger operations. Several carloads of pipe and machinery have arrived at Jacksonville, and the improvements will be made during the summer at the close of the operating season. Two giants have been working steadily through the winter. The old 'diggings,' which have produced from $25,000 to $60,000 per year for the past 30 years, are now nearly worked out. There is a quantity of higher ground, equally as rich as the old, but it cannot be worked by the present water system on account of being above the gravity head of the giants. In order to reach it, a new high-line ditch will be dug having a length of 35 miles. The present ditch of the Sterling is 25 miles long, and the water-supply one of the best on any southern Oregon placer. The same source of supply will be utilized for the new ditch. This work at the Sterling is in keeping with similar work that has lately been done upon other large hydraulic mines in southern Oregon, many of these, because of continued operation, covering a period of from 25 to 50 years, being short of available ground. Most of them have rich bench diggings, to reach which higher ditches must be constructed and new equipment installed. This has been done on the Columbia on Grave creek; the Steam Beer and Blalock, near Leland; the Wimer, of Waldo; the Logan & Simmons, of the Illinois; as well as many other smaller properties in Josephine and Jackson counties. These important changes will bring southern Oregon back to its former record of gold production and establish the placer-mining business on a new and more substantial basis.

Grants Pass, March 22.

UTAH

JUAB COUNTY

Water has been encountered in a winze below the 2300-ft. level of the Grand Central mine. The winze is 80 ft. deep and has been sunk in low-grade ore, and sinking has been stopped. The lower levels of this mine are producing most of the ore shipped. At the Opohongo a shoot was cut on the 750-ft. level. Below the 700-ft. level a great deal of work has been done from the winze, from which a drift has been driven on ore for 200 ft. Lessees at the East Tintic Development property are shipping from 100 to 150 tons of zinc ore per month. Ore shipments from the Tintic district during the week ended March 21 totaled 181 cars.

SALT LAKE COUNTY

On December 31, 1912, the Ohio Copper Mining Co. had $281,208 in cash and accounts receivable amounting to $273,127. Profits from August 1, when the company was reorganized, to the end of 1912, were $105,000, and the net income was $57,000. During the five months production was 2,343,439 lb. copper, 11,920 oz. silver, and 380 oz. gold.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—C. C. Reed, supervisor of the Colville National Forest, has received application from the J. L. Harper Consolidated mines, at Republic, for a contract to purchase 200,000,000 ft. of timber on O'Brien creek, and San Poil and Granite creek water-sheds. The timber desired is mostly Douglas fir and western larch, on about 160,000 acres of land on the mountains and river bottoms in Ferry county, within a radius of 12 miles of Republic, extending from 2 to 12 miles southward, 6 miles northward, about 8 miles westward, and 12 miles eastward from Republic. In case the desired contract is secured, the Harper Consolidated mines will begin extensive operations by next June. The cutting of the timber alone would require a large force. The cost of the timber, it is estimated, would average about $1 per 1000 ft. Assuming that a sawmill with a capacity of 150,000 ft. per day was installed, it would require about 3.75 years to cut the timber into lumber. The largest timber operation heretofore recorded on the Colville forest was the purchase by the Orr-Leeper company, last fall, of 700,000 ft. of western red cedar at Boyds, on the east side of the Sherman range, west of the Columbia river, to be used for poles and piles. The request of the Harper Consolidated mines would take about all of the natural timber now standing on the water-sheds of the three creeks, or about 1/30 of the total mature timber upon the Colville forest, which is estimated at about 6,000,000,000 feet.

Spokane, February 19.

A meeting of the North Washington Power & Reduction Co. and the Republic Mines Corporation was held at Spokane on March 11, and plans were formulated for the merging of the two companies, to operate on a large scale in the Republic district.

The North Star Mining Co., which is developing an extension of the First Thought mine in the Orient district, will resume work on April 1 and do considerable diamond-drilling. The property is equipped with a 30-hp. gasoline engine, air-compressor, and hoist. An adit is in 600 ft., giving 100-ft. depth, and a shaft has been sunk from the surface to 100 ft. below the adit. A winze and cross-cut have opened ore containing gold worth $4 to $21 per ton.

CANADA

BRITISH COLUMBIA

Ore production in the Kootenay and Boundary districts during the week ended March 15 was 51,275 tons, making a total for the year of 516,324 tons. The Mother Lode mine of the British Columbia Copper Co. shipped 7613 tons to the smelter at Greenwood, which dealt with 14,550 tons of ore during the week. The Surprise, Hamilton, and Ben Hur mines at Republic, Washington, are shipping to Trail, while the United Copper at Chewelah has sent 1116 tons to that smelter during the current year. The mines of the Consolidated Mining & Smelting Company of Canada have produced 223,787 tons of ore from July 1, 1912, to March 7, 1913. W. Baelz, connected with the Vancouver Nanaimo Coal Mining Co., states that a plant capable of shipping 1400 tons of coal per day is to be constructed at the Issaquah mine, the present plant having a capacity of 400 tons per day. The Granby smelter treated 48,894 tons of ore during the first two weeks of March and shipped 868,000 lb. of copper.

During January the adit of the Portland Canal Tunnels, Ltd., was driven 209 ft., making a total of 392 ft. An average of over 200 ft. per month is expected, the size being 7.5 by 8 ft. For ventilation, 400 ft. of 10-in. pipe has arrived at the property. Twenty men are employed, and it will be late next fall before the adit will cut the Glacier creek orebody. Prospecting is under way at the Seven Mile, Pearson & Peterson, Red Reef, Cascade Falls, and Indian Mines claims. The Lucky Jim Mining Co. will erect a mill to treat its lower grade ore. About $250,000 worth

of ore has been opened above No. 5 level, and 400 tons of ore is ready for the smelter. The mine is equipped with an air-compressor and lighting plant.

ONTARIO

(Special Correspondence.)—The Schumacher company has two diamond-drills operating on its property near Pearl Lake; the McEnaney company is prospecting its ground from the 400-ft. level by diamond-drilling; and the Moneta has resumed operation by diamond-drilling on its southern claim, presumably to cut the extension of the McEnaney veins. The Kirkland Lake section, north of Swastika, is busy, being the scene of a small boom. A deal involving $100,000 has just been concluded for the Wishman claims to a group of Toronto capitalists, David Fasken and associates, while other deals are under way. It is reported on good authority that the Wettiaufer interests have an option on the Tommy James claims, in southeastern Shaw, which they are at present diamond-drilling.

Timmins, March 20.

Thirteen Cobalt mines shipped 485 tons of ore, and five sent out 252,180 oz. of bullion, during the week ended March 15, making the respective totals for the year 3606

COBALT.

tons and 1,727,810 oz. During February, La Rose company produced 230,102 oz., worth $136,182. Expenses amounted to $57,409, and the cash on hand and ore shipments total $1,687,885. On March 20, La Rose, Nipissing, and Timiskaming companies paid dividends totaling $662,000. On the 575-ft. level of the latter mine, a vein 2 to 8 in. wide, averaging 2500 oz. per ton, has been opened for 70 ft. At the Lucky Cross, Swastika, the east crosscut has intersected 18 in. of gold-bearing ore. About 100 ft. of work has been done on the 200-ft. level. At the mill the stamps, concentrators, and copper plates are in position, while the 5 by 9-in. rock-crusher is being installed. The engine and Hardinge mill have not arrived at the mine.

YUKON

The Yukon Gold Co. is satisfied that dredge No. 1, which was blown up on February 14, as mentioned in these columns on March 8, was dynamited, and is offering a reward of $5000 for information. Now that warmer weather is coming on, preparations are being made for a busy season. For the year ended March 31, 1912, the revenue from the Yukon Territory was $563,731, and expenditure $1,112,717. The Boyle Concessions, Ltd., has taken over the entire holdings of the Northern Light, Power & Coal Co. and all subsidiary companies, including the Dawson Electric Light & Power Co., the Dawson City Water & Power Co., and the Yukon Telephone Syndicate, Ltd. The capital stock of the Northern Light & Power Co. is $3,000,000, and the properties include the coal mines, the fine steam power-plant at Coal creek, the railway from Coal creek to the mine, the transmission line of 35 miles over the hills to Dawson, the steamer *Lightning*, and other assets. The capital stock of the Dawson Electric Light & Power Co. is $150,000, the water company $50,000, and the telephone company, $65,000; making a total for the four companies of $3,265,000.

A message has been received from Atlin saying that J. E. Owens had reached there with several hundred dollars' worth of placer gold he had taken from the new 'camp' in the Teslin district, mentioned in the editorial pages last week. This is the first authentic information concerning the new district.

MEXICO

A preliminary report of the Batopilas Mining Co. states that the production during 1912 was ₱702,000. Mining, milling, and general expenses were ₱516,951, while the estimated profit was ₱162,404. The smelter at Chihuahua is treating nearly 1000 tons of ore per day. A census taken of the smelter 'camp' recently showed that over 2500 people are sustained by this industry.

HIDALGO

At the Santa Gertrudis mine a new head-frame, conveyor bridge, and steel ore-bin are being constructed. During December the Real del Monte mine produced 41,000 tons of ore. At the San Jose shaft of La Blanca mine the hoisting rope broke and a large number of men were killed and wounded.

SONORA

Exports from this state through the port of Agua Prieta during February were valued at ₱2,173,100, made up of 13,606 tons of mineral and 8085 lb. of silver bullion from El Tigre. Copper exports were worth ₱1,389,600; gold, ₱285,800; and silver, ₱497,700. The Cananea smelter produced 8,000,000 lb. of copper during the month. The smelter building is being remodeled, and the roof lifted 15 ft., which is expected to correct the smoke trouble. No. 4 Great Falls type of converter has been installed.

The property of the Cerro de Plata Mining Co., situated 35 miles south of Nogales, Arizona, has been examined by A. T. Bird, and a full report published in the *Oasis* of March 15. The district is one of slate and porphyry, with intrusions of rhyolite and granites, in the immediate vicinity of the country is a brecciated andesite cut by dikes of trachyte and quartz. About 2000 ft. from the mine a canyon has cut a wide lode which carries from 6 to 26 oz. silver per ton, and in places a high percentage of copper. The mine has been opened and shipments of rich silver ore sent to El Paso totaled 1400 tons, averaging 117 oz. per ton. Development has opened 57,660 tons of ore, which should yield 46.5 oz. per ton. In November 1912 a 5-stamp mill and cyanide plant was completed and is treating 25 tons per day, with 85% extraction. The total ore treated to February 4, 1913, was 1725 tons, yielding 52,571 oz., while the residue contains 27,641 oz. of silver. A mill of larger capacity is to be erected.

The Tigre Mining Co. at El Tigre treated 5016 tons of ore during February, also 4813 tons of current and 1617 tons of dump tailing, the total yield being $113,576. Costs, including marketing concentrate and taxes, amounted to $65,931, leaving a profit of $47,645.

State troops attacked Cananea early in the morning of March 24, from two directions, with artillery and hand grenades. The federal garrison of 350 men withstood the first assault. The concentrating and smelting plants of the Cananea Consolidated Copper Co. are shut down, and about 2000 employees are expected to help the state troops.

NICARAGUA

(Special Correspondence.)—The adit at the Escandola mine of F. Pelias & Co., near Santo Domingo, is nearing the vein where rich ore was left several years ago on account of trouble with water. Several small veins have already been cut.

Santo Domingo, January 25.

WESTERN AUSTRALIA

(Special Correspondence.)—It is reported that the Moore Filter Co., of the United States, is about to proceed against all users of vacuum-filters. There will probably be a big fight, as the various mining companies have subscribed $120,000 for a defense fund.

Kalgoorlie, January 29.

Market Reports

LOCAL METAL PRICES

San Francisco, March 27.

Antimony	12—12¾c	Quicksliver (flask)	40
Electrolytic Copper	15¾—16c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, March 27.—Copper prices are easier because of outside selling. Lead remains unchanged. Spelter is weak in absence of demands and because of strong selling pressure. Average daily prices for the past week in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Electrolytic Copper.	Lead.	Spelter. St. Louis	Silver, per oz.
Mar. 20	14.68	4.33	5.87	56⅞
" 21	14.63	4.33	5.85	—
" 22	14.60	4.33	5.80	56⅞
" 23	Sunday.	No market.		
" 24	14.60	4.33	5.75	56⅝
" 25	14.60	4.33	5.75	56⅝
" 26	14.60	4.33	5.73	57

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. March 26.		Closing Prices. March 26.
Adventure	$ 2⅜	Mohawk	$ 50
Allouez	36¾	North Butte	28
Calumet & Arizona	61¼	Old Dominion	48
Calumet & Hecla	455	Osceola	91
Centennial	.14	Quincy	67½
Copper Range	44½	Shannon	10¼
East Butte	12	Superior & Boston	3⅜
Franklin	6¾	Tamarack	28½
Granby	60½	U. S. Smelting	40¾
Greene Cananea	7⅜	Utah Con.	9½
Hancock	19½	Victoria	1¼
Isle-Royale	21⅜	Winona	2½
Mass Copper	4	Wolverine	62

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 27.

Atlanta	$ .17	Midway	$ .49
Belmont	6.12	Montana-Tonopah	1.72
Big Four	.85	Nevada Hills	1.10
Buckhorn	.90	North Star	.22
Con. Virginia	.11	Ophir	.11
Crown Point	.19	Pittsburg Silver Peak	.50
Florence	.48	Round Mountain	.50
Goldfield Con	2.80	Sierra Nevada	.03
Halifax	1.00	Tonopah Extension	2.00
Jim Butler	.88	Tonopah Merger	.84
Jumbo Extension	.26	Tonopah of Nevada	5.72
MacNamara	.19	Union	.09
Manhattan Consolidated	.12	West End	1.25
Mexican	.74	Yellow Jacket	.24

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, March 26.	Unlisted.	Closing prices, March 26.
Associated Oil 5s	100	Natomas Dev. 6s	99
E. I. du Pont ½s	93½	Pac. Port. Cem. 6s	99
Natomas Con. 6s	94¾	Riverside Cem. 6s	77
Unlisted.		Standard Cem. 6s	92.
Associated Oil 1st ref.	84¾	Santa Cruz Cem. 6s	85⅛
General Petroleum 6s	65⅛	So. Cal. Cement	80

STOCKS.

Listed.	Closing prices. March 26.	Unlisted.	Closing prices, March 26.
Associated Oil	44½	Mascot Copper	2
Amalgamated Oil	86½	Noble Electric Steel	17
E. I. du Pont Powder	90	Natomas Consolidated	11½
Pac. Coast Borax, pfd	100½	Pac. Coast Borax, old	206
do com.	80	Pac. Portland Cement	60
Pac. Crude Oil	45	Riverside Cement	50
Sterling O. & D.	1.07½	Standard Cement	17
Union Oil of Cal.	91½	Standard Oil of Cal.	170
West Coast Oil, pfd.	70	Santa Cruz Cement	45

OIL SHARES.

(San Francisco Stock Exchange.)

San Francisco, March 26.

De Luxe	60	Palmer	16
Empire	35	Republic	15
Monte Cristo	75	Sterling	1.10
Orcutt Oil	35	Turner	1.00

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

ROBERT LINTON is in Pittsburg.

E. H. BENJAMIN is in New York.

C. C. BROADWATER is in New York.

J. W. HUTCHINSON is in New York.

JOHN B. FARISH is at the St. Francis.

J. B. HARRELL is at Melrose, Montana.

HOWARD D. SMITH has gone to London.

C. H. MACNUTT has returned to London.

SAMUEL COLT has gone to Dolomi, Alaska.

HEATH STEELE is at Bonne Terre, Missouri.

CHARLES S. HALEY has returned from Peru.

H. F. WIDDICOMBE is now at Salt Lake City.

C. T. DURELL will be in Denver, Colorado, soon.

G. W. METCALFE was in San Francisco last Saturday.

W. H. LANDERS has gone to the New Almaden mine.

E. T. DUMBLE was in San Francisco during the week.

H. REIS is now with the Eagle Oil Co., at Tampico, Mexico.

J. A. HOLMES is expected on the Pacific Coast the last of April.

E. RAMMELMEYER has returned to Salt Lake from a trip to Europe.

THOMAS T. READ will leave San Francisco this week for New York.

DOUGLAS WATERMAN was married to Miss MARY PAGE DUTTON, March 22.

D. P. BOOTHE is superintendent for the Tonopah Victor Mining Company.

SEELEY MUDD, son of SEELEY W. MUDD, was married recently in New York.

E. E. CARPENTER has left Tonopah to take charge of the Nevada Wonder mill.

R. B. MARTIN will sail from San Francisco for Manila on the *Siberia*, March 29.

B. A. EARDLEY, of the Princeton M. & M. Co., Ketchikan, Alaska, was in Seattle recently.

A. W. ROSS, of London, has gone to Naraguta tin mines, Bauchi province, N. Nigeria, Africa.

C. G. OSGOOD has been appointed mill superintendent for the Montana-Tonopah Mining Company.

W. B. FISHER is now general manager for the Michigan Utah Con. Co. operating in Little Cottonwood canyon, Utah.

FRANK H. PROBERT is making a geological investigation of the Boston-Corbin Copper Co.'s property at Corbin, Montana.

DONALD F. FOSTER, of the Prestea Block A company, Prestea, West Africa, is at Belmont, Sutton, Surrey, England.

R. E. WILLIAMS, who has been assistant general manager for the Waihi Gold Mining Co. for several years, is retiring. He has been engaged in mining for forty years.

J. L. DOBBINS, formerly engineer for the Nevada Consolidated Copper Co., has returned to San Francisco from China, and is now with Haviland, Dozier & Tibbets.

GEORGE T. COFFEY, who has been in San Francisco for several months, leaves for Dawson City this week to superinteud the hydraulic operations for the Yukon Gold Company.

H. P. BARRY, general manager for the Waihi Gold Mining Co., New Zealand, is retiring after 21 years' active work, during which time the mine produced bullion worth $48,000,000.

SIR RICHARD MCBRIDE, Premier of British Columbia, who is also Minister of Mines for the province, gave the Charter Day address at the University of California this week and was given the degree of D.C.L.

James Lewis & Son's Copper Report

The rapid decline in the value of standard copper which took place during January continued during February until £63 2s. 6d. was accepted for cash on February 18, a fall of £14 2s. 6d. since the beginning of the year. There was a recovery to £64 17s. 6d. on the 20th, but under the influence of weak American advices prices declined again to £63 15s. on the 25th, recovering, however, on general 'bear' covering and a better demand from consumers to £65 on the 28th. On March 3 the buying had continued, and with a strong market there has been a further advance to £66 7s. 6d., this being the closing value for both cash and three months.

The losses due to the serious fall in the price of copper since the beginning of this year have mainly fallen upon American producers and refineries who withheld their copper from the market and refused to sell at prices which European consumers were willing to pay, and have now to accept the equivalent of £68 10s. to £69 per ton c.i.f. for wire bars. The extent to which the stocks held by the English and French manufacturers have been denuded is shown by the small quantities of copper taken for consumption from the arrivals and from the public stocks, as given in our last report. Nine hundred tons of American wire bars and ingot bars have been put into warehouse at Liverpool, and large quantities on the Continent during the past month, presumably on account of the producers.

Exports from the United States during February were advised as 26,767 tons. European stocks have increased 1947 tons, and the visible supply 1572 tons during the month. Imports are 8940 and deliveries 9128 tons less than during the same period last year. Total arrivals in England and France for February were 16,034 and deliveries 17,711 tons fine. Arrivals in England from Chile were 2012 and deliveries 2308 tons fine, and from other countries 9834 and 11,021 tons, respectively. Arrivals at Liverpool and Swansea from the United States were 2025 tons of bars and 1185 tons of ingots, equal to about 3204 tons fine copper; in London, 502; and in France 3808 tons fine. Chile charters are advised as 2600 tons, including 1200 tons for the United States. Chile exports for the past year were 37,850 tons fine, and chartered to February 28 were 7400 tons fine.

STOCKS OF COPPER (TONS FINE)

	Mar. 1, 1912.	Jan. 2, 1913.	Feb. 3, 1913.	Mar. 3, 1913.
Chilean in—				
Liverpool and Swansea..	4,429	5,348	4,600	4,304
France	672	832	739	581
American in—				
Liverpool and Swansea..	10,637	1,146	639	1,325
France	4,746	2,992	2,852	2,780
Sundries in—				
Liverpool and Swansea..	739	1,194	1,590	1,263
London and Newcastle..	5,628	3,234	2,922	3,163
Birmingham	440	325	175	63
France	558	572	687	723
English in—				
Liverpool and S. Wales..	15,183	16,516	15,494	13,819
Total in England and France	43,032	32,159	29,698	28,021
Sundries in—				
Germany and Holland...	11,500	2,882	4,903	8,527
Total European stocks.	54,532	35,041	34,601	36,548
Afloat (as advised by mail and cable to date)—				
From Chile	2,675	2,800	2,500	2,325
From Australia	5,800	5,400	6,000	5,800
Total visible supply...	63,007	43,241	43,101	44,673

Imports of other than Chile copper into Liverpool and South Wales during the first two months of the current year were: from United States, 4175 tons; Canada, 289; Mexico, 1513; Peru, 280; Spain, 2741; Portugal, 102; Norway and Sweden, 340; Australia, 2419; Japan, 42; Africa, 313; Venezuela, 260; and sundries, 295 tons, making a total of 12,769 tons fine.

Canadian Mining Production

The mineral production of Canada in 1912, according to the Department of Mines, was as follows:

	Quantity.	Value.
Copper, pounds	77,775,600	$ 12,709,311
Gold, ounces	607,609	12,559,443
Pig iron, short tons.....	1,014,587	14,550,999
Lead, pounds	35,763,476	1,597,554
Nickel, pounds	44,841,542	13,452,463
Silver, ounces	31,931,710	19,425,656
Other metallic products.....	.....	982,676
Total	.....	$ 75,278,102
Less pig iron credited to imported ores	978,232	14,100,113
Total metallic	.....	$ 61,177,989
Asbestos and asbestic, tons.....	131,260	$ 2,979,384
Coal, tons	14,699,953	36,349,299
Gypsum, tons	576,498	1,320,883
Natural gas	.....	2,311,126
Petroleum, barrels	243,336	345,050
Salt, tons	95,053	459,582
Cement, barrels	7,120,787	9,083,216
Clay products	.....	9,343,321
Lime, bushels	7,992,234	1,717,771
Stone	.....	4,675,851
Miscellaenous non-metallic.....	.....	3,364,017
Total non-metallic.....	.....	$ 71,949,500
Grand total	.....	$133,127,489

This is an increase of $29,906,495 on the previous year.

The percentage of yield from the various provinces was as below:

	Value of production.	Per cent of total.
Nova Scotia	$ 18,843,324	14.15
New Brunswick	806,584	0.61
Quebec	11,675,682	8.77
Ontario	51,023,134	38.33
Manitoba	2,314,922	1.74
Saskatchewan	909,934	0.68
Alberta	12,110,960	9.10
British Columbia	29,555,323	22.20
North West Territories	5,887,626	4.42
Total Dominion	$133,127,489	100.00

The detailed mineral production of Ontario in 1912 was valued at $47,471,990, the most important products being as follows:

	Quantity.	Value.
Metallic:		
Gold, ounces	89,080	$ 1,859,285
Silver, ounces	30,322,805	17,455,080
Copper, tons	11,116	1,581,062
Nickel, tons	22,421	4,722,040
Iron ore, tons	117,357	238,884
Pig iron, tons	589,593	8,054,369
Lead (concentrate), tons.....	26	1,290
Cobalt oxides, pounds	1,029,532	317,165
Nickel oxides	117,160	11,716
		$34,240,891
Less Ontario ore smelted into pig iron, 71,589 tons		145,326
		$34,095,565

Non-metallic:		
Arsenic, refined, pounds	3,927,347	$ 79,297
Brick, common and pressed	445,028,000	3,805,919
Building and crushed stone	.....	953,839
Calcium carbide, tons	1,998	120,000
Cement, barrels	3,028,486	3,373,653
Corundum, tons	1,960	233,212
Feldspar, tons	12,133	24,416
Graphite, refined, tons	1,246	65,076
Gypsum, tons	31,331	50,246
Lime, bushels	2,297,525	381,672
Mica, tons	318	36,634
Natural gas	.....	2,267,897
Petroleum, imperial gallons	8,432,730	344,537
Salt, tons	90,986	450,251
Talc, tons	5,902	53,118

The total non-metallic production was worth $13,376,425.

Mining and smelting nickel-copper ores in the Sudbury district of Ontario was carried on with an increased output during 1912. Prices ranged from 40 to 55c. per pound, electrolytic being 5c. higher. Details of the industry are as follows:

Ore mined, tons of 2000 lb	737,584
Ore smelted, tons of 2000 lb	725,065
Bessemer matte produced, tons of 2000 lb	41,925
Copper content of matte, tons of 2000 lb	11,116
Nickel content of matte, tons of 2000 lb	22,421
Value of matte	$6,303,102
Export of matte to Great Britain, tons of 2000 lb	2,536
Export of matte to United States, tons of 2000 lb	19,574

Preliminary estimates of the yield of Quebec, as made by the Department of Mines, show a total value of $11,017,046, as against $9,679,786 in 1911. The principal minerals produced were as follows:

	Quantity.	Value.
Asbestos, tons	111,175	$3,059,084
Bricks	100,146,100	1,284,232
Cement, barrels	2,684,002	3,098,350
Copper and sulphur ores, tons	62,107	631,963
Gold, ounces	980	19,924
Granite	.....	358,749
Graphite, pounds	1,210,278	50,680
Lime, bushels	1,705,937	455,570
Limestone	.....	1,361,082
Marble	.....	250,939
Mica	.....	99,463
Ochre, tons	7,054	32,010
Peat, tons	500	2,000
Sand, tons	81,800	33,200
Silver, ounces	26,526	14,591

Chilean Mineral Production

The total mineral production of Chile from 1810 to 1910, according to a *Daily Consular Report*, has amounted to nearly two and a half billion dollars in value, as below:

Minerals.	Quantity.	Value.
Gold, grams	103,057,323	$ 68,084,544
Silver, grams	8,794,136,000	298,695,000
Copper, metric tons	2,169,586	664,292,019
Manganese, metric tons	565,308	4,767,308
Iron, metric tons	154,321	594,968
Lead, metric tons	12,302	542,850
Cobalt, metric tons	6,388	423,663
Coal, metric tons	27,700,748	114,516,524
Nitrate, metric tons	35,596,571	1,235,311,994
Iodine, metric tons	9,557	48,780,332
Borate, metric tons	331,428	15,961,812
Salt, metric tons	2,350	3,371,548
Guano, metric tons	257,274	5,501,637
Sulphur, metric tons	45,163	1,977,810
All other	.....	688,233
Total	.....	$2,463,510,242

Company Reports

GOLDFIELD CONSOLIDATED MINES COMPANY

The report of this well known company covers 14 months from November 1, 1911, to December 31, 1912, made necessary by a change in the company's fiscal year conforming to that of the calendar year. The report of the president, George Wingfield, states that, during the period under review, ore production was 415,786 tons, averaging $19.77 per ton, a total of $8,220,238, and deducting metallurgical losses and cost of ore purchased, the net yield was $7,652,046, or $18.40 per ton. Gross expenses totaled $2,765,046, leaving net realizations of $4,886,399. Costs were reduced by $1.36 per ton, the chief items being milling, 28c. per ton; marketing concentrate, 61c.; marketing bullion, 8c.; and general expense, 10c. per ton. Two dividends of 50c. per share each, and two of 30c. each, or $1.60 per share, were distributed, aggregating $5,694.637. While they exceeded the net profits for the term, excess realizations of previous years made them possible. The year closed with a cash balance of $728,823, with bullion and other settlements outstanding of $214,774. The additional milling plant, costing $79,000, was in operation in February 1912, and resulted in an increase of 50c. per ton profit through the elimination of marketing concentrate. Plant depreciation was written off, amounting to $140,790. Development work covered 48,146 feet.

The report of the general superintendent, J. F. Thorn, who has since resigned, summarizes the 14 months' work as follows:

The production of milling and shipping ore, according to each section of the mine, was as follows, minor fractions being here disregarded:

Shaft.	Tons.	Average.	Value.
Combination	70,578	$18.88	$1,332,525
Mohawk	140,147	18.66	2,615,751
Red Top	18,748	22.15	415,225
Laguna	36,591	13.01	476,064
Jumbo (Clermont)	128,618	23.10	2,970,749
Jumbo No. 2	8,678	17.58	152,532
Total	403,360	$19.74	*$7,962,846

	Tons.	Value gold and silver.	Value copper.	Total average.	Total value.
Jumbo	12,241	$254,862	$83,194	$27.62	$338,056
Laguna	185	2,526	570	16.74	3,097
Total	12,426	$257,389	$83,765	$27.45	$341,153

	Total val.	Av. per ton.
403,360 tons milled	$7,962,849	$19.74
12,426 tons shipped	257,389	20.71
415,786 tons total production	$8,220,238	19.77
Loss in tailing	561,218	1.36
Value recovered	$7,656,020	$18.41
Cost of ore purchased	3,974	0.01
Value realized	$7,652,046	$18.40
Expenses:		
*Mining	$1,409,000	$ 3.39
Transportation	34,754	0.08
Milling	670,427	1.61
Concentrate treatment	158,496	0.38
Marketing concentrate, residue, and by-products	53,995	0.13
Marketing bullion	28,137	0.07
Marketing ore shipped	80,320	0.19
General expenses, including legal and administration	188,470	0.45
Bullion tax	53,635	0.13
Income tax	30,354	0.08
Total operating expenses	$2,707,598	$ 6.51
Miscellaneous earnings	29,342	0.07
Net operating expenses	$2,678,251	$ 6.44
Realization from operations	$4,973,795	$11.96
Construction	87,395	0.21
Net realization from operations	$4,886,400	$11.75

*In statement of production and expenses the value of the copper in the ore shipped ($83,765) has not been taken as

production. The amount realized from the copper has been considered as an offset to the expense of marketing the ore. This value amounts to 20c. per ton on all ore mined, and by adding this to production it would make a corresponding addition of 20c. per ton to total costs, making them $6.92 per ton instead of $6.72.

Operating costs are shown in the following table:

Item.	Cost per ton.	Total.	
Mining—415,786 tons:			
Labor	$2.34	$973,925	
Supplies	0.89	371,015	
Power	0.16	64,060	
Total	$3.39		$1,409,000
Transportation—403,360 tons:			
Railroad operation	$0.06	$ 24,452	
Railroad maintenance	0.03	10,302	
Total	0.09		34,754
Milling—403,360 tons:			
Labor	$0.39	$156,219	
Supplies	0.94	379,639	
Power	0.33	134,568	
Total	1.66		670,426
Concentrate treatment:			
Labor	$0.07	30,321	
Supplies	0.27	109,540	
Power	0.05	18,635	
Total	0.39		158,496
Total operating	$5.53		$2,272,679

CONCENTRATE TREATMENT COSTS

Tons treated—24,376.			
Labor	$1.24	$ 30,321	
Supplies	4.50	109,540	
Power	0.76	18,635	
Total	$6.50		$158,496

In the Combination ground, development covered 6236 ft. The principal new orebody was the 136 BX, about 300 ft. northwest of the shaft on No. 2 level, and has produced 8931 tons averaging $34.73 per ton. This lode is 150 ft. long and 40 ft. wide. A new shoot was found in the Reilly vein, 300 ft. southeast of the shaft, between No. 5 and 3 levels, and produced 12,994 tons, worth $23.48 per ton. Development in the Mohawk covered 16,332 ft. The Sheets-Ish vein on the 150-ft. level produced 24,272 tons, worth $20.01 per ton. On the 250-ft. level a new sill in the 111 vein yielded a small tonnage. The 490 shoot, between the 450 and 600-ft. levels, produced 26,682 tons of $39.02 ore. The 202 stope, between the 250 and 350-ft. levels, should yield a large tonnage during the current year. In the Jumbo-Clermont section 14,599 ft. was done, the greater part being confined to the lower levels of the Grizzly Bear, where an important discovery was made on the 1300-ft. level. The shoot was found after passing through a barren zone on the 1200-ft. level, and has produced 1453 tons averaging $32.80 in gold, silver, and copper. The Grizzly Bear shaft has been sunk to the 1400-ft. level, but driving is slow on account of high temperatures, a large flow of water, and limited hoisting capacity. These troubles are being remedied as fast as possible. Little new ore was opened in the Red Top and Laguna properties, although development covered 9541 ft. Ore reserves are estimated as 300,000 tons of good grade, in addition to a large tonnage of low-grade but profitable ore. To enable thorough prospecting of the country below 1400 ft., a diamond-drill of 3000-ft. capacity has been set up.

According to the report of the mill superintendent, J. W. Hutchinson, the concentrate plant, which he described in the *Mining and Scientific Press* of January 25 and February 1, was completed in February 1912. Its operation has cut out the cost of marketing concentrate and increased the net profit from the mill 50c. per ton. During the current year the accumulated concentrate on the dump will be re-treated. The mill is in good condition, and it worked 95.22% of the total time, the stamps averaging 9.44 tons each per day. It will be necessary to renew all the cloths on the vacuum-filter, as they have been in continuous service for four years.

Total production of the property of this company may be stated as follows:

	Tons.	Av. value.	Total value.
Combination mine	317,189	$35.31	$11,198,643
Mohawk mine	515,363	38.56	19,871,036
Red Top mine	226,284	27.78	6,286,071
Jumbo-Clermont mine	370,003	45.08	16,680,597
Total	1,428,839	$37.82	$54,036,347

Of the above production, $11,200,000 was made by lessees, and $2,700,000 by the several companies prior to their acquisition by the Goldfield Consolidated Mines Co., which has a production of about $40,136,000, of which $23,839,067 was paid in dividends. The capital stock is 5,000,000 shares at $10 each, of which 3,559,148 have been issued. The balance-sheet shows the mill, railroad, absorption, mill supplies, concentrate, bullion, and cash on hand to be worth $1,111,219. Undivided profits amount to $641,723.

STANDARD CONSOLIDATED MINING COMPANY

This famous old property is situated at Bodie, Mono county, California, near the Nevada border, and the thirty-fourth annual report gives the following information. Interesting details of the cyanide plant will appear in a future issue of this journal.

During the year ended January 31, 1913, the mine produced 8150 tons of ore averaging $11.72 per ton, and the cyanide plant treated 16,569 tons of talling from the ponds worth $5.63 per ton, the total realization being $188,902. Development in the mine covered 6216 ft., in 35 different sections, at a cost of $6.37 per foot, of $4.86 per ton; and stoping was done on 20 different veins at a cost of $5.86 per ton. An examination of the property was made by T. H. Leggett, and various suggestions have been followed as closely as possible. Because of the nature of the 'stringers' which are being worked, and the old veins which are being reworked, it is not possible to make an estimate of the ore reserves. An effort to interest lessees in the territory not being worked has been partly successful, and so far 8 leases have been issued, five being in operation. Work was discontinued on the Nevada claim, as nothing payable was discovered. The mill worked much below its capacity during the year, being hampered by limited capacity of the cyanide plant and shortage of water for power. The cost of milling was $1.92, and treatment $2.10 per ton, the total recovery being 86.6%. The hydro-electric plant continues intermittent in operation during the winter, on account of shortage of water. A number of repairs were made to water-wheels and generators. The cost of power was $8081, and sale of power amounted to $2747.

The cost of mining is given below:

	1911.		1912.	
Development, labor	$4.304		$3.701	
Supplies	1.077		1,089	
Power	0.038		0.067	
		$5.419		$4.857
Stoping, labor	4.735		4.335	
Supplies	2.478		1.448	
Power	0.042		0.078	
		7.255		5.861
Total		$12.674		$10.718

The net profit for 1912 was $7730. The company holds securities of a total market value of $54,937, and the surplus is $117,175. Production to date is valued at $16,324,895, and dividends total $5,229,809.

CROWN RESERVE

The annual statement of the Crown Reserve of Cobalt showed an output for last year of 2,714,766 oz. of silver of the value of $1,692,060, yielding a profit of $1,136,010. The total production of the mine to the first year was 15,227,143 oz., having a gross value of $8,273,908, and the total dividends paid for five years were $4,775,797. R. W. Leonard, president of the Conlagas, deprecates the attempts which have been made to inflate the stock of the company, and in a recent statement warns investors that while three or four year's supply of ore has been blocked out, the company's operations are not likely to be continued much beyond that time, as the whole property has been pretty thoroughly explored underground.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

OPAL mined in New South Wales in 1911 was valued at $270,000, and the total since 1890 is $6,210,000.

PRODUCTION OF PYRITE in Canada in 1911 was 82,666 short tons valued at $365,820, of which 32,102 tons was exported.

CONCRETE made of a 1-3-6 mixture requires 1 bbl. of cement per yard, and of 1-3-5 mixture, 1.2 bbl. per yard.

MINES of Ontario employed 9500 men during 1912, of whom 32 were killed, which is equivalent to 3.36 per 1000 men employed.

AIR CONSUMED in a blast-furnace, in making one ton of pig iron, amounts to 6 tons, while there are also used 4 tons of ore, coke, and limestone.

FURNACES used for roasting pyrite are the Maletra shelf, MacDougall, Kauffmann, Herkules, Herreshoff, Wedge, Heinze-Freeland, Merton, O'Brien, Sjostedt, and Jones rotary.

ASBESTOS mined in the Ural mountains of Russia is exported in the raw state, but a large plant is to be erected for manufacture of asbestos material, by a new syndicate which controls the output of six companies whose production is about 18,500 short tons.

GRAPHITE exported from Ceylon in 1911 amounted to 30,231 tons, of which the United States imported 12,062, Germany 8572, Great Britain 5794, and Belgium 3108 tons. The industry on that island gives employment to about 50,000 men, women, and children at 770 'pits.'

GAYLEY DRY-BLAST process of smelting iron ore has shown the following results at four plants, based on actual work over a considerable period:

Output, increase, per cent	23.0	15.3	11.8	16.0
Coke used, decrease, per cent	10.5	6.0	9.8	10.5

MODERN BLAST-FURNACES consume about 40,000 cu. ft. of air per minute, and for each grain of moisture per cubic foot, there enters the furnace 1 gal. of water per hour for each 1000 cu. ft., that is, if the moisture was 1 gr. per cubic foot, 40 gal. of water would enter the furnace per hour.

PLATE-GLASS industry of the world produces about 125,000,000 sq. ft. per annum, of which 60,000,000 sq. ft. is made in the United States. There is $49,000,000 invested in the business in this country, employing 11,000 men. The average cost of manufacturing plate glass in 1912 was 23.98c. per square foot.

RUBBER production of the world in 1912 was 104,700 tons, of which Mexico, Central and South America yielded 47,700 tons; Africa, 15,000 tons; and Asia, 12,500 tons. The production of 'plantation' or cultivated rubber was 28,500 tons. In consumption, America used 48,000 tons; Great Britain, 17,250 tons; Germany, 16,000 tons; and France, 10,000 tons.

DUST losses at the Copper Queen smelter from blast-furnaces varied from 0.06 to 0.16% of the smoke, and contained 9% copper, 8% lead, and 5% zinc, and a new dust chamber using wire screens has been erected. Dust from the converters contained half this amount of copper, but twice that of the lead and zinc.

STEAM-SHOVEL work at Panama is full of interest. During January, shovel No. 227, working 26 days in the Empire district, excavated 45,541 cu. yd. of rock; while shovel No. 208, working 26 days in the Culebra district, handled 44,481 cu. yd. of rock. The best work for one day was done by No. 256 in the Culebra district, which excavated 3230 cu. yd. of rock.

GRAPHITE DEPOSITS of Pennsylvania are confined entirely to sedimentary rocks that have undergone a great degree of metamorphism, or to igneous dikes which cut such rocks. In increasing order of importance, the graphite is found in sandstone, gabbro, limonite iron ore, basic gneiss, crystalline limestone, and acid gneiss. So far payable deposits have only been found in the two last mentioned rocks.

SAND is the strongest roof-supporting material that can be flushed into mines. Tests made with flushed Delaware river sand, confined in a cylinder 6⅞ in. diam. and 10⅞ in. high, with pressures varying from 2.5 to 150 tons, showed a compression of from 0.12 to 1.93 in. Though often credited to European miners, the origin of the system of filling mine workings with sand or other material was in the anthracite mines of Pennsylvania.

MICA DEPOSITS in Canada, whether of the amber or white variety, possess a sufficient degree of similarity in the mode of occurrence of the mineral to have called for, in most instances, practically identical methods of development. The greater number of mica mines might more properly be termed quarries. The provoking feature about mica deposits of both varieties, from a miners' point of view, is the lack of continuity of the 'shoots.'

PYRITES suitable for acid making should contain as much sulphur as possible, pure pyrite containing 53.4% sulphur. Many acid manufacturers demand a product containing not less than 42%, although some purchase ore as low as 37%. In general, pyrite should be free from arsenic, but several fertilizer works accept it, if this mineral does not exceed 1%. The presence of copper, zinc, lead, antimony, calcium, magnesium, fluorine, chlorine, and selenium are undesirable.

DIAMOND-BEARING DEPOSITS may be divided into three classes, namely: (1) those in which the diamond occurs as a primary constituent in certain basic igneous rocks, as in South Africa, San Juan de Chapada in Brazil, in the Eastern Townships of Quebec, and the Tulameen district of British Columbia; (2) they are present in intimate association with chromite as a differentiation product of rocks of peridotite facies, in sedimentary deposits, as in certain conglomerates in Brazil; and (3) in alluvial deposits.

ROLLS working at a speed of 700 ft. per minute absorb the following power:

In.	Hp.	In.	Hp.
36 by 16	20	36 by 15	20
40 by 15	25	18 by 10	8
40 by 20	30	24 by 14	11
40 by 30	42	30 by 14	15
40 by 36	50	36 by 10	12
42 by 16	30	36 by 15	20
54 by 24	45	30 by 16	15
26 by 15	12	36 by 16	20

METASOMATISM in sulphide enrichment of certain ore-bodies in Colorado is summarized by E. S. Bastin in *Economic Geology*, by saying that (1) metasomatic replacement is shown to be an important process in downward sulphide enrichment in certain veins; (2) no change in volume is involved in the replacement; (3) the secondary minerals deposited in fractures are identical in character, and often crystallographically continuous with those deposited by metasomatic replacement, and are probably different expressions of the same general process; (4) since the solutions which accomplish the replacement are circulating, and their supply of replacing material is constantly being renewed, the replacement process cannot be metathetical in character, and no constant relationship between the volume of the replaced and replacing minerals is to be expected; and (6) whether or not porosity develops during replacement, appears to depend mainly upon the ratio between the dissolving and depositing tendencies in the solutions.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

PHOSPHATES IN LODE FORM—HOW LOCATED

If a mineral deposit exists in vein or lode formation—that is to say, if it be in place in the general mass of the mountain—it is subject to disposition only under the provisions of the lode mining laws, whether the mineral it bears be metallic or non-metallic in character. A deposit of phosphate rock, confined between well defined boundaries, constitutes a lode or vein of mineral-bearing rock in place within the general mass of the mountain, and hence is subject to disposition only under the provisions of the lode-mining laws.

Harry Lode Mining Claim, 41 Land Decisions, 403. Dec. 12, 1912.

OIL LEASE—RECOVERY FROM SECOND LESSEES

Petroleum in and under the surface, and not reduced to actual possession of any person, constitutes a part of the land and belongs to the owner thereof, who has the right to reduce the mineral to possession or grant the privilege of doing so to other persons. Where the owner of oil lands has wrongfully sought to cancel an outstanding lease and to make a new lease to other parties, the second lease is void, and the owners of the first lease are entitled, upon establishing their rights thereunder, to recover from the second lessees the value of the oil theretofore extracted by them, but not punitive damages if such second lessees were acting within an honest belief as to their legal rights. The recovery therefore is limited to the value of the oil extracted, less the cost of extraction.

Kahle *v.* Crown Oil Co. (Indiana), 100 Northeastern, 681. Jan. 30, 1913.

OIL PLACER—DISCOVERY VALIDATES LOCATION

Where parties located an oil placer in 1899 and sunk a well thereon, the only result of which was to develop an artesian flow of water, although it passed through some oil-sands which it was estimated would yield 40 bbl. per day, such a well, never having produced any oil, could not constitute a discovery which would support the location. The same parties, however, in 1908 went on the claim and drilled a well which produced oil in paying quantities, and this was held to complete their prior location so as to bar adverse parties who had in the meantime posted a location notice on the ground, but had not proceeded with reasonable diligence to make a discovery until after the original locators had completed their discovery well as above stated.

Borgwardt *v.* McKittrick Oil Co. (California Supreme Court), Feb. 11, 1913. (Not yet reported.)

VALID LOCATIONS IN CALIFORNIA

A lode claim, to be valid, must have its boundaries marked so that the limits of the claim may be readily traced. An attempt to locate a number of claims by posting one notice at the point of discovery of one claim would be absolutely futile. A separate discovery must be made on each claim, a notice posted at the point thereof in the usual form, and the boundaries marked as above stated. The general rule in this state is that the corners of each claim must be marked by a post or other substantial monument. An attempted location of an excessive area is void as to the excess over the statutory area, if that excess can be determined from an inspection of the notice. If the excess cannot be determined, the entire location is void. Ground covered by a void location is of course open to location by any qualified person. Assessment work may be performed for the benefit of a group of contiguous claims by driving such a tunnel on one of them as will tend to develop the group. See Daggett *v.* Yreka Mining Co., 149 California, 357, for general ruling as to requisites of valid locations in this state.

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DISCUSSION BY SYNTHETIC METHODS OF TWO PROJECTIVE PENCILS OF CONICS. By Baldwin Munger Woods. Vol. 1, No. 3. P. 31. Ill. University of California publication in mathematics. Berkeley, February, 1913.

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UNDERGROUND WATERS OF SOUTHWESTERN OHIO. By M. L. Fuller and F. G. Clapp. With a discussion of the chemical character of the waters by R. B. Dole. Water-Supply Paper 259. P. 228. Ill., maps, index. U. S. Geological Survey, Washington, 1912.

THE POSSIBLE FUNCTIONS OF THE LIFE-INSURANCE COMPANY IN THE CONSERVATION OF HEALTH. By Eugene Lyman Fisk. Address delivered before the section on Social and Economic Science, American Association for the Advancement of Science. P. 16. Charts. Cleveland, Ohio, January 1913.

MENIFEE GASFIELD AND THE RAGLAND OILFIELD, KENTUCKY. By M. J. Munn. Surveyed with the coöperation of the Kentucky Geol. Survey. Bulletin 531-A. Advance chapter from Bulletin 531, 'Contributions to Economic Geology, 1911, part II.' P. 20. Maps. U. S. Geological Survey, Washington, 1913.

MINERAL RESOURCES OF THE UNITED STATES, 1911. PART I, METALS. Chapters by E. W. Parker, W. T. Thorn, H. D. McCaskey, E. F. Burchard, C. K. Keith, B. S. Butler, C. E. Siebenthal, A. H. Brooks, V. C. Heikes, C. G. Yale, C. W. Henderson, C. N. Gerry, J. P. Dunlap, F. L. Hess, W. C. Phalen, and Waldemar Lindgren. P. 1018; index. U. S. Geol. Survey. Washington, 1912.

BULLETIN OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY. President's Report, Vol. 48, No. 2. P. 164. Boston, January, 1913. This publication contains, besides the report of the president, reports of administrative officers of the various departments, a list of articles published by students and others, and the treasurer's report. There are 1611 students registered for the year 1912-13. The library contains 95,528 volumes and 27,239 pamphlets and maps.

Commercial Paragraphs

The HARDINGE CONICAL MILL CO. has opened an office at 563 Salisbury House, London Wall, London, England.

The MERRILL METALLURGICAL CO., San Francisco, has moved its offices to the fifth floor of the Rapp Bdg., 121 Second street.

The DORR CYANIDE MACHINERY CO., of Denver, has ordered a Hardinge pebble mill and Hardinge ball-mill, both sectionalized, for use in connection with installations of their machinery.

The HARDINGE CONICAL MILL CO. reports that the Copper Range Consolidated Mining Co. has increased its order from twenty-three to thirty Hardinge conical mills. Also that an order has just been received for another sectionalized mill from the Olla de Oro Mining Co. of Bolivia, which makes four of this type of mill in that district.

Following a long-established custom, the 600 or more salesmen, as well as the department managers, of the H. W. JOHNS-MANVILLE CO. assembled in annual convention on various dates from January 2 to February 8 at Milwaukee, Boston, New York, Philadelphia, Pittsburgh, Cleveland, Chicago, St. Louis, New Orleans, San Francisco, and Toronto, to learn more about the products which they sell.

The TAYLOR-WHARTON IRON & STEEL CO. announces that H. A. Johann and Martin O'Shaughnessy, who have been in charge of the Chicago and Middle West territory, having resigned effective March 31, to engage in other business, the Chicago office of the Taylor-Wharton Iron & Steel Co. will be in charge of George R. Lyman and J. R. Bolgiano, with Guy H. Bergen, representing the company particularly in the Mesabi Range district.

Catalogues Received

W. S. TYLER CO., Cleveland, Ohio. Catalogue No. 36. 'Testing Sieves.' 16 pages. Illustrated. 8 by 10 inches.

GOLDSCHMIDT THERMIT CO., 90 West street, New York. 'Thermit Carbon-Free Metals.' 32 pages. Illustrated. 6 by 9 inches.

POWER & MINING MACHINERY CO., Cudahy, Wisconsin. Bulletin No. 41, 'Stamp Mills.' 62 pages. Illustrated. 6 by 9 inches.

DENVER ENGINEERING WORKS, Denver, Colorado. Bulletin No. 1059, 'Richards Pulsator Classifier.' 8 pages. Illustrated. 8 by 11 inches.

ALBERGER PUMP & CONDENSER CO., 140 Cedar street, New York. Bulletin No. 100, 'Hammond Water Meters.' 8 pages. Illustrated. 8½ by 11 inches.

INGERSOLL-RAND CO., 11 Broadway, New York. Form No. 575, 'Class "PE" Direct Connected Electric Driven Air-Compressors.' 28 pages. Illustrated. 6 by 9 inches.

NEW YORK ENGINEERING CO., 2 Rector street, New York. 'Proof Positive.' Testimonials about the "Empire" drill from all over the world. 30 pages. Illustrated. 4 by 9 inches.

EDGAR ALLEN AMERICAN MANGANESE STEEL CO., McCormick Bdg., Chicago, Illinois. Bulletin No. 57, 'Sheaves of Stag Brand Manganese Steel.' 16 pages. Illustrated. 6 by 9 inches.

DORR CYANIDE MACHINERY CO., Denver, Colorado. Catalogue No. 5, 'The Dorr Classifier, the Dorr Continuous Thickener, and the Dorr Agitator.' 36 pages. Illustrated. 9 by 6 inches.

CHICAGO PNEUMATIC TOOL CO., Fisher Bdg., Chicago. Bulletin No. 126, 'Compression Riveters.' Bulletin No. 129, 'Hose, Hose Couplings, and Hose Clamp Tools.' Bulletin No. 130, 'Lubrication of Pneumatic Tools.' Illustrated. 6 by 9 inches.

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HENRY B. LISTER,
Notary Public in and for the City and County of San Francisco, State of California. (My commission expires February 1, 1913.)

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T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

DESPITE disturbed political conditions in Mexico, the American Smelting & Refining Company enjoyed a good year in 1912. The fourteenth annual report of this company, which is received too late for full review this week, shows a gross income of $16,759,499, with a net income of $11,079,676. A pleasant item in the report is the announcement that the pension fund has been increased to $500,000 to provide for superannuated employees.

NOT since the famous 'Row upon the Stanislaus' has there been such a fight as has been precipitated by Mr. Whitman Symmes' report upon the Comstock. "The quarrel is a very pretty quarrel as it stands; we should only spoil it by trying to explain it," but our sympathies are not unnaturally with Mr. Symmes, since it was in this paper that he published in 1908, his first caustic analysis of the conditions that cause the present disrepute of the great lode.

LEAD production figures for 1912 are now available in detail, and are printed on another page. It speaks well for the statistical work of the United States Geological Survey that the final figures only differ by 71 tons from the estimates made for the Survey by Mr. C. E. Siebenthal, January 2, and published in our review number January 4. Evidently Mr. Siebenthal keeps in close touch with the industry and has the confidence of producers. It is regrettable that the latter do not furnish to him figures of stocks. In their absence he can only calculate the amount of lead "available for consumption." It developed this year that the actual consumption differed materially, but in the absence of exact figures, it is idle to speculate.

MINE TAXATION is a topic of lively discussion in Arizona just at present. Last week the Ways and Means Committee of the House and the Finance Committee of the State Senate, held a public hearing at which Messrs. Norman Carmichael, Will L. Clark, N. L. Amster, John W. Bennie, and J. Parke Channing took part. It is a good sign when the lawmakers call in such competent advisers. Mr. Channing, in an interesting address, pointed out differences between mining conditions in Michigan and Arizona which, in his judgment, made it inadvisable to adopt locally the physical valuation system in vogue in the Lake Superior region. To meet conditions in the Southwest, a system was preferred of estimating the value of a mine upon some multiple of the net and some fraction of the gross earnings without any further addition for the reduction works.

APPOINTMENT of Mr. Charles E. Van Barneveld as chief of the department of mines and metallurgy of the Panama-Pacific International Exposition, assures competent and scholarly direction of the work. Mr. Van Barneveld is a graduate of McGill University who after several years practice in Mexico and the Southwest, assumed the chair of mining at the University of Minnesota. It is from the latter position that he comes to California. He has an intimate acquaintance with mining in the West as well as the Middle West and the East, and we bespeak for him the hearty coöperation of mining men everywhere. The directors have been slow to make a seleetion, and there is a strong feeling that, for mining, a Californian might well have been chosen. This, however, will not affect the welcome extended to Mr. Van Barneveld.

Miners and Legislation in California

California mining men, acting through the legislative committee of the California Miner's Association, have presented a thoughtful report upon mining legislation pending at Sacramento. The Association calls especial attention to the needs of the State Mining Bureau and recommends large increases in its appropriation. In particular, the sum of $25,000 is asked in order to enable the Bureau to make a creditable exhibit at the Panama-Pacific Exposition. While, as our readers know, we are not hopeful of consistently good results being accomplished by the Bureau until its present anomalous plan of organization is corrected, there can be no question but that the best State Mineralogist can accomplish nothing without adequate funds. California is already appropriating for the overhead expense but giving no funds for field work. This is a silly and short-sighted policy. It would be better to abolish the Bureau if California is really too poor to support it on an efficient basis.

As to mine inspection, the committee seriously doubts the need of any state inspection service, but, as good citizens should, it offers valuable advice regarding amendments that should be made if the Finnegan bill, which has been recommended favorably to the House, be passed. The committee is on sound ground in urging that a sufficient salary be paid to permit obtaining the services of good men, and in objecting to limitations that would practically restrict the Governor in his selection to appointment of a common workman—one who at the end of seven years underground work in California had been so unsuccessful as to have acquired no interest in any mining property. This is too narrow a view of what constitutes competence. A pertinent amendment also is one regarding the use of liquor underground. No man under the influence of liquor should be allowed in or around a mine at any time, and the only safe rule is never to allow liquor in the mine. Under the California system, especially as it probably will be amended at this session of the legislature, the mine owner is responsible for all accidents. It is certainly proper under these conditions to interpose state authority to protect him against men who take wilful risks, and a miner who 'overestimates his capacity' may at a critical time endanger many.

As to general legislation, the report of the committee is notably conservative. It opposes a large number of bills which propose restraints on the right of contract and further limitations on hours of labor. Blacklisting, picketing, and boycotting are alike condemned, and the proposal to extend the right of eminent domain to mining companies desiring to purchase land for disposal of tailing, is also opposed. Though this would be a convenience and help to the mines, it is so certainly unconstitutional that passage of the bill would but lead to useless litigation. As to the regulation of dredging and smelter fume, discussed in an earlier issue of the *Press*, the committee naturally aligns itself with the general sentiment of mining men who see no reason for imposing additional regulation.

As a whole, the report of the committee is a brief but well-considered presentation of the miners' view of problems that confront the law-makers at Sacramento.

John Pierpont Morgan

In the death of J. P. Morgan the United States loses one of its foremost financial magnates, and the world one of its greatest bankers. Criticism as well as praise fell frequently to his lot. Many saw in him and his control of finances a dangerous portent: but as he himself pointed out when testifying before the Pujo committee, his power, as is that of every other great banker, was based upon public confidence in the man. People trusted money to him because they believed in his honesty and in the soundness of his judgment. The first has never been questioned, and events have justified the second in all but a few instances. Sharp differences of opinion existed frequently as to his policy. It is undeniable that large amounts of water were converted into securities by Morgan transactions; the permanent burden of interest that industry must bear has been greatly increased; but this may well have been in the main but a recognition of facts as they existed, and water may have cost less than prolonged industrial conflict. Morgan was preëminently a reorganizer. It was his specialty to take halting enterprises and put them on their feet, and in this he did much good. A few consolidations went to pieces and some are under fire, but in the main his work has stood. Essentially he was a merchant. He sold securities, and people bought because experience taught that Morgan stocks would pay dividends and Morgan bonds were safe as to interest and principal. Morgan had few relations with mining, though through the United States Steel Corporation, the anthracite railroads, and other enterprises, he came into secondary relations to the industry. Despite hasty generalizations to the contrary, mining is a sound and profitable industry. It is interesting to speculate what might have been the outcome if Morgan, with his insight, industry, reliance on character, and his resources, had devoted his energy to supplying the world with metals and minerals. Raw materials limited in quantity, afford the best natural basis for monopoly, and mining is founded on just those conditions. The Morgan of mining is still to come.

Copper Mines in Chile—II

By Juan Blanquier

The Collahuasi District

This copper mining district is situated in the province of Tarapacá, at latitude 21° S. Its distance from the Pacific coast is 95 miles in an air-line. The altitude is 15,000 ft. above sea-level. It was known and worked superficially by the native Indians before the arrival of the Spaniards; but it is only since 1899 that the district has been known as a producer of copper, due principally to the accidental discovery of an important orebody that yields from the surface abundant ores of an average grade of 40% copper.

There are two transportation routes from the Collahuasi district to the Pacific coast. One to the port of Iquique, the other to the port of Antofagasta. The route from Collahuasi to Iquique has a total length of 186 miles, divided into two parts; the first from the port to an intermediate point in the interior, 3700 ft. above sea-level, is served by a railroad 108 miles long; the second is a wagon-road 78 miles long, starting from the end of this railway line and ending at the mining camp 15,000 ft. above sea-level.

Transportation over the wagon-road is by two-wheeled carts drawn by six mules; the carts carry one long ton when going up to the mines with supplies and 2.5 long tons of ore when coming down. The total freight from Collahuasi to Iquique is $12 per ton. The other route from Collahuasi to the port of Antofagasta is a narrow-gauge railroad line, 300 miles long. This line has been in operation since 1907. The freight on ores to the port of Antofagasta over this line is $6 per long ton.

Geology at Collahuasi

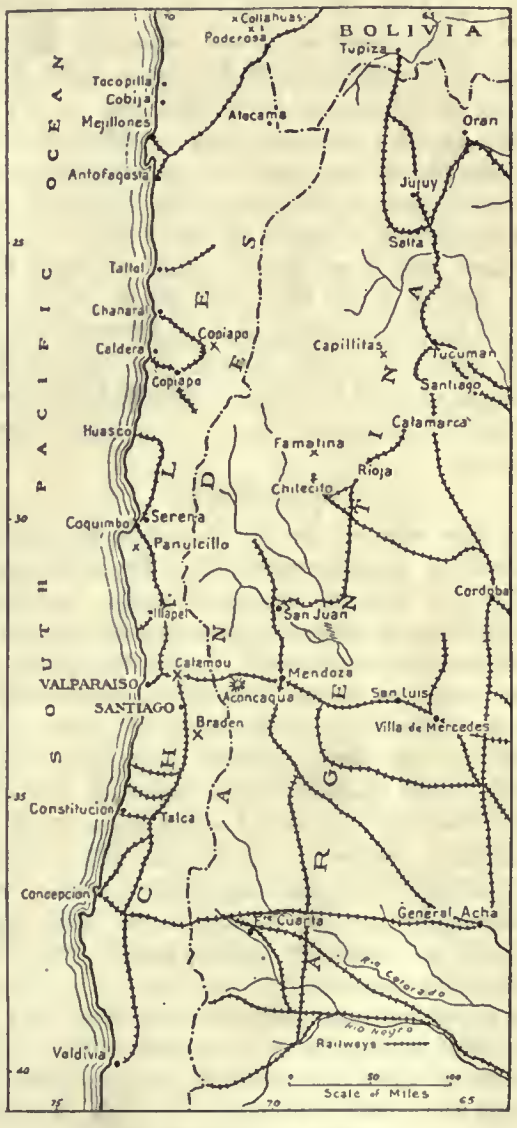
The copper-bearing ores in this district occur in fissures, in a porphyry feldspathic rock, running easterly and westerly. The porphyry shows a well defined stratification and is greatly decomposed and loosened. A number of intrusive dikes cross this country from northwest to southeast. Rich orebodies are found along these dikes on the contact with the porphyry. On the surface, oxidized copper ores are found (malachite and silicates) while at depth rich sulphides occur.

The climate at Collahuasi is dry and cold even in summer; snowstorms are frequent in winter, with infrequent rainfalls in summer. Water is scarce and is found only in a few small springs in the district. Vegetation is very scarce and is practically confined to a plant named *yareta*, which has neither branches nor leaves, but is formed by trunks that grow along the ground sending out roots which at intervals adhere to the granite rock; it takes its nutriment from the granite, decomposing the rock at the same time. The plant dies when the surrounding rock has been decomposed. The *yareta* is extensively used as fuel, its heating power being half that of ordinary steam-coal, and it costs $3 per ton at the mines.

Ordinary mine labor costs $1.50 per day of 10 hours. Two principal companies, out of a number of smaller ones, have properties and operate mines in this district. They are known as La Grande Mining Co. and La Poderosa Mining Company.

La Grande Mine

The La Grande Mining Co. has a capital of $500,000. It owns 160 claims in the district, with a total area of 1882 acres. Eight different copper



MINING DISTRICTS OF CHILE.

veins have been found running nearly parallel to each other from northwest to southeast. Twelve shafts have been sunk on these veins, the deepest shaft having a depth of 400 ft., with underground development of about 1000 ft. Exceedingly rich and abundant orebodies have been found, as may be judged by the following data taken from one of the semi-annual reports of the company, which states that "during the last six months the output of the five mines in operation was as follows: 5060 tons of ore of 30% Cu, 2592 tons of ore of 20% Cu. The ore reserves in the mines amounted at the end of the period to 85,791 long tons of an

average grade of 27.21%. The low-grade ore dumped in the waste pile amounted to 25,886 long tons of an average grade of 13.61% Cu." I understand that all the work carried on by this company is done without any machinery whatever.

La Poderosa Mine

The La Poderosa Mining Co. was organized in 1905, has $1,200,000 in stock, and owns 457 acres in the district. The ore deposit is contained in an important copper-bearing vein showing on the surface a length of over 8000 ft. Its strike is generally north 40° west, and its dip from 40 to 70° southwest; its width varies from 3 to 30 ft., the width of the orebody varying from 1 to 20 ft., with an average of 4 ft. Five mines have been opened on this vein, the most important being the Poderosa, at which a vertical shaft has been sunk 432 ft. From it six cross-cuts have been run at intervals of 73½ ft. to reach the vein at different levels; from the end of the cross-cut on each level drifts have been run on the vein, the different levels being connected by raises on the pitch of the vein. As stated, the depth of the vertical shaft is 432 ft., the length of the cross-cuts 492 ft., of the raises 1509, of the drifts 4264, and of intermediate drift 282 ft.; making a total length of underground development of 6970 ft. The ore blocked out amounts to 100,000 long tons of ore of an average grade of 24.4% Cu.

The Orebodies

The character of the ore found in the different levels of the mine is as follows: From the surface to the 220-ft. level, copper silicates, brochantite, and cuprite; sometimes malachite, azurite, covellite, and chalcocite are found. From the 220-ft. level to the lowest workings, sulphides predominate, including chalcocite, tetrahedrite, and some chalcopyrite; the primary sulphides have not yet been reached. The copper ores contain an average of 10 oz. silver per ton and a small quantity of gold. The hanging wall of the vein is generally well defined and formed of quartzite, the foot-wall is formed of decomposed porphyry and is not well defined. As a rule the porphyry underlying the vein is porous and impregnated with copper.

No water has been found in this mine, or in any other mine in this district. On account of the porous nature of the surrounding porphyry, whenever it rains the water percolates through the ground and in some instances there has been as much as 9000 gal. in 24 hours collected in the bottom levels of the mine from this source.

Equipment

The equipment at La Poderosa consists of three Babcock & Wilcox boilers, 120 lb. pressure, capacity 100 hp. At the main shaft there is a Fraser & Chalmers hoisting-engine, built for 350 tons capacity daily, wire rope of 1-in. diameter. The shaft is provided with a steel head-frame 60 ft. high, a weighing machine, one grizzly, tables for hand sorting of the ore, a small crushing plant with two 9 by 15-in. Blake crushers, electric driven, belt-conveyor, and storage-bins. A Reidler air-compressor, 100 lb. pressure, 500-cu. ft. capacity per minute, furnishes the air for 20 Murphy air-drills used underground. Four small steam pumps are in operation at different levels in the mine. The ores from the storage-bins are loaded in railroad cars and shipped to the port of Antofagasta, 300 miles distant, and exported crude to England. One of the last reports of the company shows for six months an output of 13,975 long tons of ore of 29.82% Cu and 10 oz. silver per ton.

Chuquicamata District

About two years ago the Guggenheim interests acquired property in this district; the property has been thoroughly prospected with churn-drills and proved to be a copper deposit of great importance. A steam-shovel mine is in course of development, comparable in magnitude and importance with that of the Utah Copper Co. I think that it may be interesting to give an idea of what this mining district was before the arrival of the American concern.

The Chuquicamata district (province of Antofagasta) is situated at 22°15′ south latitude and 87 miles distant from the Pacific coast in a straight line. It is in what is known as the northern region of the country. Its altitude is 10,000 ft. The climate is dry and tempered by the altitude. Vegetation is scarce. Some 15 miles south of the mining camps runs the River Loa in the valley of the same name. This valley is very fertile and is cultivated to some extent. There is a small town called Calama, with about 3000 inhabitants, situated in the valley. The mining camp is about 15 miles from this town and is connected with the port of Antofagasta by a narrow-gauge railroad 160 miles long.

The hills around Chuquicamata are formed of a white acid rock containing quartz and monoclinic feldspar. It may be classified as a granite without mica. This granite formation is crossed by a number of fractures containing copper and running generally north and south. The average width of these fractures is about five feet. When two or more veins come in contact, which is frequently the case, the mineralization spreads and reaches a width of 20 or more feet of high-grade copper ores. The gangue is of the same composition as the surrounding formation, but is greatly decomposed, the surrounding rock being solid and resistent. The veins show a few faults of little magnitude, with small horizontal displacement. No water has been found up to date in the mines. The predominating copper ores found are oxidized, due principally to the small depth of the mines. They consist principally of atacamite, brochantite, and cuprite, the former frequently in fibrous form; less frequent are the copper silicates, carbonates, and sulphates. In some of the deepest mines rich sulphide ores are found.

Surface Ores

Out of the system of veins mentioned above, there are in the district of Chuquicamata some irregular copper orebodies known in the country by the name of *llamperas*. The *llamperas* are in a portion of the mining camp above the level of the copper veins.

and it is believed that there is some underground relation between the *llamperas* and the veins. However, this has not yet been proved. The *llamperas* are apparent on the surface of the ground. They form in the above-mentioned granite rock, which is deeply decomposed and fissured. In these fissures is found the copper ore in oxidized forms which will average from 3 to 4% copper, in the form of brochantite, atacamite, and soluble sulphates.

Methods of Work

The exploitation of the *llamperas* is carried out in the following manner: The ground is broken by blasting. All the broken material is then passed over 10-mesh sieves; the fine is rich and contains about 15% Cu, while the coarse, which is sent to the waste pile, averages about 2%. This simple process of concentration is made possible from the fact that the ores are more fragile than the accompanying gangue. I understand that the *llamperas* form the base for the steam-shovel project in course of development by the American company. The method of treatment of the ores will be, as I have heard lately, by leaching and electrolytic precipitation. The necessary acid for leaching is derived from the same ores, while hydro-electric power will be generated in the River Loa and transmitted to the mines for power and electrolytic precipitation.

Smaller Mines

The mining district covers a large area of land, being 2½ miles long and probably about the same width. A number of companies had properties and worked mines in the district, the principal of which were: 'Compañia de Minas de Calama,' working 200 men and having an output of 1000 long tons of ore per month averaging 13.2% copper; 'Compañia Poderosa de Chuquicamata,' working 160 men and outputting 700 tons per month of 12.5% Cu ore; 'Mina San Rafael,' working 120 men and producing 200 tons per month of 18% Cu ore; 'Mina Aurelia,' employing 40 men and producing 100 tons per month of 13% Cu ore; 'Compañia Anglo-Chilian,' with an output of 70 tons monthly of 20% Cu ore; 'Mina Flor del Boquete,' with output of 60 tons per month of 15% Cu ore.

Besides the above enumerated concerns, there are a number of smaller companies operating in the district.

The Panizo

The neighboring 'Panizo' mine, owned by the Compañia Poderosa de Chuquicamata, is 450 ft. deep and at this level the vein has been proved for a length of 600 ft. The orebody is formed by a number of copper veins running north and south and having the general characteristics of the other veins in this district. The system of work is that of blocking the ore by means of levels and raises. The ore is hoisted through a vertical shaft, and 80 men are employed. Hand drilling is used exclusively, with black powder and dynamite for explosives. Underground transportation is made in small cars run by hand. Hoisting through the main vertical shaft is done by means of a steam hoisting-engine with a capacity of 2 tons from a depth of 1000 ft. Labor costs are as follows: Drillers, $1.50 per day of 10 hours; trammers, $1.25; surface men, $1.25. The output of the mine averages 275 long tons of 12.5% copper ore per month. The cost of mining and sorting per ton of ore ready for shipment is $10.

Probably 80% of the total output of the district is shipped to Antofagasta by rail and exported crude to Europe. The remainder of 20% formed by lower grade ores is treated in a small copper smelter near Calama, about 15 miles distant from the mines.

End

Shamva Reduction Plant

The reduction and treatment of the Shamva mine in Rhodesia was due to be running before the end of the year. Ore will be drawn out in the adits by petrol locomotives and deposited in a large storage bin. From this it will be fed into trucks and lowered by gravity to grizzlies placed over three No. 7½ Gates stone-breakers. After the oversize has been reduced in these the whole product, fine and coarse, will be deposited upon a belt-conveyor which discharges into trommels where the ¼-mesh product will be eliminated and sent direct to the tube-mills, while the oversize will be deposited into a bin feeding 56 Nissen stamps each of 2000 lb. weight and using ¼-in. mesh screen, the ore being crushed in cyanide solution. The capacity of the plant will be in the neighborhood of 50,000 tons per month and the cost of treatment is expected not to exceed 4s. 6d. per ton. After leaving the stamps, the pulp will gravitate to the feed-cones of eight 22-ft. tube-mills, using Osborne liners. The underflow of the cones will pass through the tube-mills over short copper plate and blanket tables, and thence to a centrifugal pump to be elevated back to cones again. The overflow of the tube-mill cones will pass direct to eight sand-cones superimposed over four others in which the sand will be classified out, and mixing with the barren solution from the slime plant extractor boxes will gravitate to eight 50-ft. by 8 ft. 6 in. sand collecting and leaching tanks in which the sand will be leached, washed, and deposited on the dump by rope haulage. The slime and solution overflowing the sand-cones will flow to five 35 by 10-ft. Dorr thickening tanks, part of the clear overflow of which will run to the extractor boxes and a portion back to the mill supply tank. The thickened pulp from the discharge of the Dorr tanks will be pumped up to five 45 by 10-ft. Pachuca tanks, connected in series, where, after air agitation, the slime pulp will run to the storage agitators connected to the Butters filter plant. The latter will consist of 336 leaves designed on the gravity system of working. All solutions will be precipitated in ordinary zinc extractor boxes and the gold slime smelted in two Morgan gas-fired melting furnaces.

Copper concentrate produced in February by the Elmore vacuum plant, at the mines of the Sulitjelma company in Norway, amounted to 1137 tons.

Chosen Mining Company's Reduction Plant

By J. D. Hubbard

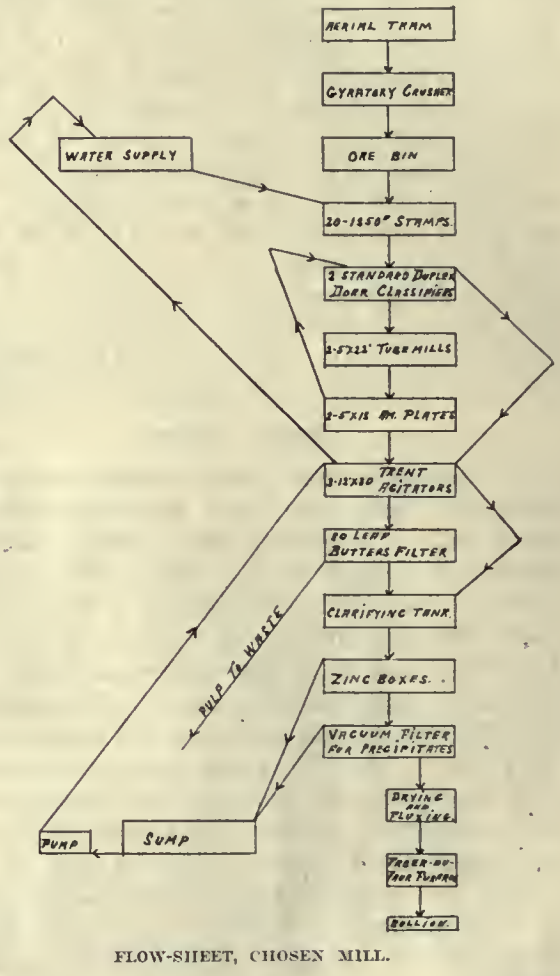
On the first of August 1911, the stock of the Chosen Mining Co. was placed on the market in Japan and Korea, and was quickly taken up by the investing public. Prior to this date the Morris-McGary partnership of Seoul had carried on considerable development and had brought the property to a point where it was considered in shape to put on the market. An article describing the location, capitalization, and ore estimation on this property appears in the *Mining and Scientific Press* of July 20, 1912.

While employed as metallurgist for the company I was instructed by the management to experiment on the ores in the Kosung orebodies, and to design a reduction plant for them. The Chosen Mining Co. has a splendid assay-office and laboratory equipment, probably the best in Korea, and over two months were spent in experimenting on the ores. The reduction plant shown by the accompanying flow-sheet was designed, and an order for the equipment placed with the Allis-Chalmers Co., which, as it happens, maintains the only mining machinery agency in Japan.

Mill Not Completed

The heaviest pieces of machinery for the plant, including crusher parts, mortars, and tube-mills, are now at Chinnampo, awaiting a favorable opportunity for transportation to the millsite. Completion of the work has been postponed by the present general superintendent at Kosung until such time as the ore reserves in the mine are in shape to meet the demands of the mill. An overestimation of the ore reserves on the part of the former management at the mines is responsible for the present condition and delay in the mill construction. The Chosen Mining Co. has a good property, however, and it will come into the rank of a real producer before long. The preliminary work of excavating and preparing foundations has all been completed, and figures of the low cost attained will, I hope, prove of general interest.

The plant ordered was for 600 tons daily capacity, and the excavations and retaining walls built on that basis. The first unit, for 200 tons, has been ordered and will undoubtedly go in at the proper time. The ore from the mine is to be conveyed to the mill by an aerial tram over a distance of one mile, and dumped into a 4-K gyratory crusher, and then into the ore-bin. Thence it is to be fed to 20 1250-lb. stamps crushing to four-mesh, in weak cyanide solution, and the pulp passing to two standard duplex Dorr classifiers, which overflow to a Trent agitator for dewatering, the coarse and fine material then going to two 5 by 22-ft. tube-mills fitted with El Oro lining. The product from the tube-mills is to pass over stationary silver-plated amalgam plates 5 by 12 ft. in size, and thence to Dorr classifiers. The coarse product will be returned to the tube-mills and the fine and slime will pass to a Trent agitator for dewatering. Three 12 by 30-ft. Trent agitators are to be used, one for filling and dewatering, one for agitating, and one for settling and thickening pulp for the Butters filter. Cyanide solution to make up full strength is to be added at the Trent agitator.



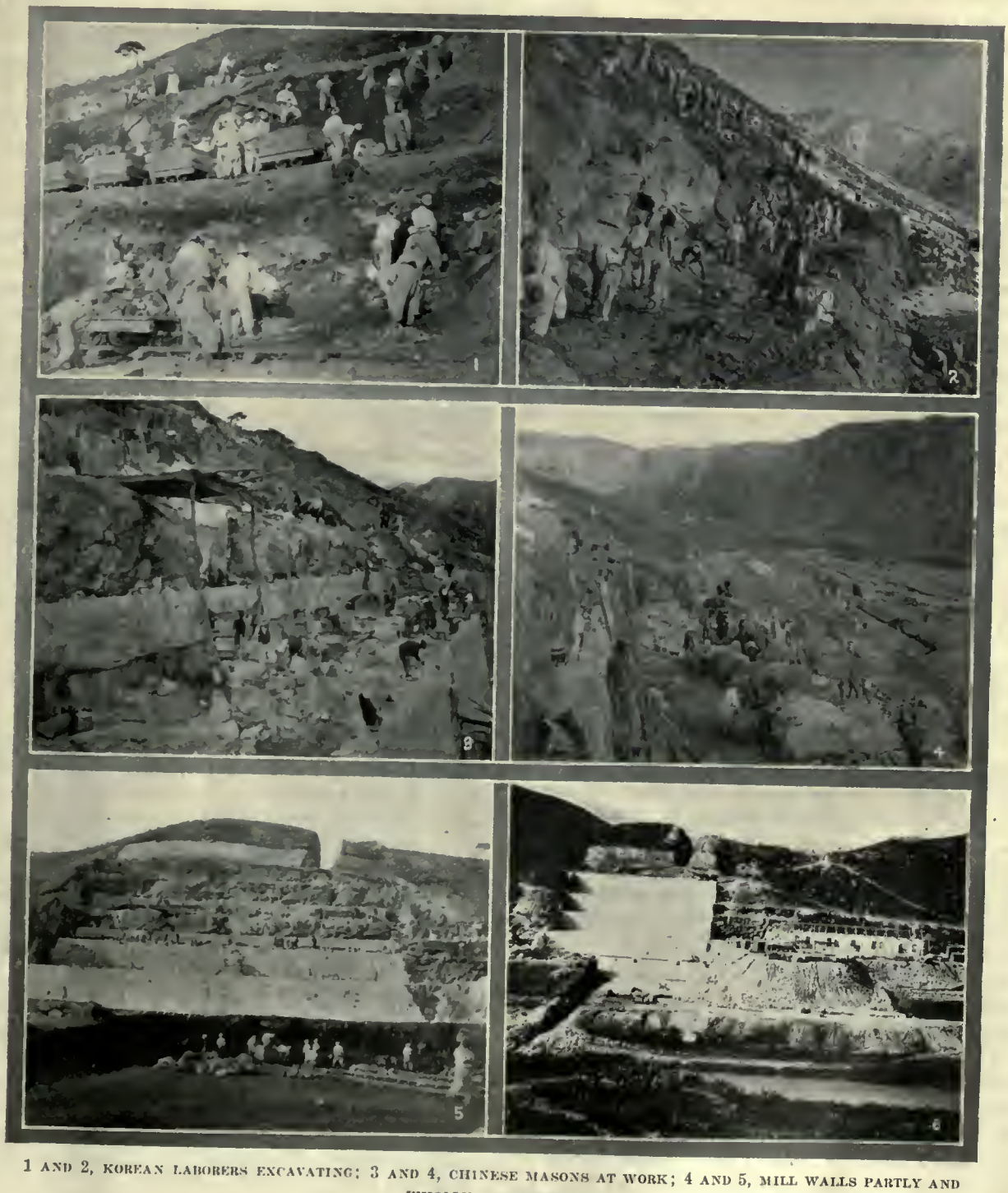
FLOW-SHEET, CHOSEN MILL.

The next unit consists of an 80-leaf semi-gravity Butters filter. From the filter the pulp passes to waste, with the gold-bearing solution to clarifying-tanks, and thence to the zinc-precipitation boxes. The gold precipitate is to be cleaned in a vacuum-box, and after drying to be melted in a Faber du Faur tilting furnace.

All the excavations and retaining walls for this pant have been competed and details of cost will be given here. On account of the low price of labor at Kosung, these costs are especially low and probably constitute a record. Management and office expenses are excluded from these items. All material from excavations was handled by pick and shovel, after blasting, and trammed in cars from 100 to 600

ft. The seale of wages paid was: coolies, 20c. per day; miners, 25c.. and bosses, 30c. to 40c. At these rates the laborers boarded and supported themselves and their families. It is hardly neeessary to state that the eost of high living does not bother the Korean. Ten hours was the working day. By a judicious weeding out of the useless and incompetent, careful selection of the native bosses, and a strict adherence to rules laid down for their protection by the superintendent, good results may always be obtained from Korean labor. The site was chosen by the general superintendent, the benches were laid off, and the excavations listed opposite were made.

Bench.	Dirt, cu. yd.	Rock, cu. yd.
Tramway	251.00	562.00
Engine room	415.00	830.00
Shops, etc.	3,200.00	80.83
Above ore-bin	450.00	81.20
Ore-bin	944.17	1,899.35
Battery floor	720.70	1,115.41
Tube-mill floor	1,269.30	2,538.70
Agitator floor	1,561.50	785.80
Fliter floor	801.85	16.72
Sump floor	709.90	211.45
Lower drain	1,105.55	27.60
On filter floor, extra	560.00	8.26
Totals	11,988.97	8,157.32



1 AND 2, KOREAN LABORERS EXCAVATING; 3 AND 4, CHINESE MASONS AT WORK; 4 AND 5, MILL WALLS PARTLY AND WHOLLY COMPLETED.

The total net cost of excavation per cubic yard is $0.330325. As over one-third of this material was rock, the actual cost is very low. All the cars, track, shovel, picks, hammers, ties, crowbars, etc., were turned over in good condition for use at the mine. Only those lost or broken, and the depreciation on them, are here charged. Owing to an unusually mild winter for Korea, the work was continued during

the winter months, only stopping on stormy days. Gloves were supplied during the coldest period. The coldest was 2° below zero, but the temperature quickly rose to 12°F. when the sun came out. The laborers found it expedient to work well to keep warm, although a Korean can stand a surprising lot of cold.

The detailed costs were as follows:

Item.	Cost.	Cost per cu. yd.
Native labor	$4.125.97	$0.204800
Superintendence	1,400.00	0.069485
Shovels	31.00	0.001535
Picks	2.96	0.000335
Pick steel	3.83	
Car rails, spikes, etc.	38.50	0.001910
Car oil	0.37	0.000015
Drill steel	29.54	0.001465
Hammers	3.00	0.000146
Hammer handles	10.29	0.000510
Pick handles	9.11	0.000450
Gellgnite	666.50	0.033180
Fuse	112.75	0.005595
Detonators	57.90	0.002875
Hand axe	0.75	0.000035
Wooden ties	12.00	0.000595
Twine	0.40	0.000020
Crowbars	1.50	0.000070
Cotton gloves	9.00	0.000455
Rope	5.90	0.000295
Nails	0.85	0.000045
Depreciation on cars	7.50	0.000385
Charcoal	113.90	0.055665
Lumber	9.25	0.000465
Total	$6,654.79	$0.330315

Chinese Contract Labor

The contracts for the masonry walls were let to Chinese from Manchuria, who are excellent masons. The walls were built up of rough cut stone, granite laid in lime mortar, all nicely faced on the exposed surface. The Chinese have their own way of working as to time and are best left alone. They start early and continue work as long as the light lasts. But every half-hour they must stop for the customary smoke and rest, which lasts from 15 to 20 minutes. In net working time they put in about nine hours per day. A foreigner hiring these Chinese by the day would soon find himself in difficulties, as they would put up all kinds of tricks on him, and lying is regarded by them as a virtue when used against a foreigner. In construction work constant supervision is necessary. The Chinese are liable to work in rotten stones or to slight the mortar if not watched. Foreigners should be careful when exasperated not to strike these Chinese. Vitriolic language and a 'cussing out' in three languages, also a comparison of their work, generally has the desired effect. On the other hand, there is a certain proportion of worthless laborers of which even contractors cannot get rid. In my experience in handling many kinds of labor, I have found certain human beings who are positively not worth their salt and who would even spoil a rough stone if allowed to handle it. All the soap-box orators seem to carefully avoid the remedy for this class. To say they would put them at something they could do would be superfluous, for such people cannot drink water without mussing it.

The contract for the first masonry walls (No. 1, 2, 3, and 4) were let April 9, 1912, and the walls were completed by May 28. The contents of the walls and dimensions were as follows:

No.	Ft. long.	Ft. high.	Ft. thick.	Cu. ft.
1	130	13	3.00	5070.0
2	130	15	2.75	5362.5
3	130	15	2.75	5362.5
4	130	20	3.50	9100.0

Or, in all, 24,895 cu. ft. or 922 cubic yards.

Contract price (including labor and tools)	$2,025.00
Lime, 228,835 lb. at 37c. per 100 lb.	855.75
Sand—hauling, $48; labor, $18	66.10
Hauling stone from quarry	154.75
Rope, 25.5 lb. at 20c.	5.10
Use of company cart at 25c. per day	4.75
Lumber and timber	11.97
Surveying	7.50
Charcoal, 15 boxes at 85c.	12.75
Gellgnite (147 sticks), 60 detonators, 180 ft. of fuse	9.90
Special courier, re rinderpest quarantine	1.20
Hauling, company cart, 13.5 days, at $3	40.50
Total	$3,195.28

This gives an average cost of $3.46556 per cubic yard of masonry. The cost of material per cubic yard of masonry was:

Labor and tools	$2.196310
Lime	0.928150
Sand	0.071700
Hauling	0.216920
Timber and lumber	0.012950
Surveying	0.008135
Charcoal	0.013825
Gellgnite, detonators, and fuse	0.010735
Miscellaneous	0.006850
Total	$3.465545

The same contractors were given the work for the second and final contract, against some keen rival bidding on the part of other Chinese and Korean contractors. The contents of the masonry walls on this contract were as follows:

	Cu. yd.
Ore-bin end walls, east and west	54.26
Battery floor, east	12.22
Battery floor, end walls, west	16.66
Tube-mill floor, end walls, east	35.00
Tube-mill, end walls, west	32.66
Agitator floor, end walls, both	47.00
Filter floor, one wall	17.82
Sump floor, one wall	30.55
Filter floor retaining wall, 130 by 13 by 3 ft.	187.77
Sump floor retaining wall, 65 by 10 by 2.5 ft.	120.37
Total	504.31
Shop wall foundations contained	70.00
Walls (net) contained	152.00
Total	222.00

Totals for both walls, 20,957.50 cu. ft. or 776.31 cu. yd.

Costs

		Per yd.
Contract price, including labor, tools, sand, and hauling	$1,150.00	$1.481365
Lime, 167,368 lb. at 37c. per 100 lb.	622.49	0.801865
Drill steel (both contracts), 348 lb.	8.70	0.011205
Charcoal, 10 boxes	8.50	0.010945
Gellgnite, detonators, and fuse	0.94	0.001210
Surveying	6.40	0.008240
Lumber and cement	18.35	0.023635
Extra bonus to contractor	25.00	0.032205
Total	$1,840.38	$2.37067

COST FOR ALL WALLS

	Cu. yd.	Rate.	Amount.
First contract	922.00	$3.46554	$3,195.280
Second contract	776.31	2.37067	1,840.385
Total	1,698.31		$5,035.665

This gives an average cost of $2.965105 per cu. yd. for all masonry work completed. The final cost of excavating, $0.330325 per cu. yd. for both dirt and rock, and the final cost of the masonry per cubic yard are probably record figures for the locality.

All was not easy by any means. Many difficulties came up during construction, the most annoying of which was a quarantine for rinderpest clapped on the Korean cattle by the Japanese. As these cattle brought the lime in, we were compelled to suspend work for several days, finally overcoming the difficulty by relaying the lime bags to other cattle, at no additional cost to us. The Korean lime is of very high quality and makes excellent mortar. The average load that these Korean cows and bulls will carry is 300 lb., but a large bull will carry 400 lb. Contracts for lime in quantity were given to Korean contractors. I might mention right here that written contracts with Koreans generally are worthless, for if they make nothing they will soon come around with a tale of awful disaster to their distant family which needs their immediate attention, for which, like the Japanese, they are "very sorry," of course—that is, that they are caught at it.

Converter Practice at Bogoslovsk

*The converter plant of the Société Minière de Bogoslovsk, on the eastern slope of the Ural mountains is quite out of date (having been started in 1885) and consists of modified Manhès converters, the tilting being performed by hand; a modern plant is now being built. For reasons which will be given later the converters will be of the ordinary 4 to 6-ton type, although under other circumstances I should have preferred the large basic converter now in vogue.

The liquid slag from the converters which is not required for fluxing purposes is taken by the crane and tilted into the water-jacketed forehearth, in such a manner that the stream of liquid slag meets the slag and matte as they overflow into the forehearth. When, two years ago, this method of dealing with the bessemer slag was started, it was noticed that the dump slag was somewhat richer in copper than previously, undoubtedly due to a little rich bessemer matte going over; this was confirmed when a small settling pot was used; the matte which settled there being considerably higher in copper than the bulk of the matte tapped from the main forehearth.

The average copper produced from the Bogoslovsk company's ores contains only about $15 worth of gold and silver per ton, but, on account of its exceptionally high quality, it has been marketed as B.S. ingot copper. However, circumstances have arisen in the Russian markets which make it desirable to cast a certain proportion of the production into anodes for electro-copper. So as to obtain a return from the precious metals, I have introduced a system of concentration of the gold and silver in the anodes; this is attained in the following manner:

A first charge of matte is tilted into a converter and blown to slagging point and the slag drawn off; after the slag is removed from the converter a second charge is added and blown to slagging point, the slag is run off; after the slag is removed from a third charge the converter holds a working charge of white metal (about 65% Cu). This is blown until the pokers used for clearing the tuyeres show signs of metallic copper; the converter is hastily tilted and the white metal run into a special ladle and transferred to an adjoining converter, to be blown into blister for ingot copper; the copper bottom, containing practically the whole of the gold and most of the silver that was in the original matte, is cast into anodes. With very little practice it is easy to make bottoms representing the desired proportion of the total output of copper. With a large basic converter I fear it would not be possible to carry out this concentration of precious metals, and the blowing power at our disposal would not give sufficient pressure to work converters beyond 4 to 6 tons capacity.

The converters run about six charges without repairs; the lining consists of 80% silica sand and 20% plastic clay. The old linings are classified into rough (slaggy portions), and fines (—4 mm.); the fines are fed onto a Francis rapid concentrator, the concentrates from which, assaying 35% Cu, are briquetted with tar from the company's adjoining charcoal ovens, and thrown into the converters. The tailing (assaying 1%) constitutes an excellent material for mixing with fresh lining; if desired, tailing retaining only 0.25% of copper may be obtained by crushing the material down to 1 mm. before passing over the concentrating table.

*Excerpt from a paper presented before the Institution of Mining and Metallurgy, February 20, 1913.

Determination of Ash in Coal and Coke

By JAMES SMUCK

*Weigh one gram of finely ground coal or coke into a weighed platinum dish having a diameter of 2 to 3 in.; add just enough pure alcohol to produce a thin paste with the sample, and by manipulating the dish in the hands, run the mixture up around the sides of the dish, distributing a thin uniform film on the sides and bottom. Now evaporate off the excess of alcohol carefully by warming the dish, and place over a Bunsen or in a muffle furnace. In the former instance, heat the dish to redness and then place over a blast-lamp turned on full. In either case the carbon burns off readily. The success of the method depends upon distributing the finely ground sample over a large area which is easily accomplished by the method outlined. Twenty minutes is sufficient time for a determination, while the method in general use requires at least an hour, and the results check closely.

*Abstract from *Chemist-Analyst.*

Adequate Sampling in Modern Mill Practice

By Donald F. Irvin

Any reference to sampling and sampling methods postulates a material or materials to be sampled, which in modern metallurgical practice will be found to be extremely varied, even in a comparatively simple plant, and more so as the scheme of treatment is amplified and extra care is taken to secure proper and sufficient sampling. In the columns of technical publications the term sampling most often refers to underground development, though there is a much larger variety of samples taken in the average reduction plant treating precious-metal ores than in mine work, and a greater degree of accuracy must be observed in their selection. The following notes are based upon the current practice at a mine where hand sorting, wet concentration, and cyanidation are employed.

Grades of Ore Treatment

The mining department delivers two classes of ore to the metallurgical department, one being hand-sorted high grade in sacks, and the other the regular grade of mill ore to the crusher bin. The mill ore is crushed and screened over a grizzly, the fine passing directly to the mill-bins, over a continuous weighing and recording machine, and an automatic sampler, while the coarse ore is hand sorted. From the latter a small amount of high-grade ore is picked out, as well as some waste, and the remaining coarse ore joins the fine before reaching the weighing machine. In the milling department three products are made: coarse concentrate from jigs, fine concentrate from tables, and tailing, which passes to the cyanide plant. Thus there are six grades of ore in the milling department which require assay. These are handled as follows: The sacked ore from the mine, picked ore from the sorting belt, and jig concentrate, being in 100-lb. sacks, are each allowed to accumulate until there is a ton of any one grade, and then a sample is taken from the stacks, representative of the ton lot. This sample is checked later by one taken when the concentrate is loaded into cars at the railway shipping point, and another sample is obtained at the smelter. Waste is sampled daily by a grab sample.

Handling Concentrate

There remains the ore passing the automatic sampler to the mill-bins and the table concentrate. Inasmuch as the former is the basis for tonnage calculations, it is sampled for moisture as well as metal content, but the latter assay is not the one which is used in crediting the metallurgical department with 'ounces fine metal received', as will be shown later. All the concentrate is flumed to concentrate storage-bins, where excess water is removed, and in regular succession each binful is drawn out upon a cement floor, where it is sampled by spoon sampler, and then sacked in 100-lb. sacks. This concentrate, like the high-grade ore, is resampled upon arrival at the shipping point. It should be understood that all concentration is done in water, and thus no cyanide solution touches the concentrate at any stage of treatment. In addition to gold and silver, the concentrate and high-grade ore are assayed for copper and lead.

With the arrival of the concentrator tailing at the regrinding section of the mill, additional determinations are required by the introduction of cyanide solution, carrying dissolved metals and chemicals. Also, here begins a need for closer pulp sizing than in concentration processes, and a stricter regulation of pulp thickness. Above the classifiers supplying the regrinding tube-mills is placed an automatic Scobey sampling equipment, which takes a sample of the concentrator tailing and thus provides a head sample for the cyanide plant, as well as indicating the work done by concentration. This sample, however, is not taken as the absolute measure of that sent to the cyanide plant.

Cyanide solution first meets the pulp where the classified sand enters the tube-mills, and the dissolving of metals, with variation of cyanide content, continues in the tube-mills, reclassifying machinery, and thickening-tanks handling the reground sand. This sand having shown a pretty constant value, no regular assay of it is made. The original slime sent from drag-classifier A in the tube-mill department is thickened in mechanical settlers and then in a dewatering filter; from that point traveling to the agitating equipment jointly with the thickened slime from the reground sand. No separate assay of this thickened natural slime is made, as it bears a fairly constant relation to the value of the concentrator tailing, nor is there an assay of this composite feed to the agitators, for reasons given later.

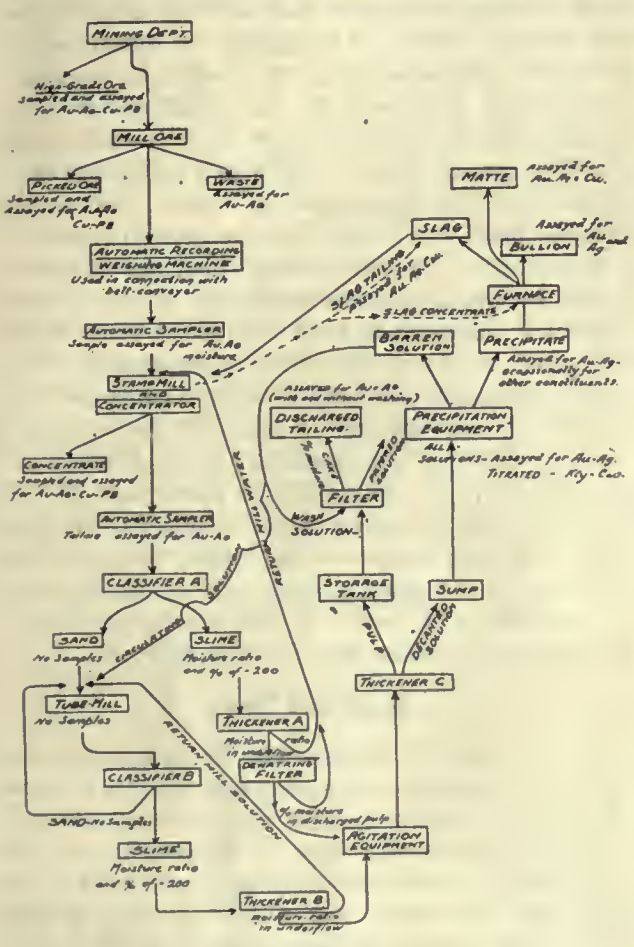
Sampling Sand

Included in this pulp is sand reground in tube-mills, coming from an old dump. This sand is sampled and assayed for gold, silver, and moisture, as it comes into the plant, and is weighed in an automatic recording balance, of tripper type, designed by the Avery Scale Co. of Milwaukee as a wheat scale. It is a very satisfactory machine for the purpose. After passing through a series of agitators, arranged for continuous agitation, the cyanide pulp is thickened and the decanted solution is diverted to a sump tank, while the thick pulp is stored in a filter-plant supply-tank. The term 'storage' is in this case merely a relic of the earlier nomenclature of cyanidation, as the pulp is flowing into and through the tank steadily and the variation of level of pulp does not exceed 1½ to 2 ft., as a rule.

From this tank a daily pulp sample is taken as a preliminary test of the filter tailing to be expected next day. This sample is, of course, a washed sample, and is a check upon the progress of the dissolution of metal in the process of agitation.

At the filter-plant four pulp samples are taken, the exigencies of the operations having developed a

need for that number. Three samples represent the three shifts on the filter-plant, and these samples are taken by hand in the tailing sluice. Because of the extremely tenacious and heavy lumps of filter cake, a Scobey sampler could not be depended upon to keep in operation, much less take a true sample; hence the hand sampling. The fourth sample is a composite of all three shifts, and is taken directly from the cake on the filter leaves. Filter cake varies in thickness from 1 to 1¼ in. Each of these four samples is prepared as two samples, a washed and an unwashed, the fourth sample always showing a lower soluble difference than the three taken from



SCHEME OF SAMPLING

the tailing sluice. This shows that filtration and displacement of soluble metals in the cake are good, but that soluble metals are introduced into the sluice by the use of weak barren solution, which is the means of dropping the filter cake. The cake sample stands as evidence of the degree of efficiency attained in the filter-plant, but the average of the samples taken from the sluice is the actual measure of metallurgical loss, and as such is the base from which all metallurgical returns are figured.

At this plant it is customary to regard

$$\frac{\text{metal content of tailing} + \text{recovery by cyaniding} + \text{recovery by concentrating}}{\text{total tonnage}}$$

as a measure of the average assay of the mill ore.

This figure is, of course, corrected for waste picked from the sorting-belt and for old sand tailing brought into the plant, at the tube-mills, as before mentioned. Although a calculated figure, it has been double checked for weeks at a time, by hand and by machine, and the three have been found to be reasonably close together. The calculated figure has been adopted as the standard, for the same reason that extraction figures are based upon bullion returns rather than upon indicated extraction as shown by assays. Hence, values taken for mine ore and concentrator tailing are not based upon the evidence of the automatic samplers.

Solution Assays

Two classes of pregnant solution are handled, one being the solution expressed as the filter cake is forming, and the other being the effluent derived from washing the cake with barren solution. No water wash is given. These two solutions are assayed and titrated separately for Au, Ag, KCN, and CaO, and after being precipitated are assayed and titrated again. There are other solution assays made daily, one being the solution in No. 1 agitator; another, the solution in the pulp discharged from the filter-plant. Besides these, a solution sample is taken for assay, occasionally, from the tank containing the excess wash solution, although as this solution is changed daily, there is little or no enrichment noted.

Precipitation is carried on in two circuits; the wash solution being completely precipitated, while the solution used in building up the agitator pulp is only partly precipitated. This method provides two classes of precipitate as well as two grades of pregnant and barren solution. The precipitate is assayed for Au, Ag, Cu, and Zn, as well as moisture.

It might be noted here that the effluent barren solution from the zinc presses is sampled by a ⅜-in. nipple tapped into the lower side of the main effluent-solution pipe. The nipple is fitted with a rubber tube and adjustable pinch-cock, which supplies a 2-litre bottle, the flow being regulated so as to fill the bottle in 24 hours.

During the first months of operations, before the nature of the precipitate was well established, complete analyses of it were made, and the following constituents, which make up 98 to 99% of the whole, were determined: Au, Ag, Cu, Zn, CuO, ZnO, Fe_2O_3, Al_2O_3, $CaCO_3$, SiO_2. After a time this was discontinued and only the first four metals were determined, the others being fairly constant.

Bullion Samples

When fluxing and fusing have been finished, the resulting slag and bullion, with the small quantity of matte accumulated from time to time, are separated and prepared for further treatment. The bullion is sampled while molten, by a dip into the potful of metal, the small portion taken being granulated by pouring it down an inclined plane, in a gentle stream of water. This sample checks more closely with smelter and umpire assays than bored samples, although previously three holes were bored in both top and bottom of the bars of bullion to a depth of two inches. The average of differences in silver content of the bars, between the bored and dipped samples, over a total of 60 bars sampled, shows 0.08% less for the dipped sample. The proportion of silver to gold by weight is over 200 to

1 in bullion. Bullion assays are made regularly for gold and silver and occasionally for copper. The zinc content is negligible. All base metal is usually considered as copper.

The slag is not assayed now as it comes from the pot, but is returned to the stamp-mill, where a special run with one battery is made monthly, and the crushed slag is concentrated on one Wilfley table. The battery clean-up and table concentrate are remelted as bullion, thus making a closed circuit. The slag tailing is caught in a concentrate-bin, and a sample taken from the bin in the same manner as for ordinary concentrate. Thereafter it is shipped to the smelter. The slag assay is made for gold, silver, and copper, it containing enough copper to be valuable for that metal alone.

Matte Treatment

Matte is not disposed of separately, but is resmelted in such a manner as best to clean it of gold and silver, and when reduced sufficiently in grade is broken up and shipped directly as concentrate. Generally, two passages of matte through the furnace will reduce it to a grade suitable for shipment, but it is a difficult product to handle satisfactorily, at best. It is worthy of note that this matte carries almost no gold but much silver, resembling chemically and physically stromeyerite.

All of the solution samples mentioned thus far are tested in the assay office and reported daily, but for the regulation of the treatment of pulp during the course of the three shifts, a titration equipment is in use in the cyanide plant itself, and titrations are made upon the solution contained in the first agitator of the series. It is not found necessary to make tests upon the succeeding tanks, as experience proved the course of extraction and attendant decrease in cyanide content to be so regular that it is now known to a sufficiently close approximation by the strength of solution in the first agitator. Cyanide consumption remains fairly constant, and as six titrations are made in 24 hr. there is never any very sudden change in the strength of the solution.

With the titration equipment is included a small set of scales, and a flask of known volume, wherewith the specific gravity of the pulp passing through the tanks is noted at the same time that the titrations are made. An increasing ratio of liquid to solid in the agitation pulp means decreasing capacity, increased amount of weak solution to run to waste, and greater tendency for the sandy particles of the pulp to settle in the agitators, or in the connections between them.

Screen Tests

There are other tests made at the assay-office, not requiring fire assay, namely, screen tests, and any special volumetric determinations. Screen tests are, naturally, required only in the regrinding and classifying sections, and the finished product from drag-classifiers A and B are both screened through 200 mesh and the per cent of –200 material noted daily on one sample each from the three shifts. Formerly the sand product from the drag-classifiers was screened also, but as it now is dependent upon mechanical upkeep of the machine for freedom from slime, rather than regulation of pulp, screen tests are no longer made upon it.

Occasional screen tests are made also upon the underflow, and feed to the vortex classifier, which prepares the battery pulp for concentration. Inasmuch as this machine depends upon positive pressure of water rather than the static balance of the pulp in a drag-classifier, regulation is not effected in the same manner.

The pulp as it enters the No. 1 agitator is resampled for a screen test, and the per cent of –200-mesh material contained therein is an actual measure of the fitness of the pulp for agitation: 85 to 90% of –200 mesh being the proportion sought.

The same samples from the classifiers are estimated by hydrometer for their liquid to solid ratio (as they operate best at 5 or 6 to 1), and any deviation from this proportion is noted and proper changes made to restore it to the desired ratio.

The water overflowing from thickener A is also tested by hydrometer to obtain the liquid to solid ratio, for whenever it fails to overflow clear water, the small weight of fine slime in the muddy water being returned to the head of the mill contains metal which will salt the sample taken by the automatic sampler, between the concentration department and the cyanide plant. Formerly the percentage of –200-mesh pulp discharged by the tube-mills was observed daily, but this sample is no longer taken, as the overflow of the classifier is a perfect indication of the grinding: a result of the maintenance of a closed circuit by the classifier and tube-mill.

Occasional Tests

Among other determinations regarded as occasional or special in their nature are analyses of chemical supplies received—lime, cyanide, and zinc dust—and any determinations of constituents of cyanide solution other than the daily titrations for cyanide and lime. These are made from time to time, but not daily, with special volumetric work on cyanide solutions when conditions seem to require it.

No mention has been made of experimental work, which, in the nature of such things, requires a complete determination of metals and chemicals present, with screen tests, specific gravity determinations, per cent of extraction obtained under varying conditions, and other points. It will suffice to say that there is experimental work carried on relative to concentration and cyanidation questions pertaining to this property, and in every case a full and instructive set of samples is taken, proportionate in number and accuracy to the experimental equipment and the nature of the information sought. Miniature air-agitators, a small pressure-filter, and two small concentrators (one of the Wilfley type and the other of the Deister) comprise the bulk of the special testing equipment that cannot be improvised from the regular assay-office supplies.

Apart from any question of absolute value lost in discharged tailing, whether 50c. per ton, $1, or $3, I believe that a greater disrepancy and more misleading data can arise from inaccurate estima-

tion of ore received for treatment, and more importance attaches to it, than to any other factor in the field of metallurgical control, and this increases with the value of the ore. For instance, it seems folly to debit a reduction plant with 105 tons of ore as a day's run, based upon 70 carloads, each of which is estimated to contain 1.5 tons of ore, when 15 or 16 cars may be drawn from a wet chute, with a moisture content of 6 to 10%, and the balance of the cars perhaps containing ore with 2 to 3% moisture. Also, some of the ore may be slabby and may occupy much space. In this case, when the mill returns 90% actual recovery upon 90 or 95 tons of ore, dry weight, it appears to have made a bare 80% recovery or possibly less, upon the false assumption of 1.5 tons per car. The opposite result may be reached with fine dry ore, but it is seldom that such ore comes from underground in any quantity.

Small track scales over which the ore-cars may be run furnish a satisfactory outlet for the small property that cannot afford an automatic recording machine for weighing the ore, and the absolute accuracy attending all metallurgical calculations involving tonnage thereafter justifies their purchase many times over. There are few mills that cannot admit such construction between hoist-bin and crusher, and with the gross weight thus established accurately, it is an easy matter to take moisture samples by some form of automatic sampler. At the property mentioned in this article the recording weigher checks to within 0.5% of absolute accuracy.

Tailing Samples

Tailing, whether sand or slime, is generally low in value and easily sampled, so that the operator of a plant can readily obtain his metal input, metal loss, and net production at once, regardless of any intermediate steps, and no matter how important they may be for the purpose of proper regulation of the daily course of treatment. Accurate sampling of mill pulp of average value presents no great difficulties, if only the sample cut may be taken where the stream is dropping from one level to another. If this is not possible, a launder cut-out is well worth installing, as sand and heavy particles traveling on the bottom of the launder make pulp samples that are dipped from a stream flowing in a launder almost worthless. The simple fact that a sample is valuable only as it embodies the information sought, regardless of whether it is taken according to traditional methods or not, and that its value is proportionate to the degree of accuracy obtainable under the given set of conditions, should be the basis of sampling. Thus, a thickening-tank performs the function of dewatering, and under any ordinary conditions the ratio of moisture in the feed and discharge show its efficiency once the tonnage of dry pulp sent through it is known. When such a machine has become established in routine, between certain limits, there is no feed for further sampling. On the other hand, a vacuum-filter operates both as a dewatering machine and as a displacer of dissolved metals. This is important enough to justify frequent samples, to obtain the percentage of efficiency of each branch of its functions, and can never be omitted without loss of valuable data.

A consideration of the real informative value of each step in sampling has governed the final form of the sampling schedule on this property, and from that logical standpoint has been found to be satisfactory. Other samples are possible, but they have been considered to be of no economic advantage; nor is this due to any false economy in assaying expense, as the assay office turns in a monthly bill to the metallurgical department for 1500 to 1800 assays, each one of which is known to 'pay its way.'

Chilean Iron Ores

The Tofo iron deposits recently purchased by the Bethlehem Steel Co. from the French company mining them, are situated near the bay of Cruz Grande, in the province of Coquimbo, Chile. The broken ore is transported on a Decauville railway to the central station of an aerial ropeway (Pohlig system), 7.2 km. long, connecting with Cruz Grande, the present ropeway having a capacity of 40 tons per hour. A quay with a 35-metre bridge has been built in Cruz Grande harbor, which allows vessels to receive their cargo direct by chute, the present loading capacity being 1000 tons per diem. The bay is well protected from northern and southern winds, but is still open to the west. The aerial ropeway, it is understood, is already being doubled by the Société des Hauts-Fourneaux du Chile, but it is evident that it must be still further increased to supply the Bethlehem steel works, as the present capacity, allowing for break-downs and bad weather, is estimated at only 25,000 tons per year. To work the mines the Bethlehem-Chile Iron Mines Co. has been incorporated in Delaware, with a capital stock of $4.000,000 in 5% bonds. The financing, it is understood, will be done mainly by the bankers who are associated with Mr. Schwab. It is proposed to build a fleet of 10 steamers of 15,000 to 20,000 tons capacity to transport the ore through the Panama canal to the works.

Eagle River Mines, Alaska

According to the U. S. Geological Survey, the first gold mining in Alaska was done in the so-called Juneau gold belt, where operations were begun over 30 years ago. The value of the gold produced in this region is more than $50,000,000. Most of this gold has been taken from the famous Treadwell and other mines near Juneau. The auriferous belt is, however, known to stretch for some 50 miles to the north, and includes the Eagle River region, described in a report by Adolph Knopf, just issued by the Survey as Bulletin 502. This report, unlike many others on mining districts in Alaska, which are of a reconnaissance character, treats of the region in detail. It is entitled 'Geology and Mineral Resources of the Eagle River Region, Alaska,' and is accompanied by a topographic map on a scale of a mile to the inch, with 100-ft. contours, by J. W. Bagley, and a detailed geologic map on the same scale. Gold-bearing lodes constitute the only mineral resources of the Eagle River region now under development.

Cost Sheets for a Dredging Company

Below are presented the forms used by the Ophir Gold Dredging Co. for keeping track of dredging data, expense, and income. They are published through the courtesy of the company.

DREDGING DATA

MONTHS	BULLION BARS			CU. YARDS DREDGED.			VALUE PER CU. YD.			DIGGING HOURS			YDAGE PER DR'M			AVERAGE DEPTH			AREA DREDGED (ACRES)			AREA UNDREDGED (ACRES)	% TIME DIGGING.			REMARKS
	No.	PERIOD FROM	PERIOD TO	RUN	MONTH	TOTAL	RUN	MONTH	TOTAL	RUN	Mo.	TOTAL	RUN	Mo.	TOTAL	RUN	Mo.	TOTAL	RUN	MONTH	TOTAL		RUN	Mo.	TOTAL	
JAN																										
FEB																										
MCH																										
APR																										
MAY																										

BULLION DATA

MONTHS	BULLION BARS			TIME - DAYS			OUNCES						GOLD			SILVER			GROSS			SMELTING CHARGE			NET			VALUE PER OZ.		
	No.	PERIOD FROM	PERIOD TO	RUN	Mo.	TOTAL	BEFORE MELT RUN	BEFORE MELT MONTH	BEFORE MELT TOTAL	AFTER MELT RUN	AFTER MELT MONTH	AFTER MELT TOTAL	FINENESS	FINE OUNCES	VALUE	FINENESS	FINE OUNCES	VALUE	RUN	MONTH	TOTAL	RUN	MONTH	TOTAL	RUN	MONTH	TOTAL	RUN	Mo.	TOTAL
JAN.																													
FEB																													
MCH.																													
APR.																													
MAY																													

INCOME

MONTHS	OPERATING INCOME: BULLION FINE BULLION	BULLION BASE BULLION	BULLION SUNDRY BULL.	PLATINUM	MISC.	DISCOUNTS	MONTHLY TOTAL	TOTAL TO DATE	PER YD. MO.	PER YD. TO DATE	PROFIT OPERATING: MONTHLY TOTAL	TOTAL TO DATE	PER YD. MO.	PER YD. TO DATE	REMARKS
JAN.															
FEB.															
MAR.															
APRIL															
MAY															
JUNE															
JULY															
AUG.															
SEPT.															
OCT.															
NOV.															
DEC.															

INCOME

MONTHS	OTHER EXPENSES						OTHER INCOME					NET PROFIT		REMARKS
	LAND EXAMINATION	MISC.	DEPREC.			MONTHLY TOTAL	TOTAL TO DATE	RENTAL	MISC.			MONTHLY TOTAL	TOTAL TO DATE	MONTHLY TOTAL	TOTAL TO DATE	
JAN.																
FEB.																
MAR.																
APRIL																
MAY																
JUNE																
JULY																
AUG.																
SEPT.																
OCT.																
NOV.																
DEC.																

EXPENSE

MONTHS	OPERATION								REPLACEMENT AND REPAIRS									REMARKS
	LABOR	POWER	WATER	SUPPLIES	MISC.	MONTHLY TOTAL	TOTAL TO DATE	COST PER YD. MO.	COST PER YD. TO DATE	LABOR	POWER	SHOP CHARGES	EQUIPMENT & SUPS.	MISC.	LIVERY & STABLE	MONTHLY TOTAL	TOTAL TO DATE	COST PER YD. MO.	COST PER YD. TO DATE	
JAN.																				
FEB.																				
MAR.																				
APRIL																				
MAY																				
JUNE																				
JULY																				
AUG.																				
SEPT.																				
OCT.																				
NOV.																				
DEC.																				

EXPENSE

MONTHS	GENERAL EXPENSE															SUMMARY OF EXPENSE								REMARKS
	SHOP MAINTENANCE	DREDGE OFFICE	AUTO	INS.	TAXES LICENCE	DEPREC.	MANAGEMENT & SAN FRAN. OFF.	BULLION EXPENSE			MISC.	MONTHLY TOTAL	TOTAL TO DATE	COST PER YD. MO.	COST PER YD. TO DATE	OPERATION	R. & R.	GENERAL	MONTHLY TOTAL	TOTAL TO DATE	COST PER YD. MO.	COST PER YD. TO DATE	
JAN.																							
FEB.																							
MAR.																							
APRIL																							
MAY																							
JUNE																							
JULY																							
AUG																							
SEPT																							
OCT.																							
NOV.																							
DEC.																							

Lead Production in 1912

The final figures of the production of lead in the United States in 1912 have just been published by the United States Geological Survey. These figures have been compiled by C. E. Siebenthal, of the Survey, from reports of the output of each lead smelter and refinery in operation in this country in 1912. The leading features of the report given herewith. Three tables are included. The first one shows the estimated world's production. Following it is a table showing the lead smelted in this country from ore from each lead-producing state and from each foreign country furnishing ore for treatment. These figures include soft lead, lead content of bullion (that is, 'work lead') and antimonial lead, and their total necessarily does not agree with the total refined lead output of the country, shown in the third table. Figures of production from 1907-1912 have been re-east and the new table supersedes earlier ones.

The refined lead product cannot be apportioned according to source of ore, owing to the fact that lead refiners treat smelted products whose origin may, as in custom refining, be unknown to them, the identity of the ore, and thus its original source, being preserved only as far as the smelter. Accordingly the table showing source of lead smelted or refined in the United States is based on smelter figures. It includes 'pig' lead reported by all smelters using Mississippi Valley soft lead ores and 'lead' produced at all other lead smelters in this country. A part of the product reported by smelters operated in conjunction with refineries is in terms of refined lead. A like part of the antimonial lead product is thus eliminated from the 'lead' produced and appears only in the figures of

THE WORLD'S PRODUCTION OF LEAD 1906-1911.

APPORTIONED ACCORDING TO SOURCE OF ORE.

Country.	1906	1907	1908	1909	1910	1911
Australia	102,514	106,923	131,174	85,098	108,907	109,789
Austria-Hungary	18,078	16,975	16,094	15,432	19,290	21,605
Belgium	24,471	28,417	39,352	44,423	44,864	33,951
Canada	26,235	13,338	18,849	22,928	16,535	11,795
France	28,219	25,353	28,770	29,652	22,266	25,353
Germany	166,117	157,156	180,887	185,076	176,258	177,801
Great Britain	26,455	30,203	32,738	31,085	32,628	29,872
Greece	13,338	15,212	17,637	16,865	18,519	15,763
Italy	23,479	25,243	28,660	24,361	15,983	18,408
Japan	3,858	3,858	3,197	3,748	3,858	3,858
Mexico	59,524	79,366	121,253	130,071	133,048	132,276
Russia	331	110	110	882	1,323	1,102
Spain	199,406	204,848	202,052	202,823	211,531	189,155
Sweden	882	882	331	220	441	2,866
Turkey in Asia	10,582	11,464	13,007	13,338	13,999	13,668
Other countries	220	220	551	6,393	17,306	20,944
United States (domestic)	350,153	372,252	310,762	363,319	389,211	405,863
Total	1,053,862	1,091,820	1,145,424	1,175,714	1,225,967	1,214,069
United States percentage of world's production	33.2	34.1	27.1	30.9	31.7	33.4

PRIMARY LEAD SMELTED OR REFINED IN THE UNITED STATES.

APPORTIONED ACCORDING TO SOURCE OF ORE.

	1906	1907	1908	1909	1910	1911	1912
DOMESTIC ORE:							
Alaska	8	.....	3	69	75	51	45
Arizona	2,884	2,418	1,464	1,507	948	3,428	3,891
Arkansas	.....	15	.....	14	.....	15	.....
California	432	938	515	977	1,207	615	811
Colorado	50,497	50,875	28,729	30,865	38,542	30,442	37,039
Idaho	117,117	123,292	98,464	103,747	109,951	117,335	127,707
Illinois	57	498	362	273	263	308	513
Iowa	270	225	110	15	.....	.....	.....
Kansas	1,932	1,798	2,293	2,763	1,308	2,522	1,937
Kentucky	44	75	.....	.....	50	.....	91
Missouri	111,075	122,856	122,451	141,105	161,659	182,203	162,610
Montana	2,485	2,145	2,320	1,451	1,943	2,484	2,517
Nevada	1,669	3,480	3,796	4,792	2,246	1,082	5,699
New Mexico	640	1,982	586	1,350	1,890	1,371	2,511
North Carolina	.....	.....	.....	.....	2	35	34
Oklahoma	.....	404	1,409	2,268	1,805	1,925	2,500
Oregon	.....	5	7	7	.....	11	21
South Dakota	.....	.....	13	.....	8	33	12
Tennessee	11	16	.....	.....	.....	.....	.....
Texas	25	12	42	44	36	57	30
Utah	56,260	55,540	42,455	66,648	60,605	54,933	60,664
Virginia	.....	83	13	.....	87	400	85
Washington	46	341	391	120	339	612	53
Wisconsin	1,753	3,573	4,013	3,252	3,909	3,966	3,301
Undistributed	380	363	36	317	101	48	120
Zinc residues	2,053	1,318	1,290	1,735	2,237	1,987	3,131
Total from domestic ore	350,153	372,252	310,762	363,319	389,211	405,863	415,322
FOREIGN ORE:							
Africa	.....	288	.....	3,150	3,310	582	1,774
Canada	7,238	2,607	162	66	25	122	29
Central America	112	23	12	20	3	28	.....
Mexico	21,435	20,204	10,145	16,944	11,704	7,333	7,407
South America	.....	919	1,186	1,536	2,996	2,677	2,332
Other foreign	18	.....	4	38	27	22	30
FOREIGN BASE BULLION:							
Canada	.....	2,716	179	1,500	.....	.....	.....
Mexico	39,743	34,251	73,210	70,816	76,805	84,220	76,805
Total from foreign ore and base bullion	68,546	61,008	84,898	94,070	94,870	94,984	88,377
Grand total, derived from all sources	418,699	433,260	395,660	457,389	484,081	500,847	503,699

[1] Primary lead is that smelted from ore.

production of antimonial lead. No lead ore from the United States was treated elsewhere during the period covered by the table. The statement of the production of refined primary lead embraces all desilverized lead produced at works in this country and the pig lead derived from Mississippi Valley soft lead ores. The pig lead derived from Mississippi Valley ores and desilverized is shown separately. The antimonial lead reported by refineries is also given. The original source of the ore and bullion affording this refined product is shown in detail in the accompanying table showing primary lead smelted or refined in the United States.

PRODUCTION OF REFINED PRIMARY LEAD IN THE UNITED STATES.

	1907	1908	1909	1910	1911	1912
Desilverized lead	283,873	265,683	297,219	301,002	295,365	309,857
Soft lead	99,801	101,012	118,801	141,318	155,947	141,248
Desilverized soft lead	29,829	29,869	32,532	27,952	35,667	29,789
Total production of refined primary lead	413,503	396,564	448,552	470,272	486,979	480,894
Production of antimonial lead	9,910	13,629	12,896	14,069	14,078	13,552

PRIMARY LEAD AVAILABLE FOR CONSUMPTION IN THE UNITED STATES.[1]

Supply:						
Stock in bonded warehouses Jan. 1	5,756	12,944	18,565	17,405	35,972	4,481
Imports—						
For consumption	15,246	9,805	18,036	15,359	13,281	14,146
For warehouse	64,569	102,241	96,145	93,249	76,671	69,414
Production from domestic ores	372,252	310,762	363,319	389,211	405,863	415,322
Total supply	457,823	435,752	496,065	515,224	531,787	503,363
Withdrawn:						
Exports of foreign lead—						
From warehouse	51,447	76,857	86,077	69,786	101,227	64,906
In manufactures, with benefit of drawback	8,268	9,254	4,796	8,800	12,080	11,320
Decrease by liquidation	4,578	13,425	8,643	7,661	14,812	5,692
Stock in bonded warehouses Dec. 31	12,944	18,565	17,405	35,972	4,481	10,492
Total withdrawn	77,237	118,101	116,921	122,219	132,600	92,410
Available for consumption	380.586	317,651	379,144	393,005	399,187	410,953

PRODUCTION OF SECONDARY LEAD IN THE UNITED STATES.[2]

Pig lead	10,039	7,858	18,360	29,492	27,389	[3] 28,500
Lead in alloys	15,508	10,543	23,327	25,939	26,895	[3] 34,850
Total recovered lead	25,547	18,401	41,687	55,422	54,284	[3] 63,350

[1] See explanatory note
[2] Secondary lead is that obtained by refining skimmings, drosses, old metals, etc.
[3] Subject to revision; statistics not yet complete.

The total production of refined lead in 1912 was 480,894 short tons, which is 71 tons less than the estimate given out by the Survey on January 2, 1913, and published in the *Mining and Scientific Press* January 4. This quantity is exclusive of 13,552 tons of antimonial lead. The total of refined lead is made up of 88,377 short tons of desilverized lead of foreign origin, 221,480 tons of desilverized lead from domestic ores, 141,248 tons of domestic soft lead, and 29,789 tons of desilverized domestic soft lead. The value of the whole quantity of refined lead was $43,280,460; of this the domestic lead was worth $35,326,530, calculated at 4.5c. per pound, the average New York price for the year. The total refined lead output was less than that for 1911 by 6085 short tons, a decrease of 1.2 per cent.

Among the states, Missouri had the greatest output—162,610 tons, a decrease of almost 20,000 tons from that of the previous year. Idaho had the next largest production—127,707 tons, a gain of 10,372 tons over the output of 1911.

In the absence of complete figures of domestic stocks, it is not possible to calculate consumption except for the lead of foreign origin. However, by taking into account domestic production and foreign imports, exports, and stocks in bonded warehouse, it is possible to estimate the quantity of lead available for consumption from year to year. On this basis the lead available for consumption in 1912 was 410,953 tons, an increase of 11,766 tons, or 2.9%. Whether this represents an increase in consumption or in domestic stocks is not determinable.

The report includes a graphic chart showing the fluctuation of the price of lead at New York and London for the period 1906-1912, a list of lead smelters and refineries in the United States, and tables of imports of lead by countries and by classes, as shown by the records of the Bureau of Foreign and Domestic Commerce. The general imports of lead show a continued decline from 1909, when 225,090,312 lb. of lead was received to 1912, when the imports were 167,121,592 lb. Of the 1912 imports, 159,455,664 lb. was received from Mexico in the form of ore or base bullion, 3,207,936 lb. of lead in ore from South America, and 3,309,356 lb. from German East Africa.

Milling Costs at Bodie

The Standard Consolidated Mining Co., Bodie, California, treated 8024 tons of ore and 16,569 tons of tailing during 1912, with 86.6% extraction, and costs of milling and treatment were as follows:

Mill	Per ton.
Labor	$0.926
Supplies:	
Shoes	0.039
Dies	0.057
Heads	0.004
Liners	0.011
Screens	0.012
Plates	0.034
Quicksilver	0.011
Firewood	0.070
Sundries	0.143
Total supplies	$0.381
Bullion charges	0.062
Distribution accounts	0.553
Total, mill	$1.922

Cyanide Plant	Per ton.
Labor	$0.854
Supplies:	
Cyanide	0.269
Lime	0.192
Zinc	0.058
Pebbles	0.020
Lead acetate	0.013
Firewood	0.031
Sundries	0.197
Total supplies	$0.780
Bullion charges	0.071
Distribution accounts	0.395
Total, cyanide plant	$2.100
Administration	$0.974

Special Correspondence

BOSTON

Raid on Butte Central.—Nevada-Douglas Plans Bond Issue.—Difficult Financing Abroad.

A sensational episode on the Curb market on March 20 was the selling of Butte Cenral down from 5⅝ to a close of 2⅝, a net loss in a day of three points. There were something like 17,000 shares of stock dealt in and perhaps 10,000 shares actually changed hands. The decline was said to be due to the closing out of loans around $3 per share which were made when the stock was selling above $6. For some time the Butte Central management here has been involved in a controversy with various interests, and the vice-president, Mr. Davison, made a statement in the Boston *Post* to the effect that a wealthy capitalist here had employed a mining engineer to write an adverse report on Butte Central as part of a well laid campaign plan to go short of the stock and break down the price, covering at a profit. Mr. Davison also stated publicly in the *Post* that a blackmailing proposition had been made to him by members of the Boston Curb firm, offering, in consideration of large gifts and concessions in stock, to turn over to him the report referred to and assist him in making a market for the stock. He says that, recognizing the character of the demand made upon him, he stated to the Curb firm in question that he would not pay a dollar for the purpose of suppressing a sandbagging report. Rumors were also put afloat in Butte at the same time derogatory to the company and the State Savings bank there refused to advance the payroll for February, as usual. This was a matter of about $6500. The Western floods and damage to telegraph lines interfered with communication with Butte, and the ugly rumors, which were said to be propagated by enemies of the Butte Central interests, got quite a start. However, the embarrassment to the company was but slight, as funds and instructions were telegraphed as soon as the wires got to working. The mine management estimates that the concentrate in transit to the smelter from the company's new mill amounts to around $30,000, for which settlement is yet to be received. Company officials here claim that with funds now on hand the company should become a self-sustaining enterprise and that good earnings will soon follow. In other words, the raid on the stock was purely a stock market affair, affecting only certain interests connected with the company, and in no way reflects upon the intrinsic value of the enterprise.

The Nevada-Douglas Copper Co., of the Mason, Nevada, district, will hold a stockholders meeting in Salt Lake City on April 16 next for the purpose of authorizing a $2,000,000 bond issue for the purpose of taking up a convertible bond issue of $600,000 which expires May 1. It is announced that the purpose of the bond issue further is to acquire the stock and bonds of the Nevada Copper Belt railroad, of which the copper company now owns 50%. Another purpose is to purchase or erect a smelter and provide further working capital for developments and equipping property. The feeling in Boston is that the Nevada-Douglas property is sufficiently large for such a bond issue, but in view of the fact that in February the company made a dividend payment of 12½c. per share, which was regarded at the time as premature, there is a disposition to question the soundness of the plans of the present management. Of the $5,000,000 stock capital of Nevada-Douglas, considerably over $4,000,000 has been taken from the treasury. The addition of $2,000,000 in bonds places a heavy burden upon the company and will undoubtedly postpone the payment of further dividends indefinitely. The Nevada-Douglas company will have to operate a very large mining property, a railroad, and a smelter, and there is grave question as to whether these enterprises can be placed on a fair footing under the present policy. The company has a contract with the Mason Valley smelter to take its ores which expires by time limitation about the end of the year. The Nevada-Douglas management has claimed that its treatment charges have been excessive and advocates the building of a smelter. It is evident that in the greatly disturbed condition of the money and stock market, Nevada-Douglas interests are undertaking, without the assistance of large bankers or underwriters, a job of financing which, while perhaps necessary, will be extremely difficult to carry through.

JOPLIN, MISSOURI

Zinc Prices Lower.—Dewatering Screens Grow in Popularity.—Rejuvenating Mines of the Baxter-Quapaw District.

Zinc ore prices are much lower than they were for the corresponding week of 1912. The offerings have dropped to $40 and $48 per ton, assay basis of 60% metallic zinc, while the best figure reported paid for choicer lots is $51 per ton. For the corresponding period of 1912 the basis range was $48 to $53 per ton, with a top price of $56 for better grades. Spelter, which was quoted at $6.50, East St. Louis figures last year, is now weak at $5.90, although orders for future delivery have been placed at figures in excess of this. In order to strengthen the market, many of the largest mine operators suspended operations in March, and the weekly production of sulphide ores was cut from 7000 to 3000 tons, but a resumption of activities toward the close of the month swelled the output to 4500 tons. The shutdown had little effect on the market, prices showing no disposition to strengthen to any material extent. The heaviest curtailment was in the low-grade, thin-ground, sheet-ore district of Webb City, the average weekly output from this camp alone being cut from 2000 tons to 1100 tons. The price of oxidized ores, known as calamine, is weaker, the bulk of the output selling for $22, basis of 40% metallic zinc. Lead ore prices have remained steady at $52 to $54 per ton, assay basis of 80% metallic lead. Pig lead has remained unchanged at $4.20 to $4.25 per hundred pounds, East St. Louis.

The importance of slime treatment is growing throughout the Missouri-Kansas-Oklahoma district, and today the majority of the larger milling plants are equipped with tables. A feature of the sludge treatment that is also rapidly gaining in popularity is the dewatering screen, a revolving device, used for the first time in this district several years ago at the Oronogo Circle Mining Co.'s property at Oronogo, Missouri. Since then various companies have adopted screens of similar design, the device being so simple that it can be quickly made at any machine-shop. The screen takes the water from the tailing, the latter going in an almost dry state to the elevator, while the water, with the fine ore particles in suspension, passes to settling-tanks, from which the sediment is later drawn off and cleaned on tables. The use of the dewatering screen eliminates the cleaning out of sludge ponds, as a very small percentage of metallic contents escapes in the limited volume of water that passes out with the tailing.

M. G. Estabrook, a Boston capitalist, who operates the Amalgamated mine at Joplin, and the Mission mine at Lincolnville, Oklahoma, has leased from Jay F. Ripley the Okla mill at Lincolnville and will begin operations soon. The resumption of work at the Mission was the first activity of importance in the Quapaw-Baxter district in many months. In the bins of this mine at present there are more than 100 tons of zinc sulphide concentrate, being held for higher prices than now exist. Both the Mission and the Okla mills are of large capacity, the former being estimated at 500 tons per day, while the latter can handle 300 tons of ore. The dirt, as a rule, is very low in blende, but at the Okla it is reported that six new drifts have been extended into sheet ground, at a depth of 100 ft., which shows more than 5% blende.

Drill prospecting on an extensive scale has been started in the Spring City-Saginaw district, of Newton county, Missouri. Heretofore the greatest prospecting has consisted of shaft-sinking and driving, and as a result the operations have been confined largely to the upper ground. On leases of the Connor land two drills are now being worked, the company having outlined a campaign of activities to con-

tinue a year. All holes are to be sunk to a depth of at least 200 ft. or more. Heretofore the mining has been nearer the 100-ft. level and oftentimes at much shallower levels.

TORONTO, CANADA

HOLLINGER REPORT.—PEARL LAKE.—MCENANEY.—DOME LAKE —KIRKLAND LAKE DISTRICT.—NIPISSING STILL LEADS AT COBALT.—MCKINLEY-DARRAGH PROFITS.

The principal interest as regards Porcupine mining affairs attaches to the regular four-weekly statement of the Hollinger, according to which the profits from January 1 to February 25 were $241,600. For the four weeks ended February 25 the mill ran 91% of the possible running time, alterations somewhat reducing the tonnage treated, which amounted to 9240 tons, or an average of 330 tons per day. The average value of ore treated was $27.76 per ton, and the approximate extraction 97%. Milling costs were $1.49 per ton, and alteration charges 20c. per ton. Satisfactory results are being obtained underground. Work on No. 1 vein on the 300-ft. level shows the gold content to be about equal to that on the upper levels. The favorable character of the statement resulted in a decided advance of the stock in a generally quiet and depressed market. R. W. Stevenson, managing director of the Pearl Lake, reports that at 600 ft. the vein shows a marked improvement in gold content over the 400-ft. level, a mill test of 300 tons indicating the value of ore at the lower level at $35 per ton. The shaft will be put down to 1000 ft. and levels run at each 100 ft. A mill of 250 tons daily capacity, with equipment for cyanide treatment, will be erected. The McEnaney mill is now in regular operation, treating 50 tons of ore per day. The first shipment of ore was made March 1, and monthly consignments will be regularly made. The adit on the 200-ft. level has been opened up for 600 ft., practically all in ore. At the Dome Lake, good progress is being made with the 10-stamp mill, which is expected to be in operation by the middle of April, with Thomas E. Selby, formerly of the Dominion Reduction Co., Cobalt, in charge. The 5-stamp mill of the Swastika has been put in commission with sufficient ore in sight to keep it running 18 months or more. The mine is opened to the 400-ft. level, though little work has been done at that depth, and development at the 200 and 300-ft. levels has not been as satisfactory as was anticipated. The annual financial statement showed receipts of $75,514, and expenditures $73,995, leaving a balance of $1517. At the Tough-Foster property in the Kirkland Lake area, the shaft is down 70 ft. on a 12-in. vein, from which 20 tons of high-grade ore is being taken daily. The mill machinery is on the ground, and it is hoped to have it installed by the end of April. The Great Northern Silver Mines, Ltd., has purchased the Hughes or Reamsbottom claims in the Kirkland Lake district, where there is a 100-ft. open-cut on a 12-in. vein from which high-grade ore has been extracted. The Pike Lake, which has four claims near the Swastika, is arranging to install a 10-stamp mill.

The Nipissing maintains its position as a leader among the Cobalt companies and has been doing very well lately. Since the beginning of the year it has shipped $589,368 in bullion, in addition to 453 tons of low-grade ore. The new low-grade mill is running to capacity, treating during February over 200 tons per day. On the Little Silver vein, one of the first orebodies worked in the camp, an ore-shoot has been developed about 75 ft. below the old open-cut, the vein being about 2 in. wide of 3000-oz. ore. The company has bought three gold claims near Larder Lake for $50,000. The La Rose, which rather disappointed its shareholders by cutting out the extra bonus of 2½% paid for the first quarter of the year, has also added to its ore reserves. Cutting into new ground at the 115-ft. level of the Lawson property on No. 8 vein, a vein 4 to 5 in. wide, yielding ore reported to run over 5000 oz. silver per ton, has been discovered. The McKinley-Darragh, in addition to its regular quarterly dividend of 3%, has declared a 7% bonus. Its net profits for 1912 were $1,153,848, and the total cost per ounce 18.59c. Although 2,717,383 oz. was extracted last year, the ore reserves showed but little diminution, being estimated at 5,368,500 oz., or within 200,000 oz. of the estimate at the end of 1911. The Penn-Canadian, operating the old Cobalt Central property, has cut at the fifth level the Big Pete vein from which good ore was obtained on the upper levels. At depth it runs 2½ in. of high-grade ore, with good milling rock on each side of the vein. At the Beaver mine, 60 men went out on strike on March 22 on account of the discharge of an employee, and development is at a standstill. The Beaver Auxiliary at Elk Lake will start work with the new plant early in April. The first work will be the deepening of the shaft from 100 to 200 ft. The Peterson Lake will sink a shaft near the junction of Cart Lake and Peterson Lake, in the conglomerate in territory hitherto but little explored. A movement presumably in the interests of an English syndicate is on foot to acquire a controlling interest in the company, and stockholders are being asked for options. Since the success of English companies in putting the Cobalt Townsite and the Casey Cobalt on a paying basis, there have been several purchases of Cobalt properties by English investors, and agents of English syndicates have been active in negotiating for other properties.

NEW YORK

MONEY MARKET STRAINED.—BRITISH COLUMBIA PASSES DIVIDEND, BUT UTAH CON. PAYS ONE.—MASON VALLEY, NEVADA-DOUGLAS, OHIO COPPER, PHELPS-DODGE REPORTS.—DEVELOPMENT COMPANY AFFAIRS.—HAMMOND SUED.

The week ended March 29 has been one of feverish scanning of telegraph bulletins from the scenes of disaster in the Middle West. The tornado and the unprecedented floods were as one shock to the market. There has been no marked fall in price levels, but financial forces are gathering reserve strength to meet the demand that is sure to come. Only more than ordinarily careful analysis of conditions and events can reveal to those outside of banking circles the strain which our finances have undergone since the outbreak of hostilities in southeastern Europe, when England, France, and Germany all began to turn fixed into fluid capital. American securities have been returned in vast quantities; the United States has been making enormous gold shipments to bolster up foreign reserves; we have gone through a change of administrations, during which time we have had to handle an exceedingly difficult situation in Mexico, and now are brought face to face with disaster at home, second in magnitude only to the San Francisco earthquake. The market has had its own troubles, but the real question at the moment is not why it cannot do better, but as to how it can do as well as it does.

The market in copper metal has been rather featureless; the coming report of the Copper Producers' Association is expected to show a fair increase in accumulated stock and to offset some of the increase in copper surplus of the past quarter. The underlying factor in the metal market is the industrial situation abroad, and it is exceedingly hard to predict the turn of affairs in the financing of the demands made by the war. When the April 1 settlement shall have been completed abroad, the feeling will be much easier. The British Columbia Copper Co., as was anticipated to a certain extent, passed its regular 3% quarterly dividend when the postponed meeting was held on March 25. The action of the board was explained by the following statement: "The net earnings of the British Columbia Copper Co., Ltd., after charging off all ordinary development work for the last fiscal year, were $425,985. During the same period, the company paid on account of new property, and in exploration and development, $229,489. The company also has under option numerous properties upon which payments are to be made during the coming year, and the directors deem it best to use the available net revenue for that purpose, which is thought essential for the purpose of supplementing the company's ore reserves, and therefore consider it expedient to defer distribution to the shareholders for the present."

It is also understood that the British Columbia is increasing its holdings in the New Dominion, in which it already holds practically a two-thirds interest. The Utah Consolidated Copper Co. has declared a dividend of 50c. per share, payable April 12. During the past year the output was 6,506,814 lb. copper, 8,734,398 lb. lead, 230,004 oz. silver, and 14,042 oz. gold. The net profit won from the year's operations amounted to $603,923. The management states that it has been able to maintain its ore reserve, but that the average metal content is somewhat lower. The annual report of the Mason Valley Mines Co. for the year ended December 31, covers its first period of actual mining operations and shows a total income of $2,663,106, total charges $2,376,830, leaving a credit balance of $286,276, from which there is to be deducted interest on outstanding bonds of $59,379, leaving a profit-and-loss balance carried forward to surplus of $226,897. The Nevada-Douglas Copper Co. is to have a stockholders' meeting on April 15 for the purpose of authorizing an issue of bonds to the extent of $2,000,000, to be secured by a lien upon the various mines and upon the stock of the Nevada Copper Belt Railway Co., which is a subsidiary of the Nevada-Douglas.

There has been a considerable revival of interest in the affairs of the Davis-Daly Mining Co., owing to the report of the finding of ore on the 1400-ft. level, showing 10% copper and good amounts of silver. It is also stated that on the 1900-ft. level in the Colorado mine the vein discloses two to three feet of solid copper glance, assaying 50% copper. The Davis-Daly suffered for many years under the Heinze management. It is to be hoped that the stockholders who have been faithful to the company will now have some opportunity to recoup themselves. The Ohio Copper Mining Co., which is still regarded as a Heinze concern, shows by its report covering operations from August 1 to December 31, 1912, a profit of $104,953 and $57,031 carried forward to surplus. Ohio Copper has been one of the weak spots in the share list, and its progress is as yet no great matter of satisfaction to the holders. As a step in the final winding up of the affairs of the Development Company of America, the Equitable Trust Co. of New York will, on April 17, sell 400,000 shares of Tombstone Consolidated, 135,000 shares of Poland Mining, 500,000 shares of the Congress Consolidated Mines Co., 250,000 shares of Imperial Copper, and certificates of indebtedness issued by the Poland Mining Co. to the amount of $211,340. It would be difficult to find a series of enterprises having a more hearty support from the best classes of investors than was accorded to the Development Company of America and its subsidiaries. It is not too much to say that the unqualified failure of these companies worked greater harm to mining in creating a hostile attitude on the part of the general public than any number of get-rich-quick schemes such as the one that sent Julian Hawthorne and some of his associates to the Federal prison at Atlanta.

The Phelps-Dodge company's annual report is most interesting, showing as it does a net profit earned of $10,411,535, as compared with $7,283,508 in 1911 and $9,099,910 in 1910. The net profits for the year were equivalent to 23% upon the outstanding stock of the company, which is in round numbers $45,000,000, and dividends paid amounted to 15%. Copper output for the year was 192,297,374 lb., for which the average price received was 15.51c.; of this amount of copper, 52,537,859 lb. was handled on a commission basis, and the balance of 139,759,515 lb. was the product of the company's own properties. John Hays Hammond is apparently about to repeat the experience which he had with Daniel J. Sully, the one-time 'cotton king.' Not long ago Mr. Hammond was made defendant in a suit by Sully, who claimed that his confidence had been abused in some way in the flotation of the General Cotton Securities Co. to the extent of $1,600,000. Now Mr. Hammond, with the other members of the board of directors in the International Petroleum Co., is made a defendant in a suit brought by a Mr. Bushnell, who claims that stock in the company to the amount of $1,420,000 was voted to Mr. Hammond by a board of directors wholly under Mr. Hammond's control. Mr. Hammond's version of the matter, so far as it has been made public, is briefly to the effect that the company is largely indebted to him for loans advanced to save options that were expiring, and that when the company was unable to return the money advanced, the stock in dispute was voted to Mr. Hammond by the unanimous action of the shareholders.

MELBOURNE, AUSTRALIA

NEW SOUTH WALES MINING IN 1912.—THE ARDLETHAN FIELD.—DEATH OF A HERO.—CHANGES AT MT. LYELL.

The preliminary statement of the mineral production of New South Wales in the year 1912 is of a most satisfactory character. The value of the output is officially set down at £11,641,435, or say $56,772,000, the largest yet recorded in the state, beating the 1907 record by some $5,187,000. The chief causes are the high prices ruling for metals throughout the year, the unusual absence of labor troubles, and the expansion of the coal trade. Outside of gold and copper, the increase is general. The gold yield amounted to 165,295 oz. fine, a decrease of 15,826 oz. on the figure for 1911. The chief field has been Cobar; the chief mine, Mt. Boppy, with, however, a decreased production. The value of the copper output has declined $50,000, or to $2,826,000, despite the enhanced value of the metal and slightly increased output from the Great Cobar, the chief copper producer. The value of the tin output has risen from $1,497,000 the previous year to $1,648,000, a fair percentage of the output coming from dredges. The main feature of the year has been the developments in the Broken Hill field, the result of the operations of the mines there being a record production of silver, lead, and zinc. The value of the zinc production (spelter and concentrate) was $8,610,000, as compared with $6,898,000 the previous year. The export of silver, silver-lead, and concentrate came to a value of $16,971,000, as compared with $11,909,000 the previous year and $19,091,000 in the record year (1907). Adding the value of the lead (pig and matte) to the silver, silver-lead, and zinc values already given, a total is obtained of $26,871,000, as compared with $19,830,000 in 1911, and a previous record of $23,531,000 in 1907; these amounts being, it is to be noted, in every case net values and not the value of the finished products. The coal hoisted during 1912 totaled 9,885,815 long tons, valued at $17,842,000, surpassing the previous year's record figures by 738,790 tons and $1,497,000. The coke production, on the other hand, fell away 23,528 tons, to 241,159 tons, valued at $792,000, a decline of $107,000.

There has been a tremendous amount of booming of the new tinfield at Ardlethan (New South Wales). The field, which came into notice a little less than twelve months ago, is distant some 250 miles from Sydney in a southwesterly direction, although by rail it takes 337 miles to cover the distance. By interesting contrast with all the gush that has been written about this area, a contributor to the *Australian Mining Standard* gives it a vigorous roasting. He has no praise for any property but the Carpathia, which has been floated in a public company of 120,000 shares of 10s., half paid. He describes the orebody in this property as 12 or 15 ft. wide and approximately 40 or 50 ft. long. The gangue is kaolin and kaolinized granite. It is plainly a lens or pipe of the larger size. Fine tin is well distributed through the earthy ore, and the showing is certainly most promising. Concerning the other outcrops, he says roundly that some of them contain no tin, that many of the supposed lodes are purely imaginary, that the pipes are generally small, and that the value of the ore-heaps is, in many cases, overrated.

It is not out of place even in a technical journal to devote a few lines of space to the death of a mining hero such as Albert Gadd. On the occasion of the disastrous fire in the Mt. Lyell mine last October, Gadd, who was a working miner, was on duty below. Though he escaped, he reëntered the mine again and again to endeavor to save his mates, with the result that he inhaled so much of the carbon monoxide gas that he was never afterward

fit for anything, and a few days ago he died in St. Margaret's hospital, Launceston. His name is worthy of being held in honorable remembrance. There are changes at the Mt. Lyell mine. The general manager, Robert C. Sticht, is about to take up his permanent residence in Melbourne, whence he will be better able to exercise control over the various operations of the company in the different states. The new local superintendent is B. Sawyer, formerly of the New South Wales Mines Department. Al L. Dean, the company's metallurgist, has resigned his position, and in some three or four months time will return to Canada, whence he came seven or eight years ago.

JOHANNESBURG, TRANSVAAL

STAFF CHANGES UNPROFITABLE.—JANUARY PRODUCTION.—IDLE STAMPS.—TUBE-MILL RATIO.

One great cause of uneasiness on the Rand is the manner in which frequent changes of administrative staffs are made, without adequate notice, and, it is to be feared in a good many instances, without adequate reason. Two years ago one of the principal groups considered the cost of administration too high and dispensed with several of the highly paid advisers. At the end of the first year it was discovered that the new administration had increased the cost something like £20,000, and about 30 subordinates were dropped. This year another 20, including one of the chief and most experienced engineers, have been dispensed with, much to the surprise of the rest of the staff, who, however, have been officially informed that no further changes in the subordinate members are contemplated. It is, however, freely rumored that a well known American consulting engineer is expected to return to the services of this particular group shortly, which, if true, will probably lead to many other changes. Not only do these frequent disturbances tend to reduce the efficiency of the administration, but sometimes a change is made in order to modify the whole system and principle of working, and a further shake-up follows before the last appointee has been able to get the new ideas and methods into full operation.

According to the Transvaal Chamber of Mines, the declared output of gold for January was another record, the total amount being 789,390 oz., value £3,353,116, being an increase of 12,984 oz. as compared with December, value £55,154, and record by no less than £41,322, the previous highest normal month being May, with a value of £3,311,794. The increase for January would have been larger had not the outside districts shown a decline of 3137 oz., value of £9073. The Rand output was 760,981 oz., value £3,232,440, the previous highest Rand output obtained under normal circumstances being May 1912, with 746,948 oz., value £3,172,833, an increase of 14,033 oz., value £59,507. The total output from the outside districts was 28,409 oz., value £120,676, as against 32,714 oz., value £138,961, contributed toward the previous record output.

Among the more conspicuous increases on the Rand may be mentioned Crown Mines, with an increase of £21,226; East Rand Proprietary Mines, £16,553; Nourse Mines, £9821; Consolidated Langlaagte, £6397; Geldenhuis Deep, £5798; Simmer Deep, £4864; and Randfontein, £4766. The largest producers were: Crown Mines, £298,874; Randfontein Central, £273,741; East Rand Proprietary mines, £263,066. The total number of stamps at work in the Transvaal in January is given at 10,009, an increase of three only on the previous month, but on the Rand the number was 9540, an increase of 100. In the outside district the total number of stamps at work is given as 469, a decrease of 97. The Rand output for January was indeed a good showing, but with a better supply of labor available few months should be allowed to elapse without another record output being obtained.

At the end of January over 1100 stamps for various reasons were hung up, but few for reasons likely to prolong or perpetuate their idleness. The Randfontein Central has the largest number—250—idle, but these are expected to be in full swing ere many months are past. The Crown Mines, too, have no less than 175, caused by the concentration of mining and milling operations, and their replacement by a heavier type of stamp while Lancaster West has closed and thrown its mills idle. Then there is the Robinson Deep, where a new milling policy is being introduced of increasing the number of tube-mills and reducing the stamps, with the result that instead of 200 stamps running, as was the case a year ago, today there are only 160 stamps, while the tube-mills have been increased from 5 to 10. Then, again, the new mill at the Roodepoort United Main Reef has proved so efficient and difficult to keep fully supplied with ore that up to the present it has only been necessary to have half the stamps at work, with the result that 50 are idle. Another new producer, the City Deep, had 44 stamps idle, but these will soon be fully employed. Princess Estate, too, has 50 idle stamps, while Main Reef West and the Consolidated Main Reef had each 30 stamps idle. Both these concerns ought to be soon in a position to find employment for these idle stamps, but there are poor prospects of the idle 55 stamps at the Jumpers starting, as the property is fast approaching exhaustion. Other mines have from 10 to 20 stamps idle, but it will be seen that even though the January output constitutes a record, there is still sufficient milling capacity on the Rand in reserve to enable the output to continue progressing. To what extent these idle stamps on the Rand are due to the introduction of tube-mills it is impossible to say, but it is certain that the 9540 stamps, if full credit be taken for the duties performed by the 280 tube-mills, must be equal to at least 15,000 stamps of the kind in vogue some years ago. Taken altogether, therefore, what with the idle stamps and the prospects of new producers, the Rand for many years to come ought to produce a few more record outputs.

ST. PETERSBURG, RUSSIA

RUSSIAN RECORD COPPER PRODUCTION IN 1912

In the year 1912 the production of metallic copper in Russia reached the record figure of 2,048,233 poods.* This compares with 1,571,879 p. produced in the year 1911; so that if we take into account the importation of copper into Russia during 1911, namely, 477,000 p., we find the consumption of copper for that year in the country to have been about 1,995,000 p. Therefore, taking 1911 as a basis, the year 1912 has more than supplied the needs of the country in copper. Notwithstanding this fact, during the year copper was imported to a considerable extent, namely, 419,000 p. That is to say, consumption has kept well ahead of the production, which had already increased over the preceding year by 31.3%. The occasion of the annual statement may be taken to refer again to the relative importance of the various copper-producing districts and their relation to their respective productions in 1911, which was as follows: Urals, 1,103,000 p. in 1912, as against 809,000 p. in 1911; Caucasus, 576,000 p. against 477,000 p.; Altai, unknown for 1912; Siberia, 294,000 p. against 228,000; chemical works and refineries, 75,000 p. against 56,000 p. Thus the Urals, all the way through, have maintained not only their lead, but the increased ratio of lead which had been the feature of the production there throughout the year, due mainly, of course, to the intense activity of the Kyshtim works, where the production for the year amounted to 467,000 p. against 241,000 p. in the year 1911. The Upper Isset plants likewise increased considerably, from 80,000 p. to 108,000 p.; and the Syssertsk from 73,000 to 101,000 p. The Caucasian increase is one of 99,000 p. or 20.6%, and the largest contributor to this satisfactory result was the Caucasian Copper Co., with an increase from 137,000 p. to 190,000 p., followed by the Kunduroff company from 6000 p. to 34,000 p., and so on. The Siberian position shows an increase of 66,000 p. of 28.9%. The largest contributor, accompanied by the most rapidly increasing production, was the Spassky company, whose production increased from 195,000 p. in 1911 to 271,000 p. in 1912, while there was a reduction, as is already known, on the part of the Yenissei company, from 29,000 p. to 18,000 poods.

*The pood equals 36.11 pounds.

General Mining News

ALASKA

Iditarod

During the past season the Guggenheim dredge worked from August 15 to October 29, or 74 days, and handled 172,333 cu. yd. of ground averaging $2.34 per yard, at a cost of 45.9c. per yard. Some of the gravel yielded as high as $8.90 per cubic yard. The hydraulic properties dealt with 2,967,750 cu. yd., producing $629,043, or 21.2c. per yard, at a cost of 9.37c. per yard. Costs were low on account of a favorable season, and less thawing was necessary ahead of the dredges.

Juneau

During February, development at the Ready Bullion and 700-Ft. Claim mines of the Alaska United covered 480 and 66 ft., respectively, the stock of broken ore decreasing 6066 and increasing 238 tons. The two 120-stamp mills crushed 34,254 tons of ore, yielding a total of $83,689 by amalgamation, and treatment of 788 tons of concentrate. Operating expenses totaled $46,471, and construction $1402, the net profit being $35,804.

A large dam is to be constructed on Salmon creek by the Alaska Gastineau Mining Co. It will be arch shaped and will be 160 ft. high in the centre, 500 ft. long at the top, 8 ft. thick at the top, and 53 ft. at the bottom, and will contain 50,000 cu. yd. of masonry. The water impounded will generate 6000 hp., in three units of 2000 hp. each. Preliminary work is now under way.

ARIZONA

Gila County

(Special Correspondence.)—At the Inspiration Consolidated, a large number of miners were laid off on March 22, as underground development, which has been progressing at the rate of almost a mile per month, has become so far advanced over actual mill construction work that it was deemed advisable to temporarily suspend part of the mining operations. The incline through which all the miners reach the Inspiration works, and which for the present has been bottomed at 140 ft. below the 3480-ft. level (sea-level), is eventually to be sunk 270 ft. lower than the deepest workings of the mine. The 180-ton waste-pocket raise that is being driven from a point on the incline to tap the 3480-ft. level is progressing rapidly, due largely to the efficiency of the electric hoist which was recently installed at the incline. A similar hoist was installed at the Scorpion shaft, and the placing of one at the Live Oak shaft No. 1 is almost completed. At the main east and west shafts, the foundation for the 3000-cu. ft. per minute, electric driven, Nordberg air-compressor is completed. The railroad construction is fast nearing completion. The grading for the Live Oak branch is finished and the track is being laid at a rapid rate, at present having reached a point opposite the portal of the Joe Bush adit. The spur to the warehouse at the mouth of the adit should reach there this week, and will eliminate an immense amount of team haulage now required. At the Inspiration branch, only one large cut remains to be completed. Two Bucyrus steam-shovels are at work, and the construction will probably be finished by the end of April. All work at the Inspiration division will receive an added impetus on the arrival of the railroad. Construction at the mill is limited to the building of the three railroad spurs which encircle the site. The experimental plant, the operation of which was recently resumed, for the purpose of testing the efficiency of the Elmore flotation process on the Inspiration low-grade ore, is still running. It is reported to be proving successful. Ten additional adobe bungalows have been completed by the company for the use of employees. They are on the crest of the hill across the canyon from the warehouse at the Joe Bush adit. Five bungalows and the residence for H. Kenyon Burch are being constructed near the millsite by the company.

At Miami the tram system leading from the power-house to the mill is being reconstructed so as to handle all freight and timber at the lowest cost. The new change-room, which is situated about 150 ft. east of No. 4 shaft, is nearing completion. It is a two-story, steel, reinforced-concrete structure, 50 by 90 ft., and will contain 823 steel lockers, 100 shower baths, and steam heat. Especial attention has been given to the ventilation, which is a necessary requisite, of which the average change-room is devoid. When finished it will be the best-equipped change-room in the Southwest.

At the Black Warrior it is reported that the present management is contemplating the sinking of the shaft to a greater depth. Two shifts, totaling 65 men, are employed, and about 100 tons of ore per day is being shipped to the El Paso smelter.

Miami, March 27.

At the Old Dominion smelter power-plant, foundations have been laid for another large air-compressor, which will be erected in about 60 days. At the Miami, a fire service is being installed to cover about 30 acres of the property, a head of 100 ft. being maintained. At the Inspiration millsite, three sections have been graded, and the work has been suspended awaiting the completion of the railway, when construction material can be delivered. On No. 7 level of the Arizona Commercial mine at Copper Hill, a drift has cut a shoot of good sulphide ore.

Yavapai County

Reports from Turkey creek district indicate that the mining industry is prospering. The mill at Pickaway is crushing ore from the Silver Chord mine. Work has been resumed at the Great Republic. The Cash mine is to be developed on an extended scale. The Binghampton mine, situated on the Agua Fria river, is to resume operations. Electric drills are to be installed at the claims of the New Mexico Lead & Copper Co. On the 1200-ft. level of the Arkansas & Arizona mine, rich sulphide ore was cut, and a winze sunk 200 ft. has opened a considerable quantity of ore. Three new boilers and a large hoist have been ordered. It is said that a large vein has been opened in the claims owned by J. N. Duncan at Mt. Union.

CALIFORNIA

Butte County

Extensive development is to be done by the Ophir Dredging Co. near Oroville, and a well will be dug to get water on the land owned by the company. R. E. Gruber is superintendent. It is reported that the Mammoth Channel mine will be actively worked in a few weeks. A drainage adit three miles long will be started near the old Ethel mine to cut the Mammoth adit at a point 2½ miles from Magalia. This drainage adit will reduce expenses a good deal, as it will not be necessary to work the two large pumps installed. At the Gold Brick mine, Forbestown, machine-drills will be in operation in a few days. The Crystal Hill will resume work in a week or so, the old machinery which was damaged by fire having been replaced by new installations, electrically driven, power supplied by the Pacific Gas & Electric Company.

Eldorado County

Preparations are being made to clean out the old shaft of the Inter-valley mine, near Rescue. Bruce McBeath is superintendent.

The Oro Fino, or Big Canyon mine, situated three miles south of Shingle Springs, which has been unworked for 12 years, has been acquired by English capitalists. The incline shaft was sunk nearly 600 ft., and is to be unwatered. It is said that there is a large low-grade and highly mineralized orebody in the mine.

Nevada County

The Erie mine, near Graniteville, one of the largest properties in the Eureka district, has been bonded by the Eastern company owning the holdings of the Erie Exploration Co. The mine will be thoroughly developed, E. L. S. Wrampelmeier being in charge. A cross-cut from the main adit of the South Yuba mine, near French Corral, has passed through 30 in. of ore containing gold, silver, and

copper. Native silver shows in the ore. C. D. Tregoning is in charge.

SHASTA COUNTY

A 2-stamp mill is being erected at the Highland mine, French Gulch, which has been idle for several years. O. B. Hardy recently bonded the property from M. H. Peck. Good ore has been opened, and it is proposed to drive an adit about 6000 ft. Twelve men are employed at present.

SIERRA COUNTY

Early in April the 20-stamp mill of the King Solomon mine, below Alleghany, will be started. This property is owned by the Oasis Gold Mining & Milling Co., of which R. L. Polk, of Detroit, is the principal holder. It was abandoned until about a year ago, and since then development has proved an ore-shoot 4 to 16 ft. wide. W. J. Seymour, alone, has driven an adit 600 ft., at an expense of $9000, in the Rosanne mine near Alleghany, and has cut a vein of heavily mineralized ore. The El Dorado quartz mine has been leased, and the mill is crushing good

SLUICE-BOXES, LAGRANGE MINE, TRINITY COUNTY.

ore. More men will be employed at the Sixteen-to-One mine. The Bernhardt Bros. have 1100 loads of gravel ready to be washed at the Hilo. An option has been taken at the Mexican quartz property, on the South Fork. Necessary repairs are being made to the Gold Bluff-North Fork ditch and flume. It is said that a large air-compressor and 10 stamps will be installed at the Tightner. The monthly output of the mine is approximately $85,000. The vein is pitching toward the Red Star claim, owned by the Tightner company, and an adit is being extended into this ground. Repairs to the compressor at the Chips mine, above Sierra City, have been completed, and the mill will resume work. The Wide Awake mine has been bonded to Jason Frye, Sr. The Gold Canyon and Kenton will start crushing ore in a few days. Generally speaking, a good deal of work is projected in the Alleghany district.

SISKIYOU COUNTY

A small stamp-mill is to be erected by W. Blagrave on his mine on the Trinity-Siskiyou divide, near the headwaters of the Trinity river. The owner recently found rich ore in a pocket, and has since opened a vein.

TRINITY COUNTY

Eighty tons of steel rails, cut into 4-ft. lengths, are being hauled by teams from Redding, Shasta county, to Weaverville, a distance of about 65 miles, to the Lagrange gravel mine. These rails are to be used as riffles in the sluice-boxes.

The Guggenheim interests have bonded all the mining ground between Trinity Center and Carrville, a distance of four miles, the option lasting three months. It embraces the Alta Bert Mining Co.'s property and dredge, the McDonald, Mrs. Carr's claims, and the Headlight company's claims along the river. About 50 men will be employed in prospecting with drills and in sinking shafts. The Democrat mine is situated in Democrat gulch, Weaverville, and an adit has been driven 160 ft., at a depth of 300 to 350 ft. from the outcrop of a vein, and at 100 ft. in the adit good ore was cut. A winze has been sunk 20 ft., showing two to five feet of rich ore, and will be sunk to 100-ft. depth.

COLORADO

DOLORES COUNTY

The mill of the Rico-Wellington company is doing good work. Copper ores are shipped, while the lead and zinc concentrate produced averages 60% and 45%, respectively.

EAGLE COUNTY

The state commissioner of mines, T. R. Henahen, has returned from his second visit to the Brush creek district and states that prospecting has opened more rich silver ore, and native silver is seen in the sandstone. There has been a rush to Eagle, but the snow is still too deep for prospecting. Mr. Curley, mine inspector, has also visited the district, and stated that in the discovery adit there is 8 ft. of ore in sight, and in the lower adit, 100 ft. below the former, 5 ft. of ore has been opened, all carrying from 200 to 600 oz. silver per ton.

GILPIN COUNTY

According to the annual report of the Frontenac Consolidated Mines, Ltd., 30,719 tons of ore, worth $8.42 per ton, was treated. Ore in sight is estimated to keep the mill at work for three years, treating 250 tons per day, with a monthly profit of $21,000. Two lots of ore shipped from the Castle Rock mine has yielded 2.05 and 5.12 oz. gold, 17 and 19.68 oz. silver per ton, and 6.2 and 25.5% lead, respectively.

OURAY COUNTY

The Humboldt company will erect a 100-ton mill in the spring. J. W. Hutchinson, of Goldfield, has designed the plant, which will include a crusher, rolls, Hardinge and tube-mills, concentrators, and cyanide equipment.

A meeting was held at Ouray on March 17 to deal with the silting up of the Uncompahgre river by the mills of the district, farmers in the lower country stating that damage was being done. The mining companies were asked to impound as much tailing as possible. The industry has paid 59.6% of the taxes of the county during the past nine years, and agriculture only 10.5%. A general discussion followed the meeting, and committees from both parties are to meet again.

SAN JUAN COUNTY

About the middle of March the Allerton Mining & Milling Co., which operates the Joe & John property at Cement creek, opened silver and copper ore worth $50 per ton in an adit in 1750 ft., and at a depth of 600 ft. below the upper workings. This company is interested in the new mill to be erected at the North Star.

SAN MIGUEL COUNTY

A snowslide rushing down the Nellie property has carried away part of the mill and demolished the transformer-house. Building of the concentrate-treatment plant at the Liberty Bell mill is progressing well. This will do away with the cost of shipment to smelters. Bad roads have prevented shipments of vanadium ore lately, but the Colorado Carnotite Co. is preparing two carloads.

TELLER COUNTY (CRIPPLE CREEK)

Three Card and one Wilfley tables have been placed in

the Colburn mill at the Ajax mine, where the Clancy electro-chemical process is used. The Blue Flag mill on Raven hill will shortly be started, and continuous decantation will be used in the cyanide department. An orebody has been opened for 40 ft. on No. 16 level of the American Eagles mine, Bull hill, and shipments have returned $110 per ton. Block 239 of the Stratton estate is producing two cars of ore per week from the 260-ft. level. Ten to twelve inches of good ore has been cut in the south section of the 1600-ft. level of the Vindicator mine. Air pumps are lifting 200 gal. of water per minute from the 1600 to the 1500-ft. level, from where it is run to the Golden Cycle shaft and raised to the surface by electric pumps operated jointly by the two companies. The Portland company is sinking No. 2 shaft from the 1600-ft. level. A 75-ton mill to treat low-grade ore will be erected by the Free Coinage Gold Mining Company.

The Work Mining & Milling Co. has been denied a new trial with the Doctor-Jack Pot Mining Co., the latter having been awarded $432,000 for ore wrongfully extracted. The flow of water from the Roosevelt drainage tunnel has increased to 8500 gal. per minute, on account of melting snows. On March 28 two 'high-graders' were captured on the 1500-ft. level of the American Eagles mine, after about 50 shots had been exchanged. The men were fully equipped for stealing the rich ore, and other emergencies.

IDAHO

Shoshone County

On April 4 the Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 187, amounting to $65,000, making the total to date $14,173,350.

MICHIGAN

Houghton County

(Special Correspondence.)—Mine rescue car No. 8, of the United States Bureau of Mines, will visit the following mines between March 31 and April 20: Florence Iron Co., Reserve Mining Co., Penn Iron Mining Co., Loretto, Arago, Chapin, Pewabic, and Traders. In all, 43 men are to be trained at these mines. The car is at all times connected by telephone with the copper and iron mines of the Upper Peninsula of Michigan.

Pittsburg, March 20.

During 1912 the Mohawk Mining Co. mined 868,641 tons of 'rock,' sorted out 80,700 tons, equal to 9.29%, and stamped 787,941 tons, yielding 15,901,500 lb. of 'mineral,' containing 11,995,598 lb. of refined copper, as against 15,013,500 lb. in 1911. The average price received was 16.08c., as against 12.63c. per pound in the previous year. Receipts totaled $1,929,428, and expenses $1,264,187, leaving a profit of $665,250. Dividends amounted to $350,000, and the surplus is $897,316.

LAKE SUPERIOR COPPER DISTRICT.

The Ahmeek mill is being enlarged and remodeled, and will contain more regrinding machines than any plant in the district excepting that of the Calumet & Hecla. At the Quincy mill, one unit of a new system of Symons rolls, hydraulic classifiers, and jigs are to be installed, to reduce all the oversize from the stamp-mill and deliver a better product to the following machines. A centrifugal pump of 20,000,000 gal. daily capacity has been installed as a duplicate, in case of emergency.

The Quincy Mining Co. did 2734 ft. of diamond-drilling and 31,405 ft. of development during 1912, and sent 1,309,253 tons of 'rock' to the stamp-mills. At No. 2 shaft ore was mined from an average incline depth of 4360 ft., and at No. 8 from 3870 ft. No great change has been noted in the copper content of the rock in the new lower or bottom openings, though the section north of No. 8 shaft is showing good ore. The yield of refined copper was 20,634,800 lb., worth $3,351,360. Mining, smelting, taxes, and general expenses totaled $2,291,913, leaving a profit of $1,089,674. Dividends paid amounted to $550,000, and the surplus is $1,393,278.

MINNESOTA

St. Louis County

The Pittsburg Iron Ore Co., at Virginia, will install a 500-kw. Curtis turbo-generator and switchboard at its mines at Iron Mountain. The unit will be of the General Electric Co.'s manufacture.

MONTANA

Silverbow County

(Special Correspondence.)—Samuel McConnell, superintendent of the Butte Central, is authority for the statement that, from the present mine run of ore the company is earning a good profit, but the company has been rather slow in transferring funds from Boston to Butte for operating expenses, and this has hampered work somewhat up to the present time; but when the returns come in from the shipments of concentrate, financial problems, it is promised, will be solved for good. The mill is handling at present 100 tons of ore per day, and the concentrate contains an average of 80 oz. of silver, $7 in gold, and 7½% of lead. About 30% of the metals in the ore are saved by concentration and the balance in the cyanide department. As the lead is lost by sending concentrate to the Washoe smelter at Anaconda, it will hereafter be shipped to Utah. Mining is being done on the 200, 300, 400, and 500-ft. levels.

Butte, March 30.

(Special Correspondence.)—The new management of the Davis-Daly Copper Co. states that ore is being found beyond the faults, and it is to be hoped that something good is in sight for the long-suffering shareholders. The shaft of the Butte & Zenith Mining Co., in the extreme western part of the district, is down 350 ft., and sinking is being done at the rate of 100 ft. per month. If ore is opened in this property a revival of the western end of the district may be expected. In February the copper-mining companies of Butte again paid their miners 25c. more per shift than their contracts call for. The average price of copper was below 15c. per pound, but the miners were paid $3.75 per shift instead of $3.50 as per contract. The Tuolumne Copper Co. has elected the following officers for the ensuing year: Edward Hickey, president; Ray J. McDonald, vice-president; and J. W. Pratt, second vice-president. These, with Daniel Shields, Charles R. Leonard, N. J. Bielenberg, and T. E. Murray, constitute the board of

directors. During 1912 the company mined 47,000 tons of ore at a net profit of $9 per ton. A saving in power-costs of nearly $3,000,000 per year is credited by the Anaconda Copper Mining Co. to its electric power equipment, supplanting the more expensive steam power. This saving is not manifested in greater dividend rate, but in the handling of lower grades of ore, thus prolonging the life of the mines. The Neversweat mine will be closed for six months while the shaft is being retimbered and a new head-frame erected. The shaft of the Rainbow Lode Development Co. is down 225 ft. It will be continued to the 800-ft. level before any lateral work is attempted.

Butte, March 22.

On the 1400-ft. level of the Davis-Daly, a cross-cut 86 ft. in length, driven from a drift 500 ft. long, has opened 12 ft. of high-grade copper ore, bornite being much in evidence. The shoot can be reached from eight different points on the level. On the 1900-ft. level, 2 ft. of copper glance also cut shows another 12 in. of poorer ore.

The Bullwhacker mill is to be enlarged to treat 100 tons of ore per day, and supplies have been ordered for an output of 8000 lb. of electrolytic copper per day.

NEVADA

Lincoln County

During March the Prince Consolidated mine at Pioche sent out about 3500 tons of ore and a large tonnage of tailing from Bullionville. Diamond-drilling is being done at the Prince Extension. A carload of ore from the Boston & Pioche averaged 40% lead, 132 oz. of silver, and $4 in gold per ton. The 300, 400, and 450-ft. levels of the Gipsy mine, of the Bristol Consolidated company, have opened good lead, copper, and silver ore. On the 500-ft. level a cross-cut is being driven to get under this ore.

Lyon County

On the No. 7 level of the Ludwig section of the Nevada-Douglas, the winze at the south end is producing 15% copper ore. A shoot of carbonate ore has been opened on No. 4 level, and yields 25 to 30 tons of 6% ore per day. A raise is being driven on 18 in. of carbonate ore on No. 2 level. Work in the Douglas Hill section shows no important changes.

The third annual report of the Mason Valley Mines Co. shows that a net profit of $226,897 was made. At the mines, the ore-shoots have been developed, showing continuous ore for 800 to 900 ft. in length. Limestone has been opened for fluxing purposes. Diamond-drilling covered 2216 ft. and development 1391 ft. The smelter, which was described by T. T. Read in the *Mining and Scientific Press* of August 31, 1912, was started in January 1912, and dealt with 98,912 tons of Mason Valley ore, 142,910 tons of custom ore from Nevada and California, and 15,768 tons of limestone, producing 16,580,493 lb. of copper, 917 oz. of gold, and 49,318 oz. of silver.

Nye County

The Tonopah mines produced 10,998 tons, valued at $237,380, during the week ended March 29. The main cross-cut on No. 8 level of the West End has proved the vein to be 8 ft. wide, of low-grade ore. On the 515-ft. level of the Montana, 400 ft. northwest of the shaft, a raise of 20 ft. has cut 3 to 5 ft. of heavy sulphide ore assaying $137 per ton. The north cross-cut on the 1070-ft. level of the Merger has cut 4 ft. of ore, in trachyte formation. On the hanging wall is 10 to 14 in. of ore assaying $15 to $40 per ton. A new 150-hp. motor has been installed at the MacNamara hoist, and the 10-stamp mill is treating 83 tons per day. At the Buckeye-Belmont, a new electric-hoist motor, capable of hoisting a 2-ton skip at 700 ft. per minute, is being installed. An ore-bin will be erected near the shaft.

At Manhattan the White Caps lease is shipping ore through the Western Ore Purchasing Co. to Salt Lake smelters. This ore is worth $30 to $300 per ton, and contains antimony and arsenic, and is not amenable to ordinary treatment.

White Pine County

At the pit at Copper Flat, water from the Ely Consolidated is being used by the Nevada Consolidated. At the Liberty pit, one steam-shovel is working in ore and another in overburden. At the mill, the riffles on the Wilfley tables are being altered. A test is being made with an Isbell vanner on coarse tailing. The slime-settling plant is being increased by 16 Dorr thickeners, while at the east end of the mill there will be eight more thickeners, 8 by 20 ft., installed. Forced draft is being used in the roasting furnaces, resulting in an increase of 50% in capacity. There have also been alterations in the handling of converter slag, which is moved by an oil-fired locomotive. An interesting test will be proved by the use of oil from California and coal from Utah in locomotives about the plant. The February copper production of the Nevada Consolidated Copper Co. was 4,798,537 lb., as against 4,169,708 lb. in January and 4,888,790 lb. in February of 1912.

CANADA

British Columbia

The ninth annual report of the International Coal & Coke Co. states that 520 men are employed, and the net profit for 1912 was $232,198, of which $132,198 was transferred to the surplus account and the balance carried forward to the working and dividend fund for 1913. On March 26, 3.5 ft. of silver ore was cut at a depth of 700 ft., and in about 1000 ft., in the adit of the Utica mine at Kaslo.

Ontario

During the week ended March 22, seven Cobalt mines shipped 406 tons of ore, and five shipped 99,492 oz. of bullion, making the total from the district for the year 4678 tons and 1,577,793 ounces.

On the 575-ft. level of the Timiskaming mine, the drift has been driven in ore for over 60 ft. This is in diabase, and about 70 ft. below the contact with the Keewatin. High-grade ore has been opened in No. 8 vein of the Lawson. On the 300-ft. level of this mine, several hundred tons of rock fell on March 24, killing an Austrian.

At Porcupine the McIntyre mill is treating 150 tons per day, this being its full capacity. Twenty men are working at the Jupiter, the principal work being driving on the 200-ft. level and raising from the 300 to the 200-ft. level. On No. 3 vein of the Foster Oaves, a depth of 50 ft. has been reached. The mill is being erected as quickly as possible.

At Swastika the Burnside property has been sold to W. L. Foley for $250,000, with an initial payment of $5000. Although little work has been done on the property, it is said to be one of the most important in the Kirkland Lake district.

Yukon

The Yukon Gold Co. has started work for the coming season, and about 100 men are employed in the machine-shops and general work. The transformer stations in Bonanza valley will be moved up the hills, so as to be clear of hydraulic work. Since the company's powder-house was robbed of dynamite, it is being guarded by armed watchmen. Owing to the continued mild weather, an early break-up of the ice is expected. A new copper vein has been cut at 200-ft. depth in the Valerie property of the Atlas Mining Co. at Whitehorse.

MEXICO

Jalisco

A rich shoot of ore about 5 ft. wide has been opened in the Animas mine, owned by the Amajac Mines Co., in the Hostotipaquillo district. Supplies and machinery for the new 50-ton cyanide plant are being assembled. W. J. Pentland is general manager. The new mill for the Cinco mines has been ordered, and will consist of 30 stamps, 5 tube-mills, concentrators, and cyanide plant of 250 to 300 tons capacity. H. E. Crawford is manager. The Mezquital Mining Co. has completed experimenting on its ores, and the results show that a good recovery can be made by leaching and decantation. M. J. Slattery has gone to inspect mills in the United States and will order the new plant required.

Company Reports

GOLDFIELD CONSOLIDATED MINES COMPANY

According to the report of Albert Burch, the new general manager of the company, during the month of February 1913, the total production of this company was 26,711 tons, containing $567,356, or an average of $21.24 per ton, of which 24,840 tons was milled with an average extraction of 93.17%, and 1871 tons was shipped, of an average value of $20.93 per ton, the net recovery from all ore being $19.89 per ton. The net realization was $348,853, equal to $13.06 per ton. Development work covered 2757 ft. during the month. In the Combination section of the mine, a diamond-drill was started from a station about 350 ft. east of the shaft on the 380-ft. level, and a hole was drilled southeasterly at an angle of 48° to cut the downward extension of the Reilly shoot. The 448 cross-cut in the Mohawk, in the foot-wall of 490-R stope, cut the downward extension of the same shoot, and produced 53 tons of ore averaging $20 per ton. No. 303-M raise, in the Laguna, has cut 6 ft. of $17 ore. This new orebody has been opened by raises for 100 ft. on its dip. In the Clermont-Jumbo, the 420 stope, 700 ft. south of the shaft, has produced a large tonnage of ore averaging $36.63 per ton. The 604-W stope, on 534 orebody, produced 431 tons of $51.70 ore; while No. 802 yielded 483 tons of $50 shipping ore. Prospecting for the downward extension of the 802 shoot continues on the 1400-ft. level.

Costs for February were as follows:

Mining, including stoping and development)	$3.23
Transportation	0.08
Milling	2.01
Marketing	0.08
General expense	0.38
Bullion tax	0.15
Construction	0.30
Marketing ore	0.80
Total cost of operation	$7.03
Miscellaneous earnings	0.04
Net cost per ton	$6.99

DALY WEST MINING COMPANY

The annual report of the Daly West Mining Co. shows that mining work covered 7131 ft. On the 1700-ft. level an orebody has been opened 100 ft., and upward 125 ft. Considering the small amount of work done on the 1900, 2000, and 2100-ft. levels, a good deal of ore has been produced. The 900-ft. level will be prospected during the current year. Owing to the water-supply being frozen part of January to May, the mill only worked 201½ eight-hour shift. Production was as follows:

Crude ore sold, tons	17,497
Yield from ore:	
Copper, pounds	552,692
Lead, pounds	6,151,286
Gold, ounces	569
Silver, ounces	756,602
Value received	$303,230
Concentrate produced at mill, tons	7,245
Contents of concentrate:	
Copper, pounds	159,002
Lead, pounds	4,468,419
Gold, ounces	259
Silver, ounces	249,614
Value received	$252,558
Zinc concentrate produced, tons	1,465
Contents of concentrate:	
Zinc, pounds	1,004,554
Lead, pounds	182,209
Silver, ounces	30,211
Value received	$32,172
Total value received	$587,961
Dividends paid	$216,000
Total production to date	$15,058,186
Total dividends to date	$6,579,000
Cash on hand	$109,868

Merton's Copper Statistics

European statistics of copper stocks as of March 15 are given by Henry R. Merton & Co., Ltd., as below:

Stocks in England and France:	Long tons.
Liverpool and Swansea, Chile bars and ingots	3,150
Liverpool, Swansea, and Port Talbot, English standard copper	13,277
Liverpool and Swansea, other standard copper	2,249
London, Newcastle-on-Tyne, and Birmingham	3,199
Total standard copper	21,875
Liverpool and Swansea, furnace material (fine)	1,130
Havre, stocks fine copper	3,857
	26,862
Afloat from Chile (fine)	2,775
Afloat from Australia (fine)	4,500
	34,137
Rotterdam stocks (fine)	4,950
Hamburg stocks (fine)	4,552
Total visible supply in Europe	43,639

Settlement prices for copper recently were as follows: February 15, £65 15s.; February 28, £64 15s.; March 15, £64 12½s.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

W. J. Lorino is in Western Australia.

E. L. Oliver is back from New York.

C. C. Broadwater is returning from New York.

J. A. Holmes is expected in San Francisco May 1.

Charles E. van Barneveld will remove to San Francisco May 1.

Silas Wright is leaving Medellin, Colombia, for a journey of observation.

H. E. West has left London for India in employ of John Taylor & Sons.

J. E. Clennell has come up from Pachuca and is now at Oakland, California.

R. T. Mason has left Salt Lake City and will be at Los Angeles for the present.

Y. Tsuboi is back at Kosaka after a trip through the United States and Europe.

W. J. Rickell has gone to Knik, Alaska, to manage the Free Gold Mining Co.'s property.

T. A. Rickard has been elected corresponding member of the Canadian Mining Institute.

W. H. Shockley expects to be at Palo Alto, California, for some time after the middle of April.

L. H. Barkdoll succeeds George Kingdon as superintendent for the Old Dominion Copper Company.

F. Lynwood Garrison has had a touch of fever at Caceras, Colombia, but recovered nicely. He will be home in May.

Albert Burch, W. A. Bradley, Fred J. Siebert, John G. Kirchen, Frederick Bradshaw, W. H. Blackburn, and W. B. Alexander, form the executive committee of the newly formed Nevada Mine Owners' Association.

Joseph MacDonald is to be tried at Juneau in May for murder. The case grows out of the killing of N. C. Jones in 1902 in connection with labor troubles. At the time killing in self-defense seemed so clear that Mr. MacDonald was not tried. Why the matter has been brought up now is not clear.

Market Reports

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. April 3.		Closing Prices. April 3.
Adventure	$ 2¼	Mohawk	$ 62¼
Allouez	37½	North Butte	30
Calumet & Arizona	67	Old Dominion	50¼
Calumet & Hecla	465	Osceola	93½
Centennial	15½	Quincy	70½
Copper Range	45½	Shannon	10¾
East Butte	12¾	Superior & Boston	3½
Franklin	6¼	Tamarack	34
Granby	63¾	U. S. Smelting	41½
Greene Cananea	7⅛	Utah Con	9
Hancock	22¾	Victoria	1
Isle-Royale	25¾	Winona	2
Mass Copper	4½	Wolverine	61

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, March 27.

Atlanta	$ .17	Mizpah Extension	$ .70
Belmont	6.70	Montana-Tonopah	1.70
Big Four	.85	Nevada Hills	1.10
Buckhorn	1.00	North Star	.27
Con. Virginia	.09	Ophir	.11
Florence	.52	Pittsburg Silver Peak	.52
Goldfield Con	2.52	Round Mountain	.49
Halifax	1.20	Sierra Nevada	.14
Jim Butler	1.00	Tonopah Extension	2.30
Jumbo Extension	.28	Tonopah Merger	.86
MacNamara	.20	Tonopah of Nevada	5.72
Manhattan Consolidated	.10	Union	.10
Mexican	.74	West End	1.30
Midway	.50	Yellow Jacket	.21

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 3.

Associated Oil	$43.87	Orcutt	$ .55
Caribou	.90	Palmer	.13
Claremont	.60	Palmer Union	.18
Coalinga Central	.20	Premier	.30
De Luxe	.60	Republic	.15
Maricopa 36	.33	Sterling	1.20
Monte Cristo	.81	United Oil	.32
New Pa Pet	.42	W K Oil	2.22

MINING STOCK QUOTATIONS—NEW YORK

(By courtesy of J. C. Wilson, Mills Building.)

	Closing Prices. April 3.		Closing Prices. April 3.
Amalgamated Copper	76	Miami Copper	$24¼
A. S. & R. Co.	65½	Mines Co. of America	2¾
Braden Copper	8⅞	Nevada Con.	18¼
B. C. Copper Co.	3½	Nipissing	9
Chino	42¼	Ohio Copper	⅛
First National	1⅛	Ray Con.	19½
Giroux	2¼	Tenn. Copper	36¼
Goldfield Con.	2⅝	Tonopah Belmont	6⅝
Greene-Cananea	7½	Tonopah Ex.	2¼
Hollinger	17	Tonopah Mining	6½
Inspiration	17	Trinity	4½
Kerr Lake	3½	Tuolumne Copper	2¾
La Rose	2¾	Utah Copper	54¼
Mason Valley	6¾	West End	1½
McKinley-Darragh	1⅛	Yukon Gold	2⅛

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, April 3.	Unlisted.	Closing prices, April 3.
Associated Oil 5s	100½	Natomas Dev. 6s	99
E. I. du Pont 4½s	93½	Pac. Port. Cem. 6s	99
Natomas Con. 6s	94¾	Riverside Cem. 6s	77
Unlisted.		Standard Cem. 6s	92
Associated Oil 1st ref.	84¾	Santa Cruz Cem. 6s	85
General Petroleum 6s	65⅝	So. Cal. Cement	80

STOCKS.

Listed.	Closing prices, April 3.	Unlisted.	Closing prices, April 3.
Associated Oil	44⅛	Mascot Copper	2⅛
Amalgamated Oil	86½	Noble Electric Steel	17
E.I. du Pont Powder pfd.	90	Natomas Consolidated	14
Pac. Coast Borax, pfd.	100½	Pac. Coast Borax, old.	206
do com.	80	Pac. Portland Cement	60
Pac. Crude Oil	40c.	Riverside Cement	50
Sterling O. & D.	1.17½	Standard Cement	18
Union Oil of Cal.	91½	Standard Oil of Cal.	170
West Coast Oil, pfd.	70	Santa Cruz Cement	43

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlements on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco, April 3.

Antimony	12—12½c	Quicksilver (flask)	41
Electrolytic Copper	15¾—16c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, April 2.—Copper prices are firm on account of heavy buying here and in Europe. Lead still remains unchanged. Spelter is easy, floods interfering with consumption. Average daily prices for the past week in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Silver, per oz.	Electrolytic Copper.	Lead.	Spelter. St. Louis
Mar. 27	Wires Down	14.65	4.30	5.70
" 28	57¾	14.75	4.30	5.70
" 29	Wires Down	14.80	4.30	5.70
" 30	Sunday.	No market.		
" 31	57¾	14.90	4.30	5.70
April 1	57⅞	15.00	4.30	5.70
" 2	Wires Down	15.08	4.30	5.70

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months.

		U. S.	European.
April	1912	62,367,557	137,806,000
May	"	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	.....	95,542,720

UNITED STATES PRODUCTION AND CONSUMPTION

	Production.	Domestic deliveries.	Exports.
March 1912	125,694,601	67,847,556	58,779,566
April	125,694,001	69,513,846	53,252,326
May	126,737,836	72,702,237	69,485,945
June	122,315,240	66,146,229	61,449,650
July	137,161,920	71,093,120	60,121,600
August	145,628,521	78,722,418	70,485,160
September	140,089,819	63,460,810	60,264,796
October	145,405,453	84,104,734	47,621,342
November	134,695,440	69,369,795	55,906,550
December	143,353,280	58,490,880	65,712,640
January 1913	143,479,625	65,210,030	60,383,845
February	130,948,881	59,676,402	72,168,623
March	.....	.....	93,412,480

SILVER

Below is given the average New York quotations, in cents per ounce, of fine silver for the months indicated:

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	....	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

COPPER

Daily quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Below are average monthly quotations, in cents per pound:

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	....	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

LEAD

Lead is quoted ordinarily in cents per pound or dollars per hundred pounds delivered at St. Louis or New York. Below are the average New York quotations by months:

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	....	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, and based upon St. Louis or New York delivery. While New York quotations, as a matter of convenience, are commonly used, relatively little spelter actually goes to or comes from New York. The bulk is shipped direct from the plants in the Mississippi Valley to manufacturers, due allowance being made for freight. New York daily quotations are published in this column each week. Below are given averages by months:

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	....	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average monthly quotations, in dollars, per flask of 75 lb., are given below:

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	....	Oct.	41.50	....
May	41.75	....	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	....	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.60
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.20	0.25
Borax, cryst. and conc., bags, ℔ 100 lb	3.00	4.35
Borax, powdered, bbl., ℔ 100 lb	3 38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.50	13.60
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	4.50	5.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.60
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	8.75	9.65
Lead acetate, white, broken casks, ℔ 100 lb	10.00	10.25
Lead acetate, white, crystals, ℔ 100 lb	11.75	12.25
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	11.50	13.50
Litharge, com'l, ℔ 100 lb	8.00	9.50
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—½% Fe)	36.00	47.60
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	15.00	18.00
Potassium permanganate, drum, ℔ lb	0.11	0.12½
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.60
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.55	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	9.75	11.00

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.04½	0.05
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre, ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	60.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	50.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.60	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	30.00
Glisonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	450.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Sulphur, 80%, ℔ ton	16.50	18.50
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	475.00	500.00
Tungsten ore, 65%	450.00	600.00
Vanadium ore, 15% V_2O_5, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

On Monday, March 3, 1913, the Bunker Hill & Sullivan M. & C. Co. paid dividend No. 186 of $65,400. This makes the total amount of dividends paid $14,107,950.

New York Metal Market Review

The New York metal market, especially as regards copper and tin, was favorably affected by the news that Adrianople, the long-besieged Turkish stronghold, had fallen on March 26 and that better prospects were ahead for Europe. In the month there was one very good movement of buying for export, and one on the part of domestic consumers. Prices varied little. The exports were heavy, although not all for immediate consumption. Lead prices held steadily throughout the month, though prospective tariff changes made final consumers go slow. Prices of spelter advanced, but declined again after a brisk demand had been satisfied. Antimony closed the month lower in price and very dull, a result of overbuying. Aluminum advanced, and its scarcity, especially in sheets, was a cause of distress on the part of manufacturers. Tin dropped a couple of cents in the month, but the downward trend is believed to have ceased, largely because of more strength abroad.

COPPER

The first days of March brought a betterment in market conditions because of an improved demand from abroad, as a result of which copper advanced a few points and on March 3 was quoted at 15c. cash for Lake and 14.87½c. cash, New York, for electrolytic. Most of the selling agencies did a good business on foreign account during this period of activity, but domestic consumers did but little buying. A few days later, however, beginning on March 7 when the February report of the Copper Producers' Association was made public, a good domestic buying movement started, and in the course of a couple of days a large quantity of copper was taken, most of it for fairly early delivery. Prices responded to the awakened demand, and the price of Lake arose to 15.12½c. and that of electrolytic to 15c. As will be at once surmised, the reason for the activity was the showing of a decrease of nearly 900,000 lb. in stocks in the previous month. In this flurry the price of Calumet & Hecla was advanced to 15.25c. cash, and sales made at that figure, but Lake copper was still to be had at the lower price. It was noted that the business done on March 7, and the day after, duplicated the activity of the same time a month before, when there was also good domestic buying, but little for foreign shipment. Tight money conditions abroad were credited with the failure of Europe to buy to a greater extent. A little before the middle of the month dullness set in again and prices dropped to 15c. cash for Lake and 14.87½c. for electrolytic, prices which were quoted to the end of the month and which undoubtedly were shaded. Some strength was added to the market on March 26 by news from abroad that Adrianople had at last fallen. The event was construed as indicating early peace in the Balkans and a restoration of healthier conditions in Europe. London prices, on receipt of the news, advanced 17s. 6d. Despite the better tone of the market, indications were, at the close of the month, that buying would not be resumed in full force until the appearance of the March statement of the producers. The best feature in the latter part of the month was the heavy exports, which totaled 41,702 tons, as against 27,074 a year ago. No one believes, however, that all of the metal exported was for immediate consumption, the general view being that a good part of it went into warehouse to await demand. The average price paid for copper in the Naugatuck valley in the month of February was 15.50 cents.

LEAD

The market was dull throughout March. Demand for certain brands improved a little in the early days of the month and imparted a better tone to the situation generally, but otherwise dullness ruled. Prices, however, stood without change at 4.35c. New York and 4.20c. St. Louis. As previously pointed out, a price-sustaining influence is the narrow difference between production and consumption, but despite this, the holding up of prices is surprising in view of the fact that of all the metals, lead seems most menaced by tariff changes. A reason for the recent dullness is that open weather conditions permitted much outdoor work during the winter months, and a consequent more or less steady consumption of lead which, ordinarily, would not be purchased or used until the usual season for milder weather.

SPELTER

The closing week of March found spelter in the throes of another decline and very dull. At the beginning of March prices were about 6.25c. New York and 6.10c. St. Louis, but the market took an upward turn and 6.40c. New York was reached by March 10, for no other reason, it was reported, than that the advance was agreeable to the interests in whose hands the supply of prompt delivery metal was pretty well centred. At this time it became known that American spelter had been selling abroad at the equivalent of 5.44c. c.i.f. British ports, but this metal had been refined from Mexican ore and therefore had the advantage of a draw-back duty. While the higher price prevailed, there was a good demand, but this was soon satisfied, and then prices receded until in the last week it could be had in carload lots at 5.90c. to 5.95c. St. Louis, and 6.10c. to 6.20c. New York. March 27 it declined to 5.85c. New York and 5.70c. St. Louis. So slow did the demand become that, according to reports from the West, the production of ore was curtailed.

ANTIMONY

Throughout the month the antimony market suffered from the overstocked condition of consumers and not a few dealers. An immense quantity of antimony was contracted for in the buying movement which started last November, and deliveries against these contracts still obstruct new business. Prices have declined and some sellers have declared that they are more inclined to withdraw from the market than to press sales. When March opened, prices were about 9.25c. for Cookson's, 8.62½c. for Hallett's, and 8c. for Chinese and Hungarian grades, while at the close of the month they were 9c. for Cookson's, 8.50c. for Hallett's, and 7.62½c. for Chinese and Hungarian grades.

ALUMINUM

The close of March brought with it slightly higher prices and a firm market for aluminum. Prices in the last week ranged from 26.87½ to 27.12½c. for prompt shipment and 26.62½ to 26.87½c. for future delivery metal, 98 to 99% pure.

TIN

At the first of March tin was selling at 48.50c. New York, and in the last week of the month around 46.50c., but with the prospect of better prices because of the better feeling in London following the fall of Adrianople. Up to March 5 the market was quiet on the surface, but there was a fair business for future delivery. In the following week business in futures continued fair, with prompt-shipment metal in poor demand. At this time, and until the end of the month, tin was selling in New York at below the import price. In London during most of the month the feeling was pessimistic, which led to persistent bear selling by operators. While bearing the market, this selling gives promise of future strength, as there will be a great deal of tin required to cover short interests when contracts become due. Between March 13 and 19 the fair demand for futures continued, and the call for spot was slightly improved. In this week it was noted that there was in New York harbor the largest quantity of Chinese tin ever in that port, two ships having arrived with 320 tons aboard. This metal runs 97 to 99¾% pure, and the high grades are suitable for any purpose for which tin is used. The closing week of the month brought a little action in buying, but not much, although the trade was hopeful and believed that price recessions were about at an end. A feature of the month was the large arrivals, which up to March 27 totaled 5575 tons. Deliveries are estimated at 5000 tons, so that a good initial supply for April stocks is assured. March 26 there was afloat 2180 tons. The lowest price for the month was 45.70c., and the highest 48.50c. At auction sale in Rotterdam on March 27, about 2450 tons of Banca tin brought 131¾ florins, equal to about 48c. c.i.f. New York.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

TELEPHONE connections over the lines of the American Telephone & Telegraph Co. in 1912 totaled 8,472,000,000 calls.

WATER used by the 12 large mines at Kalgoorlie amounted to 36,780,000 gal. in December, an average of 283 gal. per ton treated.

A REGRINDING TESTING plant of one 8-ft. Hardinge mill and four Wilfley tables is being installed at the Mohawk mill, Lake Superior.

ELECTRIC HAULAGE in the Mason Valley mine, Nevada, is done by two 4-ton Jeffrey locomotives, and 42 heavy steel cars of 24-cu. ft. capacity each.

DIAMONDS won in New South Wales in 1911 totaled 5771 carats, valued at $20,000, and since 1867 there have been mined 176,731 carats, worth $570,000.

CONSUMPTION of chemicals at the Standard mill, Bodie, in 1912, was: cyanide, 1 lb. per ton treated; lime, 14.6 lb.; lead acetate, 0.1 lb.; zinc, 0.5 lb.; and tube-mill pebbles, 1 lb. per ton.

OIL consumption at the Copper Queen power-plant at Douglas is 1.125 lb. per i.hp. hr. Oil used is California crude weighing 8.05 lb. per gal. at 60°F., and has 18,400 B.t.u. per pound.

PRESSED, SEWER, AND PAVING BRICK must not crush at less than 5000 lb. per square inch gross area, hard select common brick under 2300 lb., and common brick under 1800 lb. per square inch.

JAPANESE drill men working with a California rotary in the Echigo fields, for the Nippon Oil Co., recently drilled 720 ft. in three days. The rotary machine proves to be especially well adapted to the work in Japan.

FIRE-CLAY of the Dirt Hills district, Saskatchewan, Canada, has the following analysis: Silica, 51.94%; alumina, 33.62; ferric oxide, 1.5; lime, 0.23; magnesia, trace; potash, 0.82; soda, 0.22%; and loss on ignition, 11.44 per cent.

DRILLERS at No. 3 well of the Lakeview No. 2 Oil Co., on the Maricopa flat, California, have made a record for rapid work, drilling 675 ft. in 5 days, using a 'disk' bit recently introduced. The rock consisted of clay and gravel, which is considered hard work on an ordinary bit.

WEIGHT of all metallic ores mined in the United States in 1911 was 105,000,000 tons, and that of quarries, clay-pits, oil wells, phosphate mines, and other non-metallic products together was about 300,000,000, while that of coal was 486,000,000, according to estimates of the Geological Survey.

SANITARY CANS now largely used in packing foodstuffs have little or no solder used in their making, joints being made tight by being squeezed together. It is a peculiar point about cans that the joints, which occasionally let in air, setting up decomposition of the contents, will not allow the gas so formed to escape.

SMELTERS in Canada in 1912 treated a total of 3,008,559 tons of ore, divided as follows: nickel-copper ores, 725,065 tons; silver-cobalt-nickel-arsenic ores, 8136 tons; lead and other ores treated in lead furnaces, 63,042 tons; and copper-gold-silver ores, 2,212,316 tons. These figures do not represent the complete production of smelting ores, as considerable quantities of copper and silver ores are still shipped to smelters outside of Canada.

LOW-PRESSURE steam-turbine engines have a useful field among plants with the following features: (1) Good engine design, fair operating efficiency, and increased capacity necessary; (2) inefficient engine design, condensing, or non-condensing, and improved economy necessary; (3) unsuitable or inefficient condensing plant; (4) plant location such that water-supply is limited, unsuitable, or costly, and non-condensing operation enforced; and (5) high fuel cost. For the same coal consumption, a net increase in capacity of 80 to 100% is possible, the power cost being reduced in the same proportion.

BEST Swedish filter paper is made from clean, carefully sorted rag-stock, boiled with NaOH and bleached in the half half-stuff stage by gaseous Cl. The ash content of the boiled and bleached half-stuff is 0.039 to 0.177%. Great care must be taken to beat the stuff neither too slowly nor too freely. In the former case, the rate of filtration is retarded, while in the latter case the fine grained precipitates pass through the filter. The best paper is leached with HCl and HF to decrease the amount of ash, and after this treatment it is frozen in order to render it softer and more porous. The paper is hand made, and the most rigid control is maintained over all stages of its manufacture.

SILVER production from the McKinley-Darragh mine, Cobalt, in 1912, was distributed in the following products:

	Tons.	Av. oz.
Nuggets	1.451	17,184.0
No. 1 ore	172.174	3,430.0
No. 1 picking belt	131.475	1,838.7
No. 2 picking belt	182.579	413.1
Jig concentrate	202.887	1,343.4
Sand concentrate	554.999	750.7
Slime concentrate	851.027	294.3
High-grade fines	84.555	2,345.5
Fines produced	85.810	789.3
Total	2266.957	912.9

SMELTING is to be done by the Calumet & Arizona Mining Co. at Bisbee in a new plant consisting of the following: Crushing and sampling plant of 200-tons capacity per hour, using Snyder automatic samplers, in two sections, in a building 40 by 84 ft. in plan, and 5 stories high; bedding and conveying plant similar to that at Cananea, Sonora, there being three beds for coarse and three beds for fine ore, of a capacity of 10,000 tons, also a bed for coke of 5000 tons capacity; roasting plant consisting of twelve 21.5-ft. diam. Herreshoff furnaces, having a capacity of 80 tons of fine ore per day; and two 48-in. by 40-ft. blast-furnaces, and four reverberatory furnaces, 19 by 100 ft., the matte from which will be conveyed in ladles to six Great Falls type converters. The water-supply for the blast-furnaces will be 200,000-gal. capacity, while three steel tanks of 10,000-bbl. capacity each will hold the oil-supply for the reverberatory furnaces.

'ANNUAL,' 'representation,' or 'assessment' work required by statute is one of the principles of the common law of mining wherever found. It was originated by the miner so that each occupant of mineral ground might show his good faith by doing something toward developing the ground, instead of holding large areas without exploration. Its wisdom has remained unquestioned through all the ebb and flow of criticisms and proposed changes of the mining law. State statutes or district rules may require more than $100 worth of work, but they cannot fix the amount at less. The first annual labor must be performed in the calendar year following the calendar year in which the location was made. Thus a claim located at 1 a.m. on the morning of January 1, 1910, needs no annual labor during 1910, but does require $100 worth of work during 1911. If a claim be located in December 1910 and discovery work valued at $100 is commenced and completed in 1911, the discovery work answers for the necessary annual labor for 1911. The work may be performed upon the ground of the claim. It may be performed off the claim, but upon a group of which the claim in question is an allied member, or it may be performed upon ground away from the claim and not included in the group.

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H. FOSTER BAIN - - - - - - - - EDITOR
THOMAS T. READ - - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

WHAT is the record for double-hand and single-hand drilling in contests? A correspondent asks, and we confess to having lost count.

MANAÑA, travelers in countries to the south of us declare, is not 'tomorrow,' as the dictionaries try to make us believe, but is really the name of the day that never comes. One young American engineer, grasping this point, promptly forbade his *mozo* to use the word and made this the first step in teaching promptness.

HEREAFTER the *West Australian Mining, Building, and Engineering Journal* is to appear as a monthly, though a weekly supplement containing quotations, items regarding contracts, and a buyer's directory will be issued. The *Journal* has given good service for ten years, and in whatever form printed will be welcome.

APPROPRIATE and graceful tributes are paid to Dr. R. W. Raymond in letters from the president and prominent members of the American Institute of Mining Engineers which we print this week. There is only one Raymond, and he has done a great work that all gladly acknowledge. If everyone who echoes the sentiments so well expressed in the letters were to have joined in signing, the list would tax the publisher.

THE UNITED STATES GEOLOGICAL SURVEY is at last to have a home, as provision to that effect was made in the public-building bill passed by Congress before adjournment. The new building is to cost $2,596,000, and of this expenditure, $596,000 is authorized, with the remainder to be appropriated as needed. Of the total sum of $96,000, a balance left from money for purchase of the site, is immediately available. Our congratulations go to the Survey and to Congress.

COLORADO mine owners are making a determined attempt to stop theft of high-grade ore. The effort to stop the purchase of stolen ore by general injunctions met with a check in the Circuit Court of Appeals, but Mr. Charles S. Thomas has applied to the Supreme Court for a review of this action. Laws in the United States are notably lax in this particular, and jury trial in such cases has proved to be a farce. There certainly should be some legal means of meeting the situation, since we can hardly advocate the summary method once applied at Cripple Creek when twenty or more illicit assay offices were dynamited in one night. Whether injunction is the proper procedure is for the courts to decide.

FREAK legislation run wild is the only fit characterization of the alien bills proposed at Sacramento. It does not seem to be generally realized that there is serious danger of the passage of a bill which would in practical operation confiscate much property in the state owned by English mining companies and which, by forcing sale of the property whenever the majority of the stock fell into alien hands, would prevent flotation of any California securities based upon ownership of real estate. The bills are intended to prevent the formation in California of permanent Oriental colonies. A simpler way to do this would be to permit such Orientals as are permanent citizens, to become citizens in name as well as fact. The number of Japanese and Chinese on the Pacific coast is not increasing, and the people we get from those countries remain alien because we force them to. The legislation proposed is uncalled for and vicious. It will properly offend not only the Japanese but Europeans and others, all of whom are affected. Also it will place the whole of the United States in a false and dangerous position to meet the prejudices of a few communities. Everyone familiar with the South sympathizes with the desire to prevent another race problem in the United States, but the legislation now under debate is a step toward rather than away from that, and is also full of danger to established business interests. It can not be too severely condemned.

SYSTEM is of first importance in a laboratory. Without it mistakes are made and trouble follows, and the department upon which a mine or treatment plant depends for guidance might as well not be there. On another page we publish rules posted in the assay office of the Zinc Corporation at Broken Hill. They are well worth wide reading, as they enforce with homely humor pertinent suggestions. Cleanliness and order is absolutely essential in assaying and analytical work. If order is maintained, it is possible to make several hundred determinations without numbering. This is done in many offices, even in those in which there is a feverish hurry to get through the day's work, and where the man who brings in a sample after midday is looked on as an enemy. Too often laboratories employ young men whose sole object is to finish the work and get away early. Fusions are hurried, samples in acids are not given proper time to dissolve, cupellations are made at unsuitable temperatures, and sooner or later there is trouble for somebody. At the assay office of the Broken Hill Proprietary, nobody follows a determination clear through, at least this was true in 1906. After each stage, such as crushing, weighing, or dissolving, the sample is passed to another room and another man. By this means a great deal of work is accomplished. The system has the drawback that it is bad for men to get into such a routine, and in case of accident those in one section of the department may not be able to help in another. This can easily be arranged by moving the assistants around occasionally, as should also be done in treatment plants. It is not good for the management to have employees get into a rut, and it is not fair to keep them in one department too long.

ELECTRICITY underground introduces many new problems; the more so since so large a portion of men and managers now in service were trained before its use became common. As told in our Book Review department, when electric power came to the Rand it was necessary to hold a special course of lectures to instruct managers in the ways of meeting problems raised by its introduction. Safety admittedly must come first, and yet we are not quite prepared to go so far as the labor delegate to a conference we once attended. Starting from the proposition just stated, he argued that since a voltage of 50 would certainly be safe, nothing higher should be permitted in the mine. Voltage is not the only matter that brings up problems, and standardization of equipment and rules is badly needed in mine electric equipment. We print this week the provisional report of the committee of the American Mining Congress on standardization of electrical equipment for metal mines. This report has involved much study and work. Before putting it in final form it is desired to have it as perfect as possible. Detailed criticism and discussion is therefore invited. We will gladly make space for suggestions.

QUESTIONS relating to persistence of ore in depth are of perennial interest. It has been our pleasure to publish many important articles bearing on the subject, notably the contributions of Mr. F. Lynwood Garrison, of Mr. T. A. Rickard, and the discussion they evoked. We are old-fashioned enough to believe that it makes a deal of difference what type of deposit is involved. Certainly the chance of persistence in depth is notably less in the case of the lead-zinc deposits of Wisconsin than the lead-silver veins of the Comstock. No arbitrary rule as to depth is safe. It is from this that the importance of studies of genesis arises. Because of incomplete data they may be inconclusive, and they may even lead to wrong conclusions, but the same result follows from reliance on direct observation alone. A case in point is with regard to the importance, or lack of importance, of the finding of rich ore in depth on the Rand. In his presidential address, as noted elsewhere, Mr. M. G. Elkan summarized recent discoveries in such form as to show not only that rich ore occurs, but that it is found at depth in widely scattered localities. Our Johannesburg correspondent, in discussing the matter, points out certain other facts which, taken together, greatly minimize the commercial importance of these finds. Regarded as the mineralization of favorable sedimentary beds by deep-seated solutions, there is no inherent reason as yet known why the Rand should not continue to produce rich ore to depths below those at present planned to be worked. It is outside other experience, however, to find such large and persistent ore-shoots even in favorable habitat, and it would be quite within the expected that the ore-shoots should decrease in size with depth as they do along the strike, and come to conform more nearly to the usual size of ore-shoots in sandstone and quartzite, such, for example, as the genetically similar orebodies in the Portland mine in the Black Hills of South Dakota.

Prospects, Mines, and Capital

Finding a mine is apparently no easy task. It will be remembered that a year ago the Canadian Mining & Exploration Company, Limited, was organized with ample funds and an excellent staff to finance and operate mining properties. While opportunities in Canada were to receive first consideration, the company was open to proposals from other countries as well. The company was prepared to provide capital for the extension of plant or re-equipment of producing mines or to undertake their management; to finance and work idle properties already developed; or to test prospects from the earliest stage of development. The balance sheet of the company shows that in the first year of its life nearly $40,000 was expended, of which $12,700 was directly spent on examinations, not counting staff salaries and traveling expenses. In all, 428 properties were considered, of which 285 were in Canada, 110 in the United States, 21 in Mexico, and the remainder scattering. So far as public information goes, no property was accepted, and it is known that only a very small number were found to present such intrinsic evidence of value or were offered on such terms as to warrant a field examination. Undeterred by their first experience, the company is still hopefully looking for a mine and has issued a circular giving details of the sort of information desired when proposals are submitted.

The experience of this company tallies with that of the Guggenheim Exploration Company, the United States Smelting, Refining & Mining Exploration Company, and other concerns actively engaged in the search for mines. Of the large number of properties submitted, a very small portion warrant field examination, and only out of the many is an occasional mine found. It is pertinent, however, to point out that each of the concerns mentioned has found good mines, and this is true indirectly of the Canadian company, since its directors and stockholders are owners of some of the best mines in America. It is not that there are no mines still to be found, but owners of undeveloped and idle properties have so little knowledge of how to present a property, of what a property must show to warrant its purchase, or such exaggerated notions of values, that it is hard to do business. From every mining camp there is hopeful talk about the coming of 'outside capital,' and yet it rarely takes more than a few minutes study of proposals as actually made, to show that they are not on a business basis. Few owners of prospects even know how to get an honest sample of their ore, and with the best intentions they deceive themselves and others. The miner must have hope, but it is well also to have ore. If you would sell a prospect, find out first what you have, then write an accurate statement regarding it. A two-cent stamp will take your papers to any of the concerns mentioned, or a dozen others, and your property will be given just that attention that the face of your statement shows it to deserve. To sell a real property or to obtain money for development, it is not necessary "to know a man who knows a man who knows one of the Guggenheims," or to pay a long string of commissions to middle men; but you must have a property of real value and be able to convince the buyer of that fact—just as you would if you sold a horse.

Filtration Royalties

Complete settlement of litigation over vacuum filters is still far off, but at least progress is being made. It is true that individual suits continue. The Moore Filter Company is suing the Talisman Consolidated in New Zealand, and the Lord Nelson in Victoria, while at Kalgoorlie a defence fund has been raised. Nearer home prospects are brighter. The Moore company and the Oliver Continuous Filter Company wisely decided to substitute friendly negotiations for a threatened battle in the courts, and a complete adjustment of all points at issue between these concerns has been reached. While full details have not been made public, it is understood that all questions of infringement as between the two concerns are dropped, and all present users are protected in existing rights. For the future both filters will be sold by each company, and sales are to be upon the basis of the lowest permissible first cost with a tonnage royalty, graduated according to the richness of the ore. Users may commute future royalties on a three-year basis. We congratulate both companies upon the making of this agreement, and we earnestly hope that means may be found to avoid threatened litigation in other directions. The rewards of invention should go more largely to the inventor, and taking into account the expense of defending the usually nebulous rights granted by a United States patent, it will often be found that a compromise is better than a fight. Mining men are mainly concerned in having the free choice of all types of apparatus without fear of becoming involved in litigation between rival patentees. They are, we believe, willing to pay a proper profit either in lump sum or in royalties to the men who make their own success certain, or increase their profits from a venture. In the United States there has been among mining men a strong objection to patent royalties. Just why, is not clear, since in other business relations royalties are a common phase of mining. Lump sums, either in excess manufacturers' profits or commutation of royalties, while commonly paid would seem to be peculiarly inappropriate in mining. In this industry it is especially important to keep down initial investment because the individual venture may prove a failure, but a share in going profits can be more freely granted for the reason that the mining ventures that do prove profitable afford a large margin. Inventors, because they increase the profit made by users of their machines, are entitled to share in that return and the royalty basis is fundamentally sound. In the past, mining companies have paid thousands of dollars in the form of excess sale prices on machines that, through no fault of the latter, were never used or were only run a short time. It would certainly seem more economical as well as fairer, to buy at lower rates and pay in proportion to returns received. The amount of the royalty, naturally, is a matter for negotiation.

Transportation Facilities in Central Africa

By Sydney H. Ball and Millard K. Shaler

Mining is so dependent upon improvements in transportation facilities and in means of communication, that the following résumé of the progress made in those directions in the Belgian Congo and neighboring colonies during the year 1912 may be of interest.

Congo Steamer Service

The steamer service between Antwerp and Matadi, the port at the head of navigation on the Lower Congo, has been improved by adding to the fleet of the most important steamship line (Compagnie Belge Maritime du Congo) two modern liners of 7500 tons, the *Anversville* and new *Albertville*. The time from Antwerp to the mouth of the Congo river has been reduced to 18 days. Other lines have likewise added to their fleets, and it is rumored that a new Italian line intends to run from Antwerp directly to the Congo.

Practically all travelers to the Katanga, in southern Belgian Congo, sail by the Union Castle line by way of the West Coast to Cape Town, or the German East Africa line. The former line has two sailings a week from Southampton, the mail steamers making the voyage in 17 days. The German line has recently doubled its passenger and transport service. From Cape Town to Elisabethville, *via* the Rand and Victoria Falls, is 6½ days' travel by rail. The route *via* Beira (Portuguese East Africa), Salisbury, Victoria Falls, and Elisabethville, is also occasionally used to the Katanga, but is rather long, the voyage from Naples to Beira lasting about 24 days. A five-days train service connects Beira and Elisabethville.

The East Coast route, *via* Suez and Mombassa, British East Africa, thence by rail to Port Florence on Lake Victoria Nyanza (from this port there is a weekly steamer service to all points on the lake) is popular with travelers to the Great African Lakes region. The Union Castle and the German East African lines each has a tri-weekly steamer service down the East Coast. The French company, Messageries Maritime, runs a mail service from Marseilles to Mombassa, the voyage taking 17 days. This route brings the Kilo gold mine, in Belgian Congo, within one month's travel of Marseilles.

River Steamers

The Congo river above Livingstone Falls (that is, above Leopoldville), with its numerous tributaries, is a great highway for river steamers. The importance of the Congo river and its tributaries as arteries of communication is evident from the fact that for boats of 22 tons there are over 7500 miles of navigable waters, and for boats of more than 500 tons over 1050 miles. The navigable rivers are being continuously improved by the placing of buoys and by the removal of the larger rocks from the more dangerous places. Boats are also running on the magnificent chain of lakes on the eastern border of the colony.

The 'Diesel' motor-boat given by the Belgian King for mail service on the Upper Congo was near completion on June 1 last. This boat is a three-decker of the Nile type, about 200 ft. long and 26 ft. broad, with a draught of 3.6 ft. It is a 430-ton, two-propeller boat of 1300 hp., with a speed of 15½ knots, and will make the voyage from Leopoldville to Stanleyville and return (2672 miles) in about 14 days, instead of the 30 to 35 days now necessary. She will carry oil for the round trip from Leopoldville and, later, extra oil for smaller steamers which may ply on the tributary streams.

Pipe-Line for Oil

In this review last year mention was made of the proposed construction of a pipe-line 250 miles long from below Matadi to Leopoldville, to furnish crude oil for steamers on the Upper Congo. The line, now nearly completed, is 4 inches in diameter and will have 8 pumping stations. It will be capable of delivering annually some 50,000 tons of crude petroleum. The oil must be pumped from sea-level to an elevation of 2400 ft. (Thysville), thence it falls to an elevation of a little less than 1000 ft. at Stanley Pool on the Upper Congo. The tank farm on the Lower Congo at Ango Ango has storage for 8000 tons of oil. The company building it expects to have the line in operation by March or April 1913. On the upper river, above Stanley Pool, oil barges are to be launched to furnish oil to the up-river steamers. To date favorable contracts for crude oil delivered at Ango Ango have not been made, and the company is considering commissioning its own ocean tankers.

A drydock is now being built at Leopoldville and a floating dock of 800 tons' lifting capacity is soon to be sent out to the same port. The state is setting up a 500-ton steamer for the Kasai river service, has ordered a dozen smaller steamboats for the Upper Congo river, and is contemplating adding a steamer of 800 to 1000 tons to its river fleet. Soon seven 500-ton steamers will be plying between Leopoldville and Stanleyville, two belonging to the state and five to the Great Lakes railroad. Both the state and commercial companies have added fast boats to their fleets, and it is expected that these boats, many of which can burn oil, will considerably reduce the time in ascending the Congo.

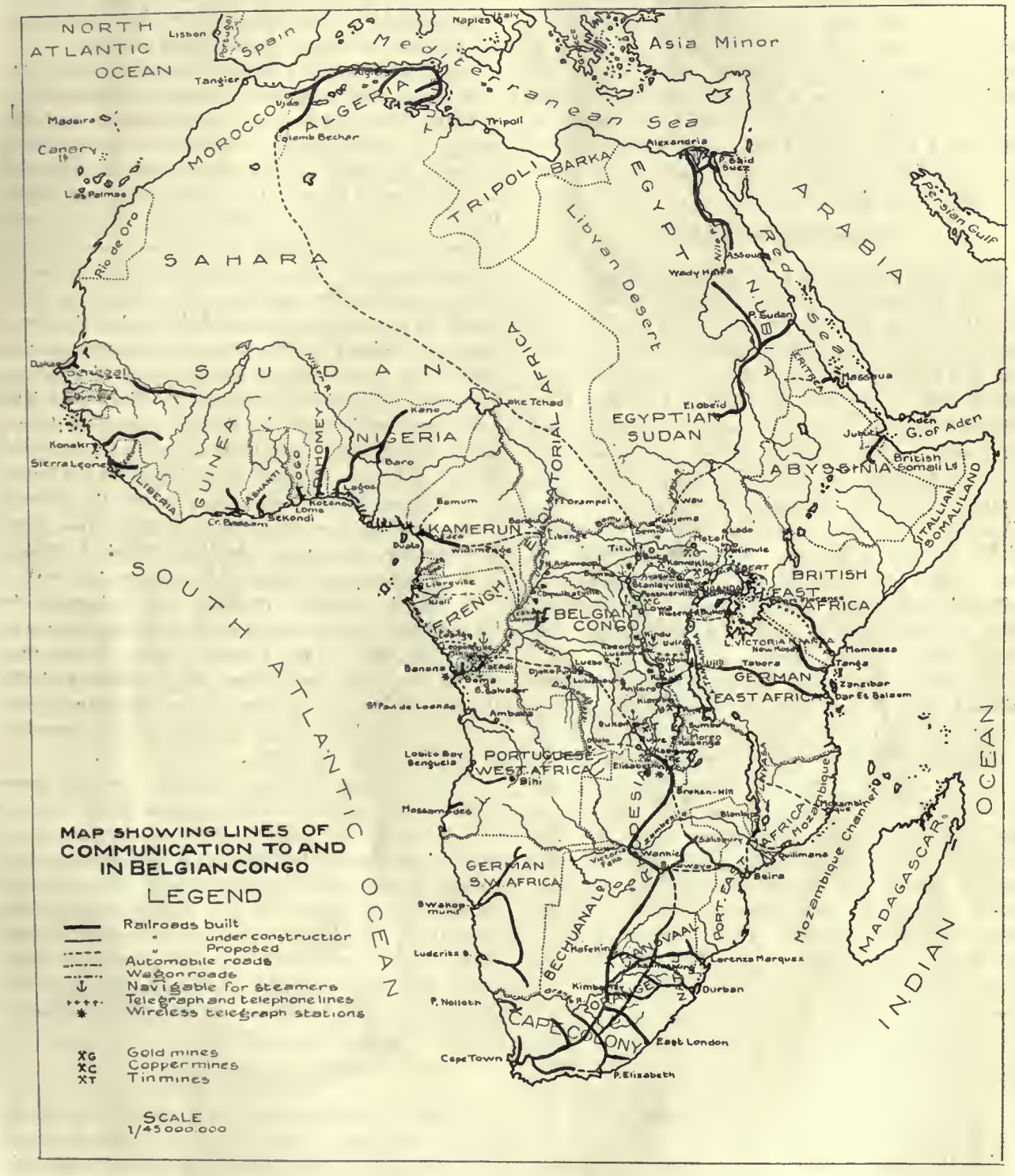
The Great Lakes railroad has regular steamer and railroad service between Stanleyville and Kongolo. There are 300 miles of rail in two sections. The river stretch, Ponthierville to Kindu, 200 miles, takes two to three days. Among the four steamers plying between these latter points is one of 100 tons. A monthly steamer service is assured by the same company between Kongolo and Bukama, in Katanga. The trip takes about six days. From Bukama to Kambove is 200 miles by caravan route, largely practicable for bicycling. In this region the minimum wage of porters is about 35 cents per day.

food included. Once a month during at least eight months in the year, the company runs steamers from Kongolo to Kiambi, three to five days' voyage up the Luvua river, near which recently tin has been found. On these upper sections the Great Lakes Railroad Co. operates one steamer of 200 tons and one of 50 tons. Two barges of 200 tons and a tug are being built at Kongolo. Kiambi is 18 days' march from Elisabethville, a considerable part of it possible on a bicycle.

The state has a regular steamer service on Lake Moero between Pweto at the north end of the lake and Kasenga on the upper Luapula river, a three-day trip. Steamers also run on Lake Tanganyika from Sumbu to Uvira. On the latter lake a German steamship company also operates, and on Moero an English trading company has a small steamer.

Railroads

Considerable progress in railroad building has been made during the year. The completion of the railroad from Elisabethville, where the smelter of the Tanganyika Concessions Ltd. is situated, through the copper belts to Kambove, has been retarded by labor shortage. Rails have, however, been laid on 67½ of its 106 miles of length to the Lufira river, and the grade is finished 14 miles farther. It should be completed about April 1913. It was estimated that this line would cost a little under $35,000 per mile. Construction of the line from Kambove toward Bukama, about 200 miles distant, will then begin. In June 1912 material and workmen were being sent from Kongolo by steamer to Bukama, and work has begun at that end of the line. This line should be finished in 1914 or 1915



(more probably the latter year), and will give through rail and steamer connection between Europe and Cape Town by way of Matadi and the Congo river.

The branch of the Great Lakes railroad (167 miles long), starting at Kabalo, 50 miles above Kongolo, and ending at Lukuga on Lake Tanganyika, opposite the German post Ujiji (80 miles by boat), is well under way. December 31, 1912, 60 miles of rails had been laid, and for 40 miles farther the grade is completed, as is also the 140-metre bridge across the Lnizi. This road should be finished by the end of 1913 or soon after. Coal was discovered near this line a year ago, at a distance of about ten miles from the lake.

German Railroad Lines

The German line from Dar-es-Salaam (East Coast) to Ujiji on Lake Tanganyika, reached Tabora early in 1912, and on October 1 was 82 miles west thereof; the line will be completed, presumably, early in 1914. The 530 miles from the coast to Tabora cost about $20,000,000, or $37,000 per mile. The line from Tabora to Kigoma, a bay on Lake Tanganyika about three miles north of Ujiji, will be 260 miles long, and will probably cost over $42,000 per mile. The completion of this railroad will put Lake Tanganyika, one of the most beautiful lakes in the world, within 20 days of Europe. With the completion of the German and Belgian lines to Lake Tanganyika, rail and steamer service will cross Central Africa from Dar-es-Salaam on the East Coast to the mouth of the Congo on the West.

The Germans are also to extend the Usambara railroad (now at New Moschi, 196 miles inland from Tanga and at the foot of Mt. Kilimanjaro) to Mambo, German East Africa, and it will supposedly terminate finally at Lake Victoria. They are also building a railroad from Duala, 4°N. latitude on the Kamerun coast, to Bidjoka, 95 miles. The line is already open to a point on Sanga river 50 miles west of Edea. On the West Coast the Germans, almost as soon as they received a portion of the French Congo as a result of the Morocco incident, considered the advisability of continuing this line to either Libenge on the Ubanghi river (at the mouth of the Lobaje) or to the Congo (at the mouth of the Sanga). It is reported that the Germans are to build either a railroad or an automobile route between Bukoba, on Lake Victoria, and Kissenge, on Lake Kivu, which lies between German East Africa and Belgian Congo.

The Mayumbe railroad, which goes north from Boma, Belgian Congo, is now being operated for over 70 miles, and it is stated that eventually it will serve the Minduli copper mine, in French Congo. The latter is now, however, connected by a light railroad 95 miles long, with Brazzaville, a town on the French side of Stanley Pool, where connection is made at Kinshasa.

The main artery of trade between Congo seaports and not only the Upper Belgian Congo, but the French Congo as well, is the Lower Congo railroad from Matadi to Leopoldville, 250 miles. Recently this road has somewhat reduced its freight tariffs, although even further reductions would notably aid in the development of the colony. The double-tracking of this line is still under consideration as a possibility, as is the reduction of its curves and grades, and the widening of its gauge. The problem of its electrification has recently been studied. Six waterfalls on the Congo were found capable of furnishing 113,000 hp., enough for the railroad and the lighting of several Lower Congo towns.

The French project for a trans-African railroad from Algiers to Cape Town, using the Belgian-English line from Stanleyville to Cape Town, took the past year, rather definite form by the incorporation of L'Union Française pour la Réalisation des Chemins de Fer Trans-African. In January 1912 an expedition to make a preliminary survey from Colomb-Bechar (the present southern terminus of the Algerian railroad) to Lake Tchad, started out from the former point. The engineer who arrived at Lake Tchad in September is said to believe that the crossing of the Sahara desert presents no unsurmountable difficulties. From Lake Tchad the line will presumably follow the divide between the Shari and Nile basins and will enter the Belgian Congo at Semio on the Bomu river, from there going to Stanleyville. The French have also under consideration the building of a railroad from Libreville, on the French Congo coast, to Nouvelle Anvers, on the Congo river. The first two sections of the line (N'Jole to Makakou), a distance of 300 miles, have been surveyed.

A French company (Société des Sultanats du Haut-Ubanghi) has made a preliminary survey north from Kadjema (Upper Ubanghi river) to the rapids on the Suen river, thence by the Wau and the Bahr-el-Ghazel to the Nile. A narrow-gauge railroad is to be built from Bangui to Fort Crampel, both in the French Congo.

A line 360 miles long (one-metre gauge) from Pointe Noire on the Atlantic, just south of Loango to Brazzaville on Stanley Pool, presumably to be built by the French, will furnish a much-needed competitor to the Lower Congo railroad. This year the Government proposed to vote $17,000,000 for the construction of this line and the betterment of the ports at either terminus. It will presumably take some eight years to build. A branch line from this road to the M'Boko Songo (French Congo) copper mines is among the possibilities.

The Benguella Route

William's Benguella railroad, which has as its goal the Katanga copper belt, is, as projected, about 1225 miles long. Of this, 425 miles, from the Katanga copper belt to the Belgian Congo frontier, is to be built by Belgian capital. The Atlantic end of this railroad was opened to traffic on September 17, 1912, for 270 miles from Lobito bay. By June 1913 it should reach Bihi and have 325 miles of railroad under operation. Upon arrival at Huambo, a little over one mile above sea-level, the most difficult part of the line will have been finished. Should capital be found for the completion of this road, it will be a most valuable adjunct to the exploitation of the Katanga copper belt, since it will give a short-line competitor to the railroads from the

south. According to agreement with the Portuguese Government, this line must advance each year at least 100 km., at which rate it would reach the Belgian Congo frontier in 1921 at the latest.

The surveys for the railroad from Lusambo (Sankuru river) to Bukama (Upper Congo river) are finished, and work will presumably begin upon the arrival of the Cape-to-Cairo railroad at Bukama in 1914 or 1915. The route will probably be changed, however, as further surveys are being carried on with the idea of fixing the western terminus at N'Dolo on the Lower Congo railroad near Leopoldville. The proposed new route touches Luebo, Luluabourg, Kanda Kanda, and Mutambo, Mukulu, and not Lusambo, joining the Cape-to-Cairo railroad at Lubende, some 15 miles south of Bukama. The line as outlined would be about 1250 miles long, and its completion would probably take some twenty years.

The route previously mentioned as being opened into the northeastern part of the Belgian Congo *via* Mombassa and Lake Victoria has recently been greatly improved and is used largely for access into the Ituri and Lake Albert regions. Supplies for the Kilo gold mines are also sent by this route. From Port Florence, on Lake Victoria, an 800-ton steamer calls weekly at all the ports, including Jinja (Ripon Falls), Kampala, and Port Bell. For travelers to Lake Albert or Kilo, landing is made at Jinja, from which port a railroad has been constructed to Kakindu on Lake Kioga. Here a steamer is taken for Port Masinda, whence a motor road is utilized to Butiaba on Lake Albert. Steamer service exists on this lake to Mahagi, whence a motor road, nearly finished at this date, is available to Kilo or to Nimule on the Upper Nile. The sole break in an otherwise continuous steamer, rail, and motor communication between Mombassa and Alexandria on the Mediterranean sea, is 105 miles of caravan route between Nimule and Lado (Gondokoro). There is also a weekly motor service between Kampala and Toro (Fort Portal), and a good caravan route thence to Boga (on the Semliki), Irumu, and Kilo. By the East Coast route, mail arrives in Europe from Avakubi (on the Ituri) in 45 to 50 days, and from Kilo in about 40 days.

In 1913 a railroad will be begun from Beira to the Shire Highlands, to join with the railroad existing between Port Herald, on the Zambeze, and Blantyre. It is expected that the latter will be extended to the south end of Lake Nyassa. Steamers are now plying on this lake, and it is probable that some time its north end will be connected by rail with Lake Tanganyika, thus forming another entry into the Belgian Congo. The projected continuation of the branch railroad northwest from Salisbury would materially shorten communication between Beira and the Katanga copper belt.

Auto and Wagon Roads

Auto roads are being constructed in the Katanga between Elisabethville and Kasenga on the Luapula river, and between Kambove and the Biana plateau country, through the Pande valley. A wagon-road has recently been built between Nioki, the Portuguese post seven miles below Matadi on the Congo river, and San Salvador, 120 miles away in Angola. A wagon-road is under way between Stanleyville and Avakubi, and mule haulage has been undertaken in the Uele district between Titule (the end of the automobile road from Buta) and Angodia.

Telegraph, Telephone, and Wireless

The Belgian colony owns telegraph and telephone lines from Banana to Coquilhatville; Kasongo to Uvira; and one from Elisabethville, in the Belgian Congo, to the Rhodesian frontier. The latter connects with Cape Town. A telegraph line has been built between Matadi, the chief Congo port, and Nioki, in Angola; this latter port is connected with Saô Paul de Loando, which has cable communication with Europe. Formerly cable messages were all sent by wireless from Kinshasa to Brazzaville (French Congo) and thence to Loango, on the Atlantic coast. Cables, of course, can also be sent by wireless to the Atlantic coast stations, or telegraphed from Brazzaville to Loango. A telegraph line connects Fort Portal, Entebbe, Kampala, Kakindu, Masinde, Ninule, M'Bale, and Port Florence to Mombassa on the East Coast.

The Belgian Congo budget for 1912 included $340,000 for the extension of wireless stations in the Belgian Congo, with an additional $81,000 for the upkeep and exploitation of those existing at the first of that year (Leopoldville and several others in the Lower Congo). At present, stations exist at Bukama, Banana, Boma, Matadi, Leopoldville, Coquilhatville, Kisala, Stanleyville, Kindu, Lowa, Kongolo, Kikondja, and Elisabethville. Later other stations are to be erected. In consequence, Boma, on the Lower Congo, and Elisabethville, are in communication by wireless. Messages have been sent and received between Kongola and Stanleyville (435 miles), and Kindu and Brazzaville, French Congo (750 miles), and unreadable signals have been heard between Lisala and Elisabethville (1060 miles). Banana, at the Congo mouth, has communicated with Swakopmund, German Southwest Africa. In the French, English, and German possessions in Africa, a number of widely distributed stations exist, and it is probable that within the coming year wireless messages can be sent from one end of Africa to the other. At first considerable difficulty was experienced because of the effect of sunlight on the shorter waves, and the best results were obtained between 2 and 6 a.m. Now, however, messages are sent during the day. An extra high-power station is being erected at Brussels, in the hope that eventually communication can be established between Belgium and her colony.

Conclusions

From the above it will be seen that considerable progress is being made in opening lines of communication in Central Africa. The importance which wireless telegraphy has for mines situated in out-of-the-way corners of the world is as yet little appreciated. The erection of wireless stations, one at the nearest railroad, the other at the mine, is much cheaper than that of a telegraph line, and the personnel required much less. In many regions in

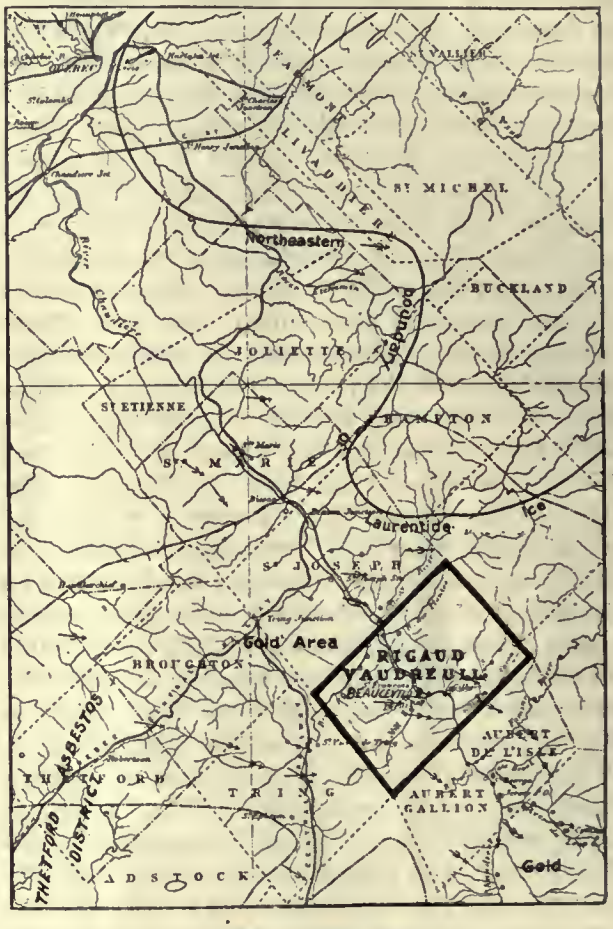
which the theft of telegraph wires or the destruction of the poles is a pastime with the natives, the wireless has undoubtedly advantages. Progress in railroad building during the past fifteen years has been particularly noteworthy. With a white population of 4000, there are at this date 788 miles of railway in operation in the Belgian Congo alone, and almost 500 miles are under construction. There is, then, almost one-quarter mile of railroad in operation in this colony per white inhabitant. Mining interests have added an important impetus to this progress, and the future of mining in Central Africa depends largely on the continued extension of routes of communication. It may be pointed out that Alaska has today only 465 miles of railroad, a comparison not in keeping with the general idea that tropical countries are backward in development.

Persistence of Ore on the Rand

In the course of his presidential address at the annual meeting of the Chamber of Mines on February 27, M. G. Elkan noted the numerous instances shown recently of excellent ore disclosed at the present deepest points of working in several mines all along the Rand. He gave the following instances. The Geduld Proprietary Mines struck the reef but a few days before at the deepest point of its workings, 1925 ft. vertical from the surface, obtaining the value of 12.1 dwt. over a width of 48 inches. The New Modderfontein Gold Mining Co., in its circular shaft, has struck the reef at a depth of 2158 ft., where it disclosed a value of 13.2 dwt. over 48.4 in. At the Modderfontein Deep Levels, in the incline shaft, which has reached a point equal to a vertical depth of 3100 ft. from the surface, a value of 10 dwt. over 46.8 in. has been obtained along a distance of 420 ft. At the Cinderella Consolidated, on its deepest, the fifth level, which runs at a vertical depth of 4440 ft. from the surface, 1350 ft. driven and sampled give an average value of 9.1 dwt. over 42 in. At the City Deep, on its deepest, the tenth level, or at a vertical depth of 3286 ft., the main reef leader has given an average value of 14.7 dwt. over 28.9 in. The nineteenth level—the deepest—driven at a vertical depth of 4190 ft., showed the main reef leader to have a value of 10.4 dwt. over 36 in. The Crown Mines, at its deepest working, the sixteenth level cross-cut from No. 5 shaft, at a vertical depth of 2660 ft., has exposed a large body of reef, being the main reef leader and the main reef, of quite abnormal width and value—the main reef leader alone has given 11 dwt. over 132 in. Farther west, the Consolidated Main Reef, which quite recently struck the reef in its No. 3 vertical shaft at a depth of 2365 ft., at which point it assayed 17½ dwt. over 48 in. In the Roodepoort district, the Princess Estate, in the central section at the deepest working point, 2758 ft. from the surface, the 1690 ft. driven on the twelfth level have given an average assay value of 9.31 dwt. over the milling width of 26 in. The mines cited are many miles apart, and are spread all over the Rand from east to west.—*South African Mining Journal.*

Mining Alluvial Gold in Quebec

Nuggets of gold were found in the eastern townships of Quebec as early as 1834, and in the past three years serious efforts have been made to work the alluvium near Beauceville by modern methods. The ground lies within the Seigniory Rigaud Vaudreuil, and the operations have been conducted by the Champs d'Or Rigaud Vaudreuil, Ltd., of Montreal. This company was organized in 1907 with a capitalization of 1,000,000 shares of $1 each. Of the total, 500,000 shares were given for the property and in addition $75,000 cash was paid, the



QUEBEC PLACER FIELDS.

company at the same time assuming payment of a balance of $122,593 due. The mining rights cover 71,000 acres, of which part has been tested by drill under direction of Fritz Cirkel. According to Mr. Cirkel, the tested ground covers an area approximately 2¾ miles long by 200 to 700 ft. wide. Within these limits it is estimated that there are 7,300,000 cu. yd. The results of drilling are said to range in value from 11c. to 28c. per cubic yard, including material from surface to bedrock. Two tests by hydraulicking are quoted, the first showing a recovery equivalent to 36c. per cubic yard from 2600 cu. yd., and the second, based on 16,600 cu. yd., a recovery of 42c. This second run was made in 1911. The water for hydraulicking is brought from Lake Fortin, seven miles above the workings on Rnisseau des Meules, by ditch and flume. From the penstock there is an 18-in. pipe 5200 ft. long giving a head of 270 ft. and supplying three giants having 3, 4, and 6-in. nozzles, respectively. At Beauceville, on the Quebec Central railway, and 1½

miles away, a power-house was built containing a 25-hp. engine and 150-kw. generator which delivers current to the mine. This power was used to drive a mechanical elevator, which by means of a line of 52 buckets, of 3-cu. ft. capacity each, stacked 6000 cu. yd. per 24 hours. There is also a portable derrick for handling large boulders and stumps. As shown by the accompanying figure, the plan of work was to break down the bank by means of giants, drive the gravel through a sluice to the elevator, and then spread the tailing by means of a third giant. As will be readily understood, the elevator was soon found unnecessary, and the work was continued by use of giants alone. Further study showed the ore burden to be barren glacial drift and the gold to be confined to old gravel on the bedrock. This has raised a question as to the economy of breaking down the whole bank, and it is understood that the feasibility of opening the property as a drift mine or of dredging is now being considered. The company operated about 5 months in 1912, and the June clean-up was $20.900. Figures for later clean-ups have not been made public. The whole enterprise is peculiarly suggestive in that considerable areas in eastern Canada are known to hold out promise of similar buried gold placers.

HYDRAULICKING AT BEAUCEVILLE, QUEBEC.

Cement was made in Canada to the amount of 2,684,002 bbl. and value of $3,098,350 in 1912, according to statistics of the Department of Mines. The largest portion of this output was from mills in Quebec.

Accidents in Metal Mines

An inquiry by Albert H. Fay, mining engineer, of the United States Bureau of Mines, and published as Technical Paper No. 40 of that Bureau, shows that fatal accidents in metal mines in the United States are more numerous, in proportion to the number of men employed, than are the fatal accidents in coal mines. Of the 165,979 employed in the metal mines in the United States during the calendar year 1911, 695 were killed, which represents a rate of 4.19 per 1000 men employed, as compared with 3.73 per 1000 for the coal mines of this country for the same period.

The total number of fatalities and serious and slight injuries due to accidents is as follows: Deaths, 695, or 4.19 per 1000 men employed; serious injuries, 4169, or 25.12 per 1000; and slight injuries, 22,408, or 135.01 per 1000. Of the total number of fatalities, 532 occurred underground, or at the rate of 5.18 per 1000, and 153 were killed on the surface, or 2.49 per 1000.

The figures show that approximately two-thirds of the total deaths and injuries that occur in and about metal mines were caused as follows: Of the fatal accidents, 32.52% are due to falls of ore or rock from roof, wall, or bank; 11.23 to explosives; 15.39 to falling down stope, shaft, or winze; and 5.32 to mine fires. Of the serious accidents, 31.37% are due to falls of roof, wall, or bank; 19.05 to car and haulage systems; 12.19 to machinery; and

6.41 to timber and hand tools. Of the slight accidents, 28.86% are due to falls of roof; 15.52 to car and haulage systems; 10.10 to machinery, and 8.02 to timber and hand tools.

The figures for the copper mines show 396 operators employing 44,693 men, of whom 31,557 were employed underground and 13,136 on the surface. The total number of deaths and injuries due to accidents reported is as follows: Deaths, 238, or 5.33 per 1000 men employed; serious injuries, 1326, or 29.67 per 1000; and slight injuries, 9016, or 201.73 per 1000. Of the total number of fatalities, 199 occurred underground, making this rate per 1000 men employed 6.31. The surface fatalities were 39, or 2.97 per 1000.

The figures for the iron mines show 207 iron-mine operators, who employed 45,953 men, of whom 25,461 were employed underground and 20,492 as surface men, including those engaged in steam-shovel work. The number of deaths and injuries resulting from accidents in these mines is as follows: Deaths, 197, or 4.29 per 1000 men employed; serious injuries, 2.032, or 44.22 per 1000; and slight injuries, 8690, or 188.3 per 1000. Of the total number of fatalities, 136 occurred underground, or 5.34 per 1000 men, and 61 employees were killed while engaged in surface work, making this rate 2.95 per 1000.

The figures for the lead and zinc mines refer only to those in the Mississippi Valley. The lead and zinc mines of other states are grouped with miscellaneous metal mines on account of the difficulty of making a distinct classification, as lead and zinc occur in so many places as associated metals in silver ores, as, for instance, in the lead-silver mines of the Coeur d'Alene district, Idaho. The Mississippi Valley lead and zinc mines form a class by themselves, and hence are easily segregated. The statistics given embody the reports of 483 operators employing 12,521 men, of whom 9247 are underground employees and 3274 surface men. The total number of deaths and injuries due to accidents is as follows: Killed, 43, or 3.43 per 1000 men employed; serious injuries, 177, or 14.14 per 1000; and slight injuries, 1311, or 125 per 1000. Of the number of men killed, 32 fatalities occurred underground, making this rate 3.46 per 1000 men employed, while 11 men were killed on the surface, or 3.36 per 1000 men.

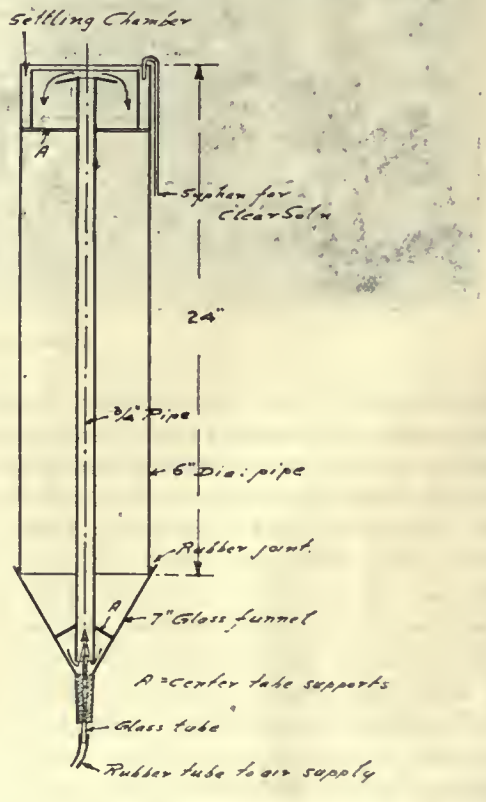
The figures for the miscellaneous metal mines show 3817 operators, employing 48,919 men, of whom 35,176 were underground, and 13,743 surface men. The deaths and injuries due to accidents are as follows: Deaths, 193, or 3.95 per 1000 men employed; serious injuries, 540, or 11.04 per 1000; slight injuries, 3078, or 62.92 per 1000. Of the total number of fatalities, 163 occurred underground, or 4.63 per 1000, and 30 on the surface, or 2.18 per 1000. The rates of serious and slight injuries are low when compared with the iron and copper mines. This may be accounted for in part by reason of the fact that this group includes many prospectors and small mines that keep no records. Fatal accidents impress themselves on the memory and are easily reported. The serious and slight injuries are soon forgotten if not recorded. Many of these mines are in states where there is no inspection, and they are not required to keep accident records. Many of the larger companies operating gold and silver and lead-silver mines of the West have for their own protection hospital service and medical aid for their employees. The reports from some of these large companies show that excellent records are being kept.

The non-metal mines employed 13,893 men, of whom 3182 were employed underground and 10,711 on the surface. The total number of deaths and injuries due to accidents reported is as follows: Deaths, 24, or 1.73 per 1000 men employed; serious injuries, 94, or 6.77 per 1000; and slight injuries, 313, or 22.53 per 1000. When compared with the copper and iron mines, these ratios seem exceedingly low. Judging from the reports received, this is largely accounted for by the fact that the mines, being small and employing an average of only 42 men each, do not keep complete records. The majority of these mines are in states where there is no state inspector, and are therefore not obliged to keep accident records and make reports thereon.

A Small Pachuca Agitator for Testing

By John Gross

*The apparatus described herein I have used in testing work lately, and have found it to answer satisfactorily for the agitation of slime as well as reground material. The accompanying drawing gives the dimensions, which follow closely the lines of the large machines used in practice.



The agitator is easily made and operated. The main cylinder consists of a 6-in. riveted pipe joined to a 7-in. glass funnel; this joint is made tight by melting rubber scrap and adding a small amount of sulphur for hardening. The melted rubber is poured

*Abstract from the Colorado School of Mines *Magazine*.

into the space around the tube and quickly sets, making a tight joint that is water-tight, not brittle, and will not break loose. For convenience the air is introduced through the neck of the funnel by means of a glass tube which can be disconnected when the tank is to be discharged. During discharging, the air is introduced into the charge through a tube from the top of the tank to avoid settling; a sample can be cut out of the discharge stream while emptying. In charging the agitator with dry material, I first put in the solution and start agitation, adding the slime or reground sand just fast enough to become mixed with the solution; this taking about 10 minutes. With a practically pure slime the agitation is perfect, and can readily be seen through the glass funnel when the pulp is not thicker than 2:1, but with thicker pulps some settling and sticking of the charge takes place in the funnel and obscures the view; when the pulp is 1½:1 or thicker, considerable settling takes place in the bottom around the sides of the funnel, and some distance up the sides of the tube, this being more marked, the thicker the pulp. In the agitation of reground sand, this settling action does not take place. The fine sand appears to have a scouring action which keeps the sides perfectly clear, and the flow of the pulp can be observed through the funnel, even on a very thick pulp.

I used with this agitator, for the air supply, an ordinary 8-gal. gasoline tank and hand-pump, as supplied with gasoline assay outfits. When pumped up to 30 lb. pressure, this tank would supply air for a period of 20 min. or more, the supply being regulated to the agitator by the valve. Where an independent supply of air is available, this is, of course, preferable, but without such a supply the agitation can be maintained by the hand pump. This requires, however, the presence of an operator during the entire time of the test. The settling-chamber (simply a short cylinder of smaller diameter than the tube, placed inside the main tube and extending 1 in. above the pulp) makes it possible to displace the pregnant solution with barren. I have been able to withdraw an amount of solution equal to the contained solution of the entire charge in 24 hours of running, this removed solution being sufficiently clear for precipitation purposes. This displacement can be arranged to be continuous if so desired, the barren solution being continuously added to the pulp in the agitation portion of the tank to keep the volume of the pulp constant. The apparatus as shown holds approximately 32 lb. of pulp. The necessary solution for a charge can be calculated and charged to the tank when ready to start the test. I have found it convenient to start agitation with less solution than the calculated amount to avoid a charge beyond the capacity, and the charge when incorporated can be added to if not sufficient to fill the tank.

A gazetteer of the surface waters of California, prepared by the U. S. Geological Survey in coöperation with the State Water Commission and the Conservation Commission of California has just been issued as Water Supply Paper No. 297 of the Geological Survey.

Raymond's Work as Secretary

In connection with the formal election of Dr. R. W. Raymond to the position of Secretary Emeritus of the American Institute of Mining Engineers, the following interesting letters were sent to Dr. Raymond and given to the technical press. The first was signed by Mr. Rand as president of the Institute and the second by H. S. Drinker and Willard H. Ward, who with Dr. Raymond are the only surviving founders of the Institute; James Douglas, James Gayley, J. H. Hammond, Charles Kirchhoff, W. J. Olcott, R. H. Richards, and R. W. Hunt, past presidents; B. S. Lyman, past treasurer; and John A. Church, Arthur Dwight, Anton Eilers, Karl Eilers, B. F. Fackenthal, Jr., W. R. Ingalls, Hennen Jennings, B. B. Lawrence, E. C. Peehin, D. M. Riordan, Robert Thompson, S. T. Wellman, W. H. Wiley, Gardner Williams, and Irving Stearns, among the members.

My dear Dr. Raymond: It has been in my mind to say to you in writing, what I have said to you verbally, in expressing my hope that the Institute is not to lose your valuable services as most competent of advisers and of editors, and that you will accept the appointment of Secretary Emeritus with its attendant salary which as you will recollect was recommended in the report of the Committee of Five and was made permissive in our new Constitution and unanimously voted by the new Board of Directors elected after a very full canvass of the Institute.

I desire in urging this upon you to say that I have felt that it would be well for us to have upon our files a statement of what the Institute owes to you, based not upon general considerations, but upon specific facts which are within the knowledge of older members (much my seniors in membership). In order that such a statement might be as complete as circumstances would at this time permit, I have ventured to request certain of the older members of the Institute to prepare a statement based on their own long knowledge of the Institute. I have received such a communication, which I have great pleasure in handing you herewith, which shall be published in the *Bulletin* and filed among the archives of the Institute, and which I personally and on behalf of the Executive Committee supplement most heartily and cordially by adding this word of appreciation to the expression of the hope indicated at the beginning of this letter—that we may long continue to feel free to consult you and to avail ourselves of your invaluable knowledge and loyalty.

Charles F. Rand, President.

Dear Sir—In connection with the official notice of Dr. Raymond's unanimous election by the Directors as Secretary Emeritus, we wish to place upon record certain statements concerning his services to the Institute which we think have not been published, and may not be generally known to the majority of our fellow-members.

When the Institute was formed in 1871, Dr. Raymond acted as Secretary of the Founders' Meeting, and became the first vice-president of the Institute, and, by request of the aged and beloved David Thomas, who was the first president of the Institute, Dr. Raymond discharged all the duties of the office of president, to which he was later formally elected in 1872, and which he held for three years. During that time, he visited Europe, and through his acquaintance and reputation abroad, established those international relations of the Institute which proved so important in later years. He also enlisted the support of the mining engineers and metallurgists of the Pacific slope, who would not otherwise have been disposed to join a society originating in the East. And for twelve years he attended, at his own expense, nearly every meeting of the Institute, wherever held, giving to it without remuner-

ation his best service, and sacrificing for it many professional and private interests.

From June 1883 to February 1905 he practically managed, under the general direction of the Council, the ever-increasing business of the Institute, as the executive officer of an unincorporated, voluntary association, the members of the Council of which were individually liable for any debts incurred. For many years he paid all current expenses (except the larger bills of the printer, etc.), recovering the amounts subsequently from the Treasurer upon drafts approved by the finance committee, which audited monthly the receipted vouchers presented by him. Any oversights or improper expenditures which occurred were his own personal loss. When the entire cash funds of the Institute were tied up by the suspension of the bank in which, with the approval of the Council, they had been deposited, he made a deposit of some thousands of dollars of his own funds in another bank, and carried the whole business of the Institute for several months, until through the ultimate recovery of its funds, he could be reimbursed. And from the annual appropriation made to him in lieu of salary, he expended large amounts for assistance in his work. During the period named, he presented to the Institute his valuable professional library, which, together with the two libraries of Clarence King and Richard P. Rothwell, purchased and presented by John Hays Hammond, and constituting the Alfred Raymond Memorial collection (so named in honor of his son, who died in 1901, while serving as his editorial assistant), form a large part of the Institute Library.

During that period, he so managed the business of the Institute as to enable it to carry the expense of publishing and distributing the *Transactions* (the volumes of which increased more than threefold in size), twice issuing two volumes in one year, and twice furnishing complete consolidated indexes; he also managed to meet, out of current funds of the Institute, the demands of the memorable joint meeting of 1890 with the Iron and Steel Institute, and of two sections of the International Engineering Congress of 1893, amounting to some $23,000, no part of which was spent on social entertainments or excursions, the whole being laid out for the hire of halls, the employment of stenographers, the printing and circulation of programmes and papers, and other items strictly germane to the technical sessions. In connection with the International Engineering Congress, two sections, those of Mining and Metallurgy, were assigned to the Institute, and neither could be refused without the abandonment of our national position as representing both. In this dilemma, he assumed, with the approval of the Council, the burden of these two sections and secured the contribution of important papers from both American and foreign authorities, the translation and editing and publishing of these papers, and their publication in two volumes, which greatly enhanced the international reputation of the Institute. Moreover, during the whole history of the Institute, his professional contributions to its *Transactions* have exceeded in number those of any other author.

In 1904, after all these ordinary and extraordinary outlays, and without having received any assistance from outside sources, the Institute was out of debt, had acquired a large library, and held an invested fund of some $18,000. This was the result of his management for twenty years. In that year, an overwhelming vote of the members dictated the acceptance of the generous gift of Andrew Carnegie, and of the consequent obligations imposed upon the Institute. In this respect, we owe to Dr. Raymond the rejection of the first plan proposed, under which the Institute would have become directly a joint owner with other societies of the new building, and the whole property might have been subject to a partition sale, as the result of a judgment against either of the joint owners. It was he who averted this situation, and the result was the creation of a separate corporation, of which, as owner of the new building, the so-called founder societies should be simply tenants under lease.

Concerning the so-called land debt, it should be said that the Institute was obliged to accept its share thereof without any alternative except the refusal of Mr. Carnegie's liberal offer. However, we are now all glad of the final result, which has given to the Institute a permanent home in a situation of social importance. The proximity of the Engineers' Club and the use by numerous scientific and technical organizations of the United Engineering Society's building, and of its commodious and convenient auditoriums, has made it a recognized headquarters for such societies. Nevertheless, the adoption of this scheme, and the acceptance of a land debt of $180,000, presented to the Institute a serious problem. At that time it was estimated that we could manage to pay from the ordinary income the increased cost of rent or its equivalent—at first $7000 per year instead of about $3000. But it was never expected that the Institute could pay, from its ordinary revenues, either the principal or the interest of the land debt. The Institute accomplished more than was expected, paying not only the increased current expenses, but also a considerable sum on interest account; and this was done by hard work on Dr. Raymond's part and on that of the office force, for which both he and they are entitled to recognition. During this period, he continued to pay from his own salary a considerable sum annually for editorial assistance.

The system of Institute excursions concerning which many criticisms have been offered on the basis of incomplete knowledge, requires consideration, since in our opinion the holding of meetings at distant points has had and will continue to have an important influence in maintaining the national and international position of the Institute. We believe that the excursions in the past have had much to do with the success of our meetings, and we hope that in connection with any plans to be adopted for the future, you will ask Dr. Raymond to prepare a complete statement on the subject such as has never yet been made. Finally, we are confident that you share our belief in Dr. Raymond's disinterested and tireless devotion to the Institute, and our opinion that the Institute has been for more than forty years a debtor to Dr. Raymond for far more than can be expressed in dollars and cents.

Gold Mines of Korea

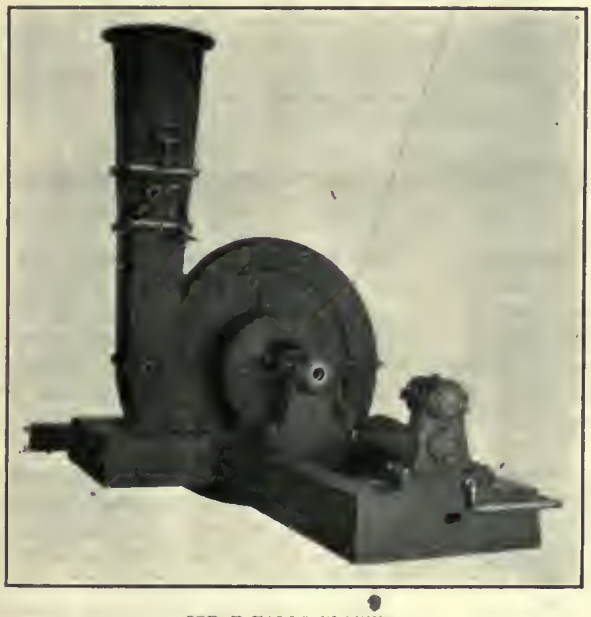
The gold mines at Suian and Unsan, Korea, are being worked by the American Mining Development Co. [Colbran-Bostwick syndicate]. The yearly production of the Suian mine is about 1,000,000 yen, while the Unsan gold mine annually yields some 3,000,000 yen gold. These two mines are the principal gold mines conducted by foreign concerns in Korea. Besides these, there is a gold mine at Chyansong, which has been recently purchased by a London firm and is now conducted under the management of French experts, the mining districts extending for 1600 square *li*. This mine is, however, still in the course of development. The Kapsan copper mine at Hamnan, belonging to the American Mining Development Co., and the Huchyong copper mine owned by the Italian Mining Co., are also in an experimental stage. Applications for quartz mines and for placer mining are occasionally sent in by foreigners, but are all on a small scale.

The Furukawa Mining Co., obtained in October last official permission to work gold mines at Chyonmamyon and Nokoli, in Knsong district, North Pyongan province. Work on these mines has been begun by the company, employing some twenty Japanese and about two hundred Korean miners. The experimental stage of the work will be, according to Gunsuke Iijima, who supervises the work as chief expert, three years, and the cost is estimated at 500,000 yen.—*Far Eastern Review.*

Great Falls Electric-Driven Turbo-Blower

By G. B. Rosenblatt

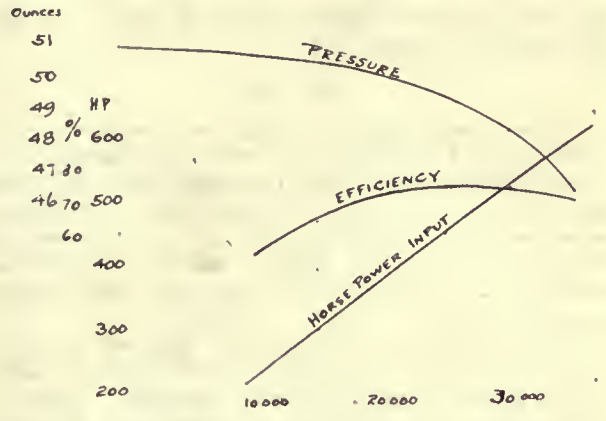
An interesting turbo-blower was recently installed in the power-plant of the Great Falls smelting works of the Anaconda Copper Mining Co. The blower has a rated capacity of 30,000 cu. ft. of free air at 48-oz. pressure. It is constructed so that it may, by slight changes, be arranged to give its rated volumetric capacity at 62 oz. It is driven by a constant-speed, 750-hp. synchronous motor, 6600 volts, 3-phase, 60-cycle, 3600 r.p.m. The motor is direct-connected to the blower shaft. There is no gearing or belting. A 750-hp. motor is not required to drive the motor at its present rating; there being only about 525 hp. required for this work. The extra motor capacity will, however, be required if the pressure is raised to 62 oz. In order that the motor may not operate at poor efficiency at 525 hp., it is designed with a flat efficiency curve, giving it practically the same efficiency from 375 to 750 hp., the efficiency at all points in this range being over 90 per cent.



GREAT FALLS BLOWER.

The blower is essentially a constant-pressure, varying-volume machine. Its characteristics are shown approximately by the accompanying curve. The same type of blower can also be built for constant-volume, varying-pressure work. The constant-pressure type of machine is particularly desirable where the blower is to operate in parallel with other blowers of either the centrifugal type or the positive cycloidal type, like the Root or Connersville. This is the case at Great Falls, and by properly dividing the load, the parallel operation of this centrifugal blower and the positive blowers is made good. The blast from the entire battery of blowers at Great Falls is used on copper blast-furnaces.

From the curve attached it will be noted that this blower has a relatively good efficiency over a wide range. This is one of the peculiarities of the centrifugal blower of this type, and is one of the reasons for its rapid introduction in Europe and Australia. It is true that at rated load a cycloidal blower will have a somewhat higher efficiency than the centrifugal blower, but it is to be remembered that a cycloidal blower must be driven from a slow-speed motor whose efficiency will be lower than a high-speed motor, and that there is introduced into the unit composed of the blower and motor the loss due to gearing, belt, or rope drive. These losses are entirely done away with in the case of a centrifugal blower, so that the over-all efficiency from electric mains to the discharge pipe will be higher for the centrifugal blower than for the cycloidal blower.



ACTUAL VOLUMETRIC CAPACITY, CUBIC FEET PER MINUTE.

The appearance of the centrifugal blower at Great Falls is shown in the illustration. The motor fits on the same bed plate with the blower in the space shown. As the unit runs at the high speed of 3600 r.p.m., the bearings are the same as those used with large turbo-generators. The revolving element is milled from a solid steel forging, held on the shaft in the same way as is the revolving field of a turbo-generator. Blower construction with riveted vanes has been tried in the past, and some such blowers are in operation, but sooner or later the rivets crystallize and the vanes give trouble, so that the use of the solid steel forging, expensive as it is, is the best solution of this problem for blower construction.

The illustration also shows the electrically controlled discharge valve. This is arranged so that it may be either actuated automatically by means of magnets or can be set by means of a hand wheel, also shown in the illustration. The blower at Great Falls has now been in successful operation for over a year, and has given no trouble whatever since it has been properly set up and balanced. The only interruption of its use in commercial service was caused by some trouble with the motor, occasioned by a burn-out in some of the coils. This was corrected some eight months ago and the blower has been in commercial service ever since. A notable feature of this blower is that, despite its high speed, it is not noisy.

Standardization of Electrical Equipment in Metalliferous Mines

A committee consisting of H. S. Sands, Charles A. Chase, and Frank E. Shepard has been studying underground electrical equipment on behalf of the American Mining Congress. A preliminary report was presented at the Spokane meeting of the Congress and published in the November-December *Monthly Bulletin*. It had received prior consideration by D. C. Jackling, W. H. Staver, W. J. Canada, P. S. Schools, and G. B. Rosenblatt. Before submitting a final report, the Committee desires the matter to receive the widest possible criticism and discussion, and to assist in obtaining this, we take pleasure in printing the preliminary draft. In submitting the report, the Committee states its intention as being to compile a set of rules which would be sufficiently broad to work no hardships on anybody and to be sufficiently exacting to bring about installations that would not only be safer, but more economical and efficient.

Definitions

The expression 'pressure' means the difference of electrical potential between any two electrical conductors.

Low Pressure.—(a) Where the conditions of the system are such that the pressure between any two conductors, or between any conductor and the earth, at the terminals where the electricity is being used cannot exceed three hundred (300) volts, this shall be deemed a low pressure system.

Medium Pressure.—(b) Where the conditions of the system are such that the pressure between any two conductors, or between any conductor and the earth, at the terminals where the electricity is being used, can exceed three hundred (300) volts, but cannot exceed six hundred (600) volts, this shall be deemed a medium pressure system.

High Pressure.—(c) Where the conditions of the system are such that the pressure between any two conductors, or between any conductor and the earth, at the terminals where the electricity is being used, can exceed six hundred (600) volts, this shall be deemed a high pressure system.

Section 1. Distribution System

Switching Station. Rule 1.—Where the generation station or sub-station is more than 500 ft. from the entrance to the tunnel or shaft, a switching station shall be installed at the entrance to the tunnel or shaft for cutting off the power from each circuit.

Hoist. Rule 2.—The circuit feeding electric hoists used for raising or lowering men shall be separate from all other circuits and shall run from the distribution centre, and no other electrical apparatus shall be connected thereto.

Lightning Arresters. Rule 3.—Where the circuits entering the shaft-house or tunnel are from an overhead transmission system, each circuit shall be protected by lightning arresters, which shall be grounded to efficient grounds prepared for that purpose.

Grounding. Rule 4.—All alternating-current systems in which the normal working pressure does not exceed the limits of medium pressure, and all three-wire direct-current systems, shall be grounded. In alternating-current power systems where the voltage does not exceed medium pressure, and where the secondaries of the transformers are connected in star, then the neutral or centre of the star shall be grounded.

Where the distribution system is delta or open delta, then the central point of one transformer shall be grounded.

Where the distribution is three-wire direct current, then the neutral shall be grounded.

The wiring for signal or telephone circuits shall be located on the opposite side of the manway, shaft, or tunnel, from the power or light wiring.

Underwriters. Rule 5.—All wiring shall conform to the rules of the National Board of Underwriters.

Shaft Wiring. Rule 6.—All power wires whose pressure does not exceed medium pressure shall be run where possible in the manway or compartment of the shaft where hoisting does not occur, and shall be either lead-armored cable or run in waterproofed or drained conduit.

If the lead-armored cable is used, the insulation must be non-hydroscopic and as acid-proof as possible. The cable shall be held in place by frequent fastenings spaced according to the weight of the cable, so that the cable is firmly and securely held in place and there is no danger of the cable 'dragging.' The lead covering of the cable must be grounded. If the wires are run in conduit, junction boxes shall be placed at every level, and in no case shall the interval between boxes exceed 150 ft. These junction boxes shall be held in place and provision made to hold the weight of the wire in the conduit leading to the junction box below on insulated supports. The iron conduit must be grounded.

Power Wires. Rule 7.—All power wires whose pressure exceeds that of medium pressure shall be of either lead-armored cable or encased in iron or steel conduit or other approved non-hydroscopic conduit; in any case, metal covering shall be well grounded with wire at least one-half the size of the largest wire in the cable or conduit.

Joints. Rule 8.—All joints must be electrically efficient, mechanically strong, and soldered unless approved solderless joints are used. All joints except in trolley wires, should be taped or otherwise suitably insulated to protect them from corrosion.

Bushings. Rule 9.—When unarmored cables or wires pass through metal frames or into boxes or motor casings, the holes shall be substantially bushed with insulating collars.

Sectionalizing. Rule 10.—Wherever branch electric circuits leave a main or secondary feeder, cut-outs and switches shall be provided for disconnecting the branch line from the supply line, and all main and distributing feeders shall be provided with sectionalizing switches at distances not exceeding one mile. All cut-outs above ground to be in approved metal cabinets, and underground in subway type cabinets.

Switches, Circuit-breakers, Fuses. Rule 11.—All switches, circuit-breakers, and fuses must have bases of marble, slate, or porcelain, or other suitable incombustible, non-hydroscopic material, free from metallic veins, and shall be placed in as dry a situation as practicable.

Circuit-breakers, Fuses. Rule 12.—Fuses and automatic circuit-breakers should be so constructed or adjusted as to open the circuit when the current through them exceeds not more than 100% the working current in the case of motors, or by not more than 30% the permissible current of the cables which they protect. Fuses shall be stamped or marked, or shall have a label attached indicating the current at which they are intended to fuse. Fuses shall be adjusted or replaced only by a competent person, authorized by the mine superintendent.

Grounds. Rule 13.—The rails of the haulage system and the air and water pipes shall be connected together wherever practicable, so that the efficiency of the 'ground' may be bettered, and where the formation is such that good electrical grounds cannot be obtained, then the tracks and air and water pipes shall be connected to a good and well prepared ground at the mouth of the tunnel or collar of the shaft as the case may be.

Section 2. Apparatus

Sizes and Capacity. Rule 14.—All electrical apparatus shall be sufficient in size and capacity for the work they may be called upon to do, and so installed, operated, maintained, and safeguarded as to reduce the danger from accidental shock or fire or overheating to the minimum.

and shall be of such construction and so operated that the rise in temperature caused by ordinary working will not injure the insulating materials.

Grounding. Rule 15.—All electrical apparatus, that is, motors, transformers, generators, and their switching devices, installed underground, shall have their frames well grounded.

Portable Motors. Rule 16.—A higher pressure than medium pressure shall not be used for portable motors.

Transformers. Rule 17.—Where pressure higher than medium pressure is used in connection with transformers installed underground, they shall be installed in a dry, well ventilated, fireproof room or compartment or station, so arranged that it can be entirely closed with fireproof doors should any accident occur, and the fire arising from the accident be smothered.

High-Pressure Motors. Rule 18.—No motors of less than 15 hp. shall be used on circuits of higher than medium pressure.

Switches and Fuses. Rule 19.—All motors, together with their starting resistance or induction starter, as the case may be, shall be protected by fuses and switches or by automatic circuit-breakers capable of entirely cutting off the current, and must be in sight of the motor.

Trailing Cable. Rule 20.—In the event of the trailing or portable cable in service breaking down or being damaged, or of its inflicting a shock upon any person, it shall at once be put out of service and shall not be used again until it has been repaired and tested by the mine electrician or assistant mine electrician.

SECTION 3

Employment of Mine Electricians. Rule 21.—At every mine where electricity is used below ground, a competent mine electrician, and, where necessary, an assistant mine electrician also, shall be employed, subject to the authority of the mine superintendent. The electrician shall have full charge of all electrical apparatus in connection with the mine.

Every person appointed to operate any electrical apparatus in connection with a mine shall be instructed in his duty by the mine superintendent or electrician before taking charge of the apparatus.

Inspection of Wiring. Rule 22.—It shall be the duty of the mine electrician to inspect all wiring and apparatus once every ten days, and once each month to make report of such inspections in writing to the superintendent, stating all defects found and how repaired or remedied.

SECTION 4. PROTECTION

Fire Buckets. Rule 23.—Fire buckets filled with clean, dry sand shall be kept where stationary electrical apparatus is located, ready for immediate use, and regularly inspected once every month. The provision of tetra-chloride fire-extinguishers is recommended.

Resuscitation. Rule 24.—Instructions shall be placed at the mine entrance and in every generating, transforming, and motor house, for the resuscitation of persons suffering from electric shock. All employees operating the electrical apparatus shall be required to acquaint themselves with these instructions.

Recording Accidents. Rule 25.—Every personal accident occurring in connection with the operation of the electrical equipment shall be promptly reported by the person injured, or by some other person on his behalf, to the mine superintendent, and shall be recorded by him at the office of the mine.

Plans. Rule 26.—A plan on a scale not smaller than 200 ft. to the inch shall be kept at the mine, showing the position of all permanent electrical machinery and fixed cables or conductors in the mine, and shall be corrected as often as may be necessary to keep it as nearly as practicable up to date, and never more than six months in arrears.

SECTION 5. HAULAGE

Location of Wires in Roadway. Rule 27.—In underground roads, the trolley wires shall be placed as close to the side and as straight as practicable, and securely supported at frequent intervals. In all roads where it is necessary for men to travel on foot, all wires, except signal wires, must be placed on the same side of the roadway. The trolley wire shall not be less than six feet from the top of the rail unless protected from casual contact of passersby by suitable shield or trough.

Protection of Cables. Rule 28.—Where the cables in main haulage roads, where persons are hauled into or out of the mines, cannot be kept at least eighteen inches from any part of the car, they shall be specially protected.

Cables and wires, unless provided with metallic coverings, shall not be fixed to walls or timbers by means of non-insulating fastenings.

Where main or other roads are being repaired, or where blasting is being done, temporary protection must be used so that the cables are protected from damage.

SECTION 6. LIGHTING AND SIGNAL WIRES

Erection of Lighting and Signal Wires. Rule 29.—Small wires for lighting or signal circuits shall either be conveyed in pipes or casings, or they may be suspended from porcelain or glass insulators or securely tied to them, so that they do not touch any timbering, rock, or metal. On no account shall staples be used. If metallic pipes are used, they must be grounded and well drained. If separate unencased wires are used, they shall be kept at least three (3) inches apart and not brought together except at lamps or fittings.

SECTION 7

Shot Firing. Rule 30.—Electricity from light and power circuits shall not be used for firing shots in a mine except where the electrical connection to such light or power circuit is made within an enclosed switch-room, which shall be kept securely locked and shall be accessible only to the authorized shot-firer. If electricity from light or power cables is used for firing shots in a mine, no shots shall be fired until all the men are out of danger.

Special precautions must be taken to prevent accidental contact between shot-firing cables or wires and power and lighting cables.

Only persons authorized in writing by the mine foreman or superintendent are permitted to fire shots electrically in a mine.

Battery or Magneto Exploders. Rule 31.—Where battery or magneto exploders are used, they shall be inclosed in a suitably constructed box, fitted with a removable connecting plug or key without which the circuit cannot be closed. This plug or key shall be detached when not required for firing, and shall not under any conditions pass from the personal custody of the shot-firer while on duty. Exploders shall be frequently tested by the shot-firer to insure that they give the necessary pressure and current.

The exploders shall not be connected to the shot-firing cable until all other steps preparatory to the firing of the shot have been completed and all persons have removed to a place of safety.

Immediately after the firing of the shot the firing cable shall be disconnected from the exploder, and no person shall approach a shot that has been attempted to be fired by electricity and has failed to explode, until the firing cable has been disconnected and an interval of five minutes has elapsed since the last attempt to fire the shot.

SECTION 8. TELEPHONES

Telephone Systems, When Required, How Installed. Rule 32.—All mines from which exit is by shaft only, and all others in which the working places extend more than one mile from a place of exit, shall be provided with an underground telephone system, provided the number of underground employees at any one time on the regular working force exceeds 25. The system shall be of approved construction, and of such extent that no working place shall be at a greater distance than three-fourths of a mile from a telephone, and principal shaft stations shall be provided with telephones.

All main telephone cables shall be insulated with waterproof insulation, and unless run through metal pipes or casings, or approved conduit, they shall be protected by a continuous lead sheath.

Mine Rescue Work in Metal Mines

Mine rescue work, which in the United States began in the coal mines, is being extended to metal mines as well. A number of the companies have bought rescue apparatus and efforts are being made to train men in its use. The United States Bureau of Mines has for three or four years maintained mine-rescue cars. These are fully equipped with first aid and rescue apparatus and the crew of each includes, in addition to the district engineer who is in charge, a car foreman, a first aid instructor, and a cook. The men live on the car and in addition to responding to emergency calls in case of accidents, travel through an allotted district giving instruction and systematically training men. Similar cars are maintained by Illinois and by various large companies. Up to the present this work has been almost exclusively confined to the coal mining regions, though the Bureau of Mines cars have occasionally visited metal-mining districts.

Car No. 8, the latest one put in service by the Bureau, has been allotted to the Lake Superior iron and copper regions. The official headquarters of this car is Ironwood, Michigan. It is in charge of Edwin Higgins as assistant mining engineer, with Edward Steidle, foreman, and George W. Grove, first-aid man. As in the case of the other cars, No. 8 is a remodeled Pullman, a part of which has been converted into a laboratory and instruction room. It is equipped with Proto or Fleuss apparatus of English make, instead of the Draeger helmets of German make used on the other cars. There are a number of differences between the two types. Perhaps the most important is that the Proto depends upon a positive feed of oxygen, while the Draeger uses an injector.

The latter results in a slight vacuum in the absorbent cartridge and in certain parts of the circulation tubes. In case of puncture poisonous gas is thereby drawn into the circuit and this is considered to have been the cause of death in several instances. A similar accident in case of the Proto would cause deflation of the breathing bag and the wearer, thus warned, would only need to open a safety valve and make his way out at the expense of his supply of oxygen. The new type of apparatus has been extensively adopted in England but is little known here.

The new car arrived at Ironwood, November 25, and received a warm welcome. While most of the mines in the district were well equipped as to apparatus, and much money was being spent so as to assure safety, there were comparatively few men trained in the new methods. In several cases the amount of apparatus available was not adequate to anything more than the briefest campaign. Up to the middle of January lectures and demonstrations had been given to approximately 2600 people, and the number of visitors to the car had averaged above 150 per week. In all, 72 men had been trained in the use of the breathing apparatus and in first aid to the injured and there is a lively interest in the work. Within three months of the arrival of the car it is expected that 150 men will have been trained for the work.

At the Newport mine, in addition to the regular safety department, a corps of five mining engineers has recently been organized whose sole duty it is to study safety conditions in and around the mine. Other companies are organizing safety departments, and it is proposed to have representatives from all the mines meet in general committee to exchange information as to methods and appliances. A general field meet may be held next summer, as in the anthracite regions the mine managers of the district have taken an active interest in the work and at a meeting held at Ironwood in November at which all the large companies were represented the following

INTERIOR OF MINE-RESCUE CAR.

recommendations were unanimously adopted.

1. It is recommended that the outline of the course of training in mine rescue and first aid as prescribed by the Bureau of Mines and approved by the Mining Conference held in Pittsburg, Pennsylvania, September 20 to 23, 1912, shall be accepted in this district.

2. That whereas two squads of five men each can be trained at one time, and as a first-aid squad must consist of five men, and as the Bureau recommends that not less than five men form a rescue corps, that each mine train not less than five men.

3. That inasmuch as the mine safety car is equipped with Fleuss breathing apparatus and the Draeger predominates throughout the Lake Superior district, that the mine rescue training consist of the use of both types of apparatus. In the case of the Draeger, the respective company is to furnish the apparatus and material free of charge.

4. That a room of sufficient floor area shall be provided for first-aid training.

5. That whereas, the Bureau of Mines provides a set of views illustrating mine rescue, first aid, accident statistics, and experimental work carried on by the Bureau, that a hall should be provided of suffi-

cient seating capacity so that all employees and general public may be invited free of all charge.

6. That the operators of the Gogebic range shall arrange an itinerary that will cover the Lake Superior district pending the approval of the United States Bureau of Mines.

7. And, further, it is recommended that the mine managers throughout the district be notified that the mine safety car No. 8 will be at their service in the near future and therefore they should inform the Bureau of Mines at Pittsburg, Pennsylvania, of the number of men they wish to have take the complete training.

Laboratory Rules Worth Following

The following rules are posted up in the assay office of the Zinc Corporation, at Broken Hill, New South Wales, and are worthy of wide reading.

1. Upon entering the laboratory, commence work at once. Do not waste your time and that of others in idle conversation, or standing about with your hands in your pockets. If the samples are not ready, prepare a stock of the standard solution required in your work, or 'take a turn' in the preparation of samples, using both hands.

2. In addition to standard books and apparatus, you are required to make good use of the eyes, nose, hands, ears, and brains, if any, which nature has given you; use your tongue when only absolutely necessary.

3. Neatness, order, and cleanliness must be strictly adhered to. Do not litter your bench with waste paper, dirty rags, dirty apparatus, or appliances for which you have no immediate use, and never allow the stoppers of reagent bottles to touch the bench. Remember that dirty appliances are the principal source of error, especially if accompanied by want of method, dirty reagent bottles, erratic methods, and a wagging tongue.

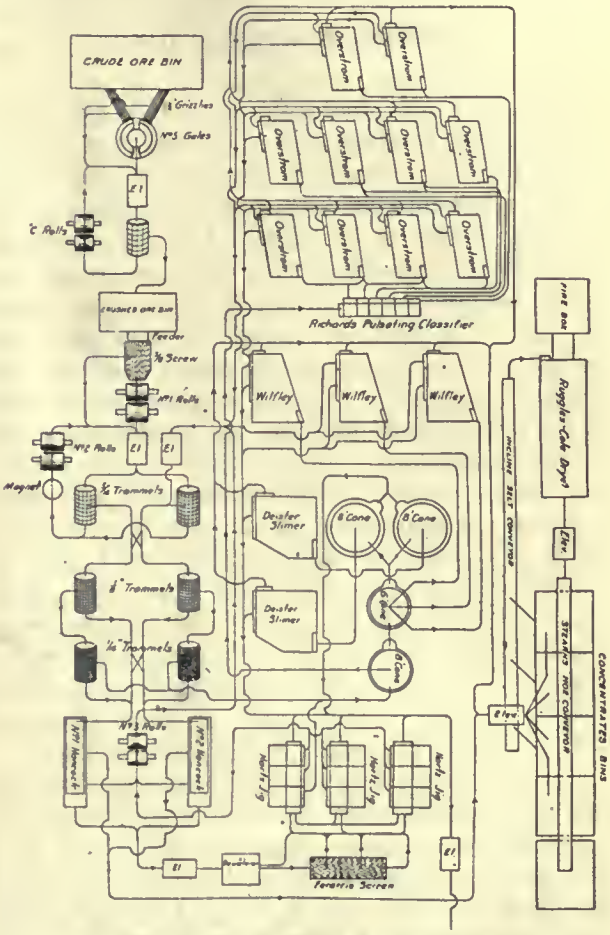
4. Pay the whole of your attention to your own work; never mind that of your neighbors, and work quietly, quickly, methodically, diligently, deliberately, observantly, thoroughly, and thoughtfully.

5. In general analytical and experimental work, (*a*) make careful and accurate notes of all experiments as you proceed. Do not continue until you have recorded the results of each experiment. When completed, use your notes for the correct statement of your work and for reference. (*b*) Avoid using great excess of acids and reagents, as besides causing numerous errors in your own work, you are overworking chemical manufacturers and salesmen. (*c*) During the later stages of an analysis, questions and doubts often arise, which can be settled with ease by the application of further tests to some of the filtrates, precipitates, residues, etc., obtained at earlier stages, if they have been preserved, and if not, confirmatory tests cannot be applied to materials which have been put down the sink. In other words, kindly remember the assay department is not a depot for the free distribution of sovereigns.

6. Attention to above rules will save much time, temper, trouble, swearing, annoyance, disappointment, repetition of work, and waste of material.

Cleaning Pyrite Ores

Pyrite ores, as they come from the mine, are not usually suitable for charging into furnaces immediately. They contain a certain amount of waste,



FLOW-SHEET, ST. LAWRENCE PYRITES CO. MILL.

and in addition much will be in lumps too large to be economically utilized in this condition. There does not appear to be any recognized standard scheme of sizing pyrite ores. The process of separating pyrite from gangue material such as quartz, calcite, and country rock is relatively simple, owing to the difference of specific gravity between the ore and waste. Where pyrite is associated with copper, zinc, and lead ores, the problem becomes much more complicated. The accompanying flow-sheet, taken from 'Pyrites in Canada,' by A. W. G. Wilson, shows the arrangement of a Canadian pyrite-dressing plant.

During the past nine months between 700 and 800 men have been employed laying a pipe-line for the General Petroleum Co. from the Midway oilfield of California to the Wilmington pumping-station, at Los Angeles harbor, a distance of 154.5 miles. The pipe is 8-in. diam., with a capacity of 30,000 bbl. per day, and within 30 days it is expected that oil will be pumped through it. A pipe-serewing machine was used in construction, and one mile per day has been completed at times. The weight of pipe used was 12,360 tons, while at each of the 14 pumping stations 317 tons of material was used. When in full operation, about 300 men will be needed. A branch pipe-line of 84 miles is also to be laid down from Gorman station to Tehachapi.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Smelting Zinc-Copper Ores

The Editor:

Sir—It will, no doubt, be of interest to most of your readers to learn that a process has been developed for the successful treatment of ore containing too much zinc for the ordinary smelting practice, and not enough to be smelted for zinc in the old-style retort furnaces. Often such ore, usually sulphide, contains silver and gold with either copper or lead, or a small percentage of both these base metals. The presence of zinc makes it difficult and often too expensive to treat such ore for recovery of the other metals, whereas, the combined value of all the metals named, including the zinc, makes such ore very valuable. To illustrate this statement: Take an ore containing 50c. in gold, 6 oz. in silver, 55 lb. in copper, and 400 lb. in zinc per ton; at the present gross values, the gold, silver, and copper alone would be $12.05 per ton, but the zinc makes the ore treatment expensive by any ordinary method, and the zinc itself is worth $20.40 per ton if 85% is recovered into a marketable product at present prices, making the total value $32.45 per ton.

The ore I refer to and similar ore elsewhere cannot be concentrated by the comparative simple wet concentration methods adopted in the Middle Western states, on account of its large content of sulphides and the fact that it contains so little mineral that can be washed out. Magnetic separation appealed to me for the concentration of such ore, but proved a failure at the Afterthought, chiefly on account of the peculiar close-grained fine crystalline structure of the ore. The use of acids to dissolve the metals in the ore never did appeal to me, for the following reasons: The waste of acid caused by the formation of salts, due more especially to the lime, aluminum, and iron contents of the ore; the mechanical difficulties of handling such a pasty mass; and the difficulty of precipitating a pure zinc from the other metals which are in solution with it, the zinc being the most difficult and last metal to be precipitated. To make sure on these points I spent considerable time with others experimenting, with the above results, and other objections equally as serious.

The flotation process, which has proved such a commercial success at Broken Hill, Australia, will make a 45 to 50% zinc concentrate from the ore on which experiments have been made by men interested in the flotation process, recovering 85% of the zinc in this form, after a preliminary treatment. The concentrate would then have to be shipped to the regular zinc smelters near cheap fuel to be recovered and smelted in retorts where about 85% of the zinc in the concentrate can be saved. After all this expense has been incurred for the recovery of about 72% of the original zinc, the question arises, what has become of the copper, silver, and gold? My informant, who made the flotation test, stated that about 60% of these remained in the tailing and about 40% followed the zinc concentrate. This splitting up of the copper, gold, and silver makes them practically worthless. If they all remained in the tailing it would pay to smelt them, or if they would all follow the zinc concentrate, then there would be some profit in sending the cinder mixed with ash from the coal used in the retorts to a lead or copper smelting plant. If cheap coal could be obtained close to large bodies of such ore as I have described, the practice adopted at Joplin, Missouri, and at one time in Canyon City, Colorado, might suggest itself, but even then the loss in silver would be excessive, and the zinc oxide produced is not generally of good quality. The cinder from such oxidizing furnaces containing the remaining silver, copper, and gold with some zinc would have to be smelted in a suitable furnace by ordinary methods.

Having investigated nearly every known zinc recovery process, I will briefly describe a process that, while not suitable for the treatment of all ores containing zinc, especially those containing the zinc in the form of a silicate or too much arsenic, is suitable for the treatment of ore containing zinc with or without copper, lead, silver, or gold, all these metals being saved if present, by partly de-sulphurizing the ore, removing the zinc by leaching with ammonia and carbon dioxide, and smelting the sweetened residue, which is only 50 to 60% of the weight of the original ore, in an ordinary smelting furnace. The reduction in weight would depend mostly on the zinc content. It has been found to be 45 to 50% on a 20% ore, recovery of the zinc being 90 to 95% from a 35% zinc ore; 85 to 90% from a 25% zinc ore; 80 to 85% from a 20% zinc ore; and from a 10.4% zinc ore containing 2.1% copper, 6.5% lead, the extraction was 73 to 80% of the zinc. (I believe the average zinc extraction from the original ore in the United States is only about 51%.) The ammonia and carbon dioxide are distilled off in order to precipitate the zinc as a basic zinc carbonate. This precipitate is calcined to a zinc oxide, which it is found convenient to make chemically pure. The ammonia and carbon dioxide are used over again continuously, with practically no loss, except a slight mechanical loss in the residue to be smelted, which is found to average 0.6 to 1.4 lb. ammonia per ton of iron. The cost of treatment is not excessive. The elimination of the zinc and reduction in weight reduces the cost of smelting to a minimum for the recovery of the other metals in a reverberatory matting furnace (and it may be possible, in some cases, to treat the residue by cyanidation). The expense of crushing, grinding, and roasting the ore will be about the same as preparing the ore for any leaching method treatment, or cyanidation. The preliminary treatment to eliminate the zinc leaves nothing objectionable in the residue for smelting.

The details of this process I have promised to write up and read before one of the leading mining engineers' societies with the consent of D. Mosher, who suggested this process to me in the first place, as described by Schnabel in his 'Metallurgy of Copper, Lead, Silver, and Gold.' Vol 1, and F. L. Wilson,

who experimented for me with this and other zinc recovery processes at the University of California for several months before graduating in 1912, and has since worked faithfully developing the process on a larger scale. Many new ideas and improvements suggested themselves, differentiating it from the process as described by Schnabel after it had been in use for several years at the Hoboken works near Antwerp, where they must have had fused products and arsenic to contend with.

S. E. Bretherton.

San Francisco, March 31.

Mine and Mineral Land Taxation

The Editor:

Sir—It would seem that this subject, so often discussed in the technical papers and magazines, would more properly come within the province of the political economist, but, as it is of such importance to the mine owners, mine managers, and the mining fraternity in general, it becomes necessary for all of us to delve into its mysteries and try to evolve some satisfactory solution of the difficulties attendant. It also appears as if there were as many different ideas of how the matter should be handled as there are persons interested, and it may happen that all of the present known orebodies will have been exhausted before a reasonable system of taxation is devised and adopted. Obviously, the simplest way out of the difficulty would be a general federal law, covering the method to be pursued in levying the tax, leaving the rate of taxation to the state, county, or district affected, the rate in each case corresponding to the general tax-rate on other property with an addition for federal purposes.

The whole matter has forcibly been brought to public notice through J. R. Finlay's article describing his methods in arriving at a valuation of the Michigan iron and copper mines for purposes of taxation for the state. Mr. Finlay evidently did the best he could in the limited amount of time at his disposal, but when we consider that the same amount of time is often consumed by an engineer in the examination of one property in arriving at its valuation for practice, I cannot see how the values given by Mr. Finlay are much more than careful guesses. In figuring the value of the mine, he takes into consideration the profit made, the dividend paid, and the period of time over which it can be continued; all of which is estimated from the best information available, and if wrong would work a hardship either on the mine owner or the state. Would it not be better to eliminate all valuation of property and all efforts of valuation and have a straight bullion or metal tax on the proceeds, either net or gross? The states interested are not always so fortunate as to secure a man of Mr. Finlay's attainments to perform this work, and the valuations are often left to men who know nothing whatever of mine values, thus forcing protests from the mine owners, lawsuits, and in general stirring up difficulties of various kinds.

Mining property differs from any other class of property. There is an unknown amount of mineral in the ground, the value of which is unknown until extracted. When extracted, the ground remaining is worthless unless it be suitable for other purposes. If available for other purposes before being mined it possesses a taxable value and should be taxed on that basis both before and after being mined. This should be a separate and distinct tax from the mineral tax.

The mineral value of land depends entirely on the profit that can be made in extracting that mineral. Then levy a tax on the metal when coming out and make certain of getting it some time on a basis that is absolutely correct and involves no element of guess-work. The improvements on the property are of no value except in connection with the extracting of the metal, and should not be subject to a separate tax. Let the bullion or metal taken out be the sole basis of calculation. It seems to me that no fairer method than this could possibly be devised. Why should the present generation load the succeeding generations with accumulating costs on mineral in the ground?

J. J. Hill recently made the statement, under oath, that the mineral lands owned by the stockholders of the Great Northern were worth $500,000,000, figuring the iron ore not available until extracted. Its valuation is in fact pure guess-work, and when ore is extracted by future generations they should have the benefits of it, unencumbered. A bullion or metal tax at that time would be the easiest means of collecting the Government's share of the proceeds.

Ore cannot be taxed but once without adding these accumulation costs, and if taxed at the time of extraction, no matter whether the selling price is high or low, it cannot escape its just proportion of governmental expense. In this connection, Dwight E. Woodbridge says in his article* concerning taxation by valuation of orebodies in the ground based on various methods of calculation: "Thus the tax value was placed over the entire orebody whether it could be mined in one year or in 50 years. It can be readily seen that after a property had been taxed on such a rate as this for 25 to 40 years there would have accumulated against the ore remaining in the ground a prepayment of taxes almost confiscation." It would be similar to $100,000 in coin lying in a safety deposit vault, drawing no interest and taxed at 3% per year. In 33⅓ years, the taxes will have equalled the entire principle with no return to the owner.

That this problem is not confined to metal mines alone is evidenced by the difficulties encountered in the taxation of coal and coal lands. The various assessors of Lackawana county, Pennsylvania, have had almost as many different methods and different values in taxing the coal lands, as a number of assessors. An article in the *Engineering and Mining Journal*, July 4, 1908, says in reference to this: "This wide difference is only another instance of the lack of any just or uniform basis for the assessment of mining property."

I have yet to see a mine owner or operator who is

*"Iron Mine Assessments in Minnesota," *Eng. & Min. Jour.*, November 23, 1907, p. 967.

perfectly satisfied with the method or methods of taxation. Quite recently the question of taxing patented claims in Nevada has been discussed in the *Mining and Scientific Press.* Under my interpretation of values this would be a very simple matter. No tax should be levied until the property is working and producing. When the metal comes out, make the property pay its just proportion. When it ceases to produce, stop taxing. If the trouble so often mentioned of large areas of ground lying idle after patenting arises, amend the present law and make it necessary to still do a specified amount of assessment work on each claim per year to hold title, just as it is necessary now to use water for some useful purpose to hold title. It might also be a good plan to limit the number of claims that any one person or corporation can locate at one time, the same as a homesteader is limited in the number of acres of agricultural ground he can take up. All vacant mineral land is supposed to be owned by the federal Government, and, as I said in the beginning of this article, it seems to me just and proper that the best method of handling the taxation of this mining property is by a general federal law, uniform in its provisions as to the method to be used, leaving the amounts to be collected to the various states as their necessities demand.

H. C. Cutler.

Reno, Nevada, March 19.

Concentration by Flotation

The Editor:

Sir—In your issue of February 15, your correspondent, Edward Walker, supplements his article of January 4 with an addition which appears to call for further correction; perhaps a few facts from one who was intimately associated with the processes mentioned may be of interest.

In the first place, Theodore J. Hoover would be the first to admit that he did not, as might be inferred from Mr. Walker's addendum, introduce into the Minerals Separation process the factor of *rapid* agitation, in connection "with the virtue of the smallness of the amount of oil." This also originated with Sulman, Picard, and Ballot, and was an integral part of their process from its inception. Mr. Hoover became connected with Minerals Separation, Ltd., at a later date.

In the second place, the credit for this rapid agitation cannot be assigned to J. D. Wolf; my firm designed for him the apparatus arrangements employed to give effect to Scammel's viscous-oil flotation method, wherein a large mass of chemically thickened oil was employed.

If rapid agitation (that is, of the order used by Minerals Separation) had been given to the Scammel (Wolf) mixture of thick viscous oil, water, and mineral, the result would have been an inseparable sludge or 'mush,' and the defeat of the whole object of his process. The type of agitation which Mr. Wolf used and for which we were mainly responsible, was that afforded by a 'Johnson mixer'; this gently broke the large mass of oil into globules of appreciable size, temporarily suspending them in the pulp in order to entrap in their substance any metallized particles with which they might be brought into contact. Thereafter these rose through more quiescent liquor to the surface by means of their residual buoyancy and coalesced into a thick stratum of floating oil with embedded mineral; this was then removed for the recovery of its metallized contents, the oil being returned to the mixing apparatus for re-use. In no sense did the Wolf agitation approach that of Sulman, Picard, and Ballot, and as one of the designers of both types of agitation, which were selected for diametrically opposed functions, I may claim to have some authoritative knowledge of the matter. Theodore J. Hoover's undoubted contributions to the development of Minerals Separation plant were in the direction of improved arrangements for combining the agitation boxes and spitzkasten, instead of retaining them in the separate form at first employed. I should be the last to wish to minimize the value of his work, which has been justly acknowledged in public by the chairman of Minerals Separation, Limited.

London, March 5. H. Livingstone Sulman.

Surplus of the Average Man

The Editor:

Sir—That the tendency of the times is beginning to tell on the industry of which your journal is such an able exponent is clearly indicated by your editorial, 'Blue Sky Legislation and Investors,' appearing in a recent number, in which you say that "It is to the accumulations of the average man that industry must look for capital for expansion." This is far from correct. The average man makes many times more, but gets less than $500 per year. It is to those who have appropriated his surplus that industry must look for capital for expansion.

San Francisco, March 29. R. E. Hegner.

Bureau of Mines Appropriations

The appropriations provided by the sundry civil appropriation bill for a Bureau of Mines were as follows:

General expenses	$ 70,000
Investigation of mine accidents	347,000
Testing of coal and other mineral fuels	135,000
Investigations, mining, and treatment of ore	100,000
Mine inspector, Alaska	3,000
Mine inspector, Alaska, expenses	3,500
Books and publications	1,500
Railway sidings for mine-rescue cars	2,000
Total	$662,000

In addition $500,000 was appropriated for much-needed buildings at Pittsburg, and provision was made for a new building at Washington to house the Geological Survey, Bureau of Mines, and related organizations. While the bill was vetoed, it will probably be passed at the present session of Congress substantially without change.

Platinum and palladium amounting to 3000 and 5000 oz., respectively, were recovered in refining copper matte at Sudbury during six years ended 1912.

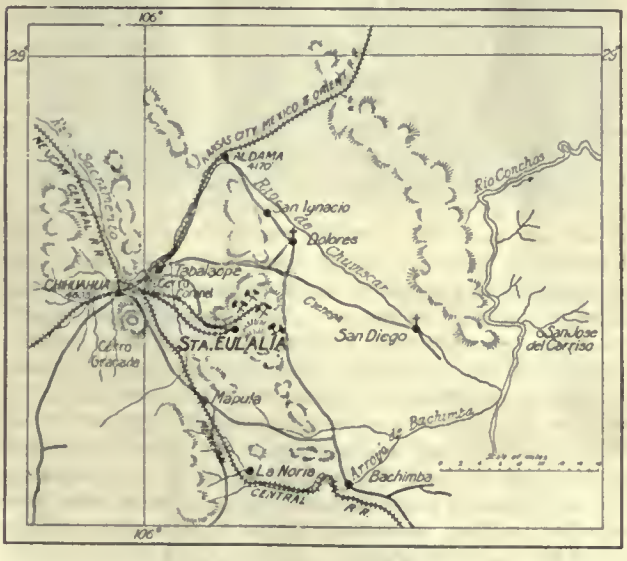
Special Correspondence

LONDON

LANYON OUT OF CORNISH TIN.—EXPLORATION COMPANY MEETING.—MYSORE CONTINUES TO BREAK RECORDS.

About a year ago I recorded that one of the tin smelters in Cornwall, the Bolitho's, at Chyandour, Penzance, had gone out of business, and that the works had been closed. This week I have to record the severance of another famous name, Lanyon, from the Cornish smelting industry. It is about 40 years since Alfred Lanyon founded the works at Carnkie, near Redruth, with a partner, and called the business the Cornish Tin Smelting Co. For the past 25 years he was the sole owner. But with his retirement the business itself does not cease, for it has been sold to Vivian, Younger & Bond, a London firm of metal merchants, who have other tin-smelting interests, notably in the Malay Peninsula, where they are active in connection with the Eastern Smelting Co. Under their ownership the routine at Redruth will be undisturbed. For many years William Bray has been manager of these works, and recently he has been assisted by his sons Richard and Hubert. Mr. Lanyon's purchases of Cornish concentrate at the ticketings have averaged £300,000 in value, and probably about twice as much black tin has been purchased from abroad.

The Exploration company, being devoted to speculation as well as investment, does not publish an elaborate report or balance sheet, but the chairman, R. T. Bayliss, gives a comprehensive review in his annual speech to the shareholders. The company's interests in Mexico are connected with mines within their own control. Mr. Bayliss was able to report that recent exploration at the El Oro had brightened the prospects, and that the purchase of additional adjoining property had increased the life of the mine. The Buena Tierra silver-lead mine, in the Santa Eulalia district of Chihuahua, was reported to be developing well, but owing to the revolutions, the Chihuahua smelter, which buys the ore, had not been running regularly, so that the Buena Tierra company had suffered severely. The latest



SANTA EULALIA DISTRICT.

flotation by the Exploration company has caused worry through metallurgical difficulties. This is the Santa Rosa, a gold-silver property in the Mazapil district of Zacatecas. A year ago a 100-ton plant was ready to begin production, but the ore has proved refractory, and experiments are being conducted by W. K. Betty with the object of solving the problem. One of the strong points of Mr. Bayliss is that he does not shirk responsibility for mistakes or miscalculations. In referring to the Santa Rosa, he said: "When I addressed you last year, I said this mine, as from January 1, 1912, would be earning a profit of £40,000 per annum. Subsequent treatment difficulties have proved me hopelessly wrong in that prediction." As regards copper, the holdings of the Exploration company are in American companies outside its own sphere of influence, and partake of the nature of speculative interests, so the directors' report does not enter into details; but Mr. Bayliss stated that the future of the copper market was so encouraging that they intended to extend their activities in this direction. The Exploration company has £250,000 in liquid capital, available at any time for the acquisition of additional properties and mines.

The original mine in the Kolar district, the Mysore, continues to be the most important, and continues on its uninterrupted way, still breaking records after a life of 28 years. The yield of gold for 1912 was £904,079, just a trifle better than the previous highest in 1909, 1910, and 1911, and bringing the total since the start to £14,376,720. The amount distributed among shareholders was £381,250, or at the rate of 125%. This is not actually the highest dividend, for during the years 1904 to 1908 the distribution averaged £40,000 more; but it has to be remembered that in those days the money for extra equipment and the sinking of new shafts was obtained by the issue of new capital. The mine continues to respond to development, and during the year the reserve has been increased by 37,629 tons, standing on December 31 last at 1,337,998 tons, or four years' supply. Much money is to be spent during the next two or three years on the further sinking of the Edgar and McTaggart vertical shafts, and also on tube-mills and cyanide plant for treating the accumulated sandy tailing. Negotiations are in hand for the acquisition of additional ground on the dip from other holding companies belonging to the same group.

NEW YORK

MORGAN'S DEATH.—COPPER SITUATION.—GREENE-CANANEA CLOSES.—MIAMI REPORT.—B. C. COPPER CO.—SHATTUCK-ARIZONA.—BUTTE NEWS.—PRICE OF SILVER.

In spite of inherited wealth and not because of it, Mr. Morgan achieved the greatest constructive career as a financier and organizer this country has ever seen. His grasp of details, his power to enthuse and create or bring out loyalty, his abiding faith in the future of himself, of his country, of the industries for the upbuilding of which he worked, were all grounded upon his adamantine conception of business integrity. He was gruff, and grim, and brusque, but he was undeviating, and in time of stress he was the restful harbor sought by all the craft of Wall Street. That he made himself one of the greatest art connoisseurs in the world, that his vast collections of art treasures show taste and rare discrimination, is but another evidence of the greatness of the man as set over against the greatness of the dollar. The leadership, the capacity, the great faith, and his inspiration of confidence will be remembered and discussed in Wall Street long after the memory of the millions he may have amassed shall have passed away. Mr. Morgan's passing marks an epoch in the financial history of the country; the next generation will not see leadership so unanimously accorded to any one individual. There will, in the next few years, be seen some strenuous competition for the first place in banking affairs, but such competition is almost certain to be institutional rather than individual, and Mr. Morgan's mantle, instead of descending to a new leader, will in all probability be hung in the gallery of Wall Street memories to be pointed out as an illustration of the greatness men sometimes achieve.

In the copper situation the encouraging feature is the record made in the export trade during March, it being quite assured now that March exports will equal if not excel those of December 1911, when the total outgo was 84,504,000 lb. Custom House figures for March show nearly 90,000,000 lb. to have been exported in March, but some considerable portion of this copper was accounted for in the February figures of the Copper Producers' Association. It is safe to predict a decrease in copper surplus somewhere between 10,000,000 and 15,000,000 lb. This showing will be offset a little by increases reported in the visible supply abroad; recent fortnightly figures showing an addi-

tion during the last half of March of 1435 tons, equivalent to 2,870,000 lb. The copper selling agencies feel so far assured of the improvement in the situation as to have advanced prices to 15⅝c., and some of the heavy sellers are already talking about 15½c., and in one instance one of the principal sellers of copper has withdrawn entirely from the market at present prices.

In illustration of the old adage that "one man's meat is another's poison," the copper situation is improved by the enforced shut-down by the Greene-Cananea, the management having wired to the local offices in New York that "it will be necessary to close down the blast-furnaces and suspend all operations until the situation clears up." The railroads have been destroyed and bridges burned, so that it has been impossible to get fuel and supplies into Cananea. This shut-down means a curtailment of about 9,000,000 lb. of copper per month. The report of the Miami Copper Co. for 1912 is just available. It shows that the company sold during the year 32,477,923 lb. of copper at an average price of 16.58c. per pound, from the production of which there was won a net profit of $2,029,765. Copper costs are not given in detail, but J. Parke Channing says, in his report as consulting engineer, that mining costs have remained high on account of unusual development work done to get the ground ready for stoping. One part of the property is now in shape for stoping and a materially reduced copper cost may be expected during the coming year. The March production of the Phelps-Dodge company was 12,261,538 lb. of copper, being a slight increase over the February output.

The report of the British Columbia Copper Co. covers the 13 months ended December 31 last, during which period there was produced 11,259,140 lb. blister copper, yielding 25,863 oz. gold, 142,025 oz. silver, and 11,146,811 lb. fine copper. The chief handicap under which the company has labored during the past year has been the low metal content in the ores handled. The rehabilitation of the plant has made operations much cheaper than formerly, but notwithstanding this, copper costs for the period covered were 12.85c. per pound. British Columbia has some extensive plans for expansion under way, and the coming year will see some new properties opened and larger ore reserves created, which plans, if carried out, will give stability to the company's future. At the annual meeting held this week, Frederick Lewisohn, Harry Bronner, and John H. Seaman resigned from the board of directors, their places being filled by Joseph B. Dulany, C. I. Straiem, and William T. Henry. The somewhat meteoric career of the Shattuck-Arizona is to be interrupted by the suspension of the dividend of 50c. per quarter which it has been paying recently. The company has a contract to deliver 500 tons of ore per day to the Calumet & Arizona smelter, shipments on this basis to begin on July 1. The management has decided that in order to prepare for these shipments it will be necessary to expend the company's present revenues in development instead of making distribution to the stockholders. So far as can be learned the various deals which were afoot for the purchase of the Shattuck-Arizona by some of the larger copper producers have all fallen through.

Evidently the Butte & Superior people and W. A. Clark are not to have the zinc industry at Butte altogether to themselves. It is reported that the assets of the LaFrance Copper Co., which include the Lexington mine and the old smelter and concentrator at Basin, have been sold to the Anaconda. The LaFrance Copper Co. was known for many years as a Heinze organization and was a part of the tangled affairs of the United Copper Co. W. F. Bartholomew, formerly a member of the staff of the *Boston News Bureau*, and E. N. Skinner, both now a part of the Thompson-Towle organization, are leaving New York this week for a two months' trip, during which they will visit nearly every important copper producing property in the country. The U. S. District Court appointed additional receivers this week in the suit brought by the Guaranty Trust Co. of New York against the Alaska Ebner-Gold Mining Co. This property appears to be a little unfortunate in that it is continually involved in litigation or reorganization.

It seems rather a far cry from the recent action of the President in announcing his change of policy toward the participation of American bankers in the so-called six-power loan of $125,000,000 to China, to the price of silver, but as a matter of fact the President's action has given the silver market more of a set-back than anything which has occurred since it began to look up. The market in silver has been maintained upon the theory that eventually negotiations for the loan would be brought to a successful close. Now silver held for Chinese account, looking forward to such a conclusion, is pressing heavily for sale, while at the same time the Indian government is no longer in the market for coinage, the net result being a rather depressing outlook for silver producers.

MIAMI, ARIZONA

SUPERIOR & BOSTON.—ARIZONA COMMERCIAL.—IRON CAP.—WARRIOR.—SOUTH LIVE OAK.—CALUMET & ARIZONA.—MAGMA.

At the Superior & Boston, plans are being formulated for a greatly increased tonnage in the near future. A favorable contract has been entered into with the American Smelting & Refining Co. at El Paso, Texas, whereby the latter is to handle all the Superior & Boston ores for a period extending over the following two years. Driving on the east and west drifts on the 600-ft. level has extended over 200 ft., while the raise from the eighth to the sixth level is expected to break through within the next week. The cross-cuts on the tenth and twelfth levels show geological changes interpreted as indicative of nearness to the main lode. The present shipments of a car per day are being maintained. The Arizona Commercial continues to carry on an active program of development. Operations at present are confined to the Copper Hill shaft. Sinking is being carried on, the shaft having now reached a point below the tenth level. A station is being cut on the tenth. Driving continues on the seventh and eighth. On the seventh a drift is being driven for the purpose of handling the ore previously found. The highly favorable developments at the Superior & Boston may lead the company to resume operations near the old Eureka shaft.

At the Iron Cap the recent discoveries on the 650 and 800-ft. levels remain promising. The raise from the eighth to the 650-ft. level is now in over 30 ft., and continues to disclose ore of a commercial grade. The find on the 650-ft. level also holds out. The shipping rate of four cars per month to the El Paso smelter is being maintained. During the month of March the Gibson Copper Co. shipped five cars of ore to the El Paso smelter. The company expects to again reach normal shipping capacity during April. About 40 men are employed. At the Warrior Copper Co. steady shipments of from 125 to 150 tons of silicious copper ore are being made daily to El Paso. The ore is freighted by teams to the Warrior siding on the Arizona Eastern about two miles below Miami. Between 50 and 60 men are employed. At the South Live Oak, drilling operations are progressing satisfactorily. Hole No. 7 has now reached a depth of 805 ft. and is to be discontinued. The new hole, No. 8, lies about 750 ft. northwest of No. 7, and about 400 ft. west of hole No. 5, the hole in which 65 ft. of over 2% ore was found. A series of unavoidable accidents have been retarding drilling operations at the Southwestern Miami during the past two weeks.

The two main shafts of the C. & A. at Superior, that are being sunk on the Morris lode, are respectively 200 and 135 ft. deep. John A. Greenway, general manager, states that no ore of a commercial value has as yet been found and that the company has no expectation of finding any at the present depth. The shafts are at points convenient for working, not on account of any special geological reason, and active exploration will not be undertaken until a depth of 700 ft. is attained. At the Magma, extensive exploration is being carried on by diamond-drilling. An 800-ft. horizontal drill-hole running in a southerly direction has just been finished, while a second perpendicular one has attained a depth of 300 ft. Results are proving highly favorable. T. I. Ryan has charge of the drill work, and is using a Longyear & Hodge machine of a 2000-ft. capacity. The

company continues to make shipments of 100 tons of high-grade ore per week by way of Florence to El Paso. About 25 men are employed at present underground. A good find of high-grade ore was recently made on the Whitlaw-Brown claims. These claims lie about one-half mile southeast of the famous old Silver King mine. Lessees on the Horn Silver claim, which lies one-half mile northwest of the Magma, are taking out considerable high-grade ore, having already made one shipment.

REPUBLIC, WASHINGTON

RAILWAY NEWS.—KNOB HILL MINES.—SILVER REEF.—NEWS FROM OKANOOON.—OWASCO MINE TO BE REOPENED.

The Great Northern Railway Co. has announced the release of its right of way through the San Poil valley, which leaves clear the right of way for the extension of the Spokane & British Columbia railway from Republic to Spokane, down the San Poil valley and along the Columbia and Spokane rivers. The consolidation of the North Washington Power & Reduction Co., the Republic Mines Corporation, and other interests at Republic has been effected, according to advices from Spokane, and a new company called the Surprise Consolidated Mining & Milling Co. organized. The Republic Mines Corporation receives 1,000,000 shares in the new concern, and the North Washington gets 300,000 shares, the balance being held as reserve. Their combined liabilities are $306,000, and the only obstacle to the consolidation is the possible action of creditors. The Republic company owns the Lone Pine, Pearl, and Surprise mines at Republic, while the North Washington company owns the

REPUBLIC, WASHINGTON.

reduction works there, and was organized primarily to provide treatment facilities for the other company. If the business goes through, the mill will be enlarged, and costs should be reduced. The output of the Knob Hill mines at Republic, which for three or four months had been reported as rather slim, has improved recently. Under date of March 26, the returns for the smelter at Trail, B. C., from 53,501 lb. of ore gave the assay value at 6.20 oz. gold and 20.2 oz. silver, and the net value, after deducting freight and treatment charges, at $119.74 per ton. The total amount allowed was $3203. Five other shipments of somewhat similar value are to be heard from. The ore from the Lone Pine and Surprise mines is not only paying expenses, but is also rapidly building up a reserve to pay off all of the labor claims of the miners standing against the Republic Mines Corporation. T. Roberts, of Sheridan, Wyoming, has taken a bond on the Silver Reef group of claims, in the Enterprise mining district, and will organize the Held-Roberts Mining Co., and push development on a 23-ft. vein in which have been found rich streaks of sulph-antimoniate silver ore, which show in the forms of ruby silver and stibnite.

G. W. Dart, president and general manager, and C. W. Smith, secretary, of the Owasco Gold Mining Co., a New York corporation, are at the Okanogan Free Gold mine, on Kruger mountain, west of Oroville, preparing to start up work. About $140,000 has been expended on this property by a Canadian company. The old openings embrace about 2700 linear feet of adits, drifts, rises, and stopes. There are four veins, of which one has been extensively developed and the others barely prospected. Internal dissention in the company resulted in suspension of operations. The new company will put in a compression plant and re-timber the mine. A contract for electric power has been made with the Similkameen Power Co. A vertical shaft will be sunk and new levels opened. The work will be started with a force of about 30 men. Mr. Dart estimates that there is enough ore in the drifts and stopes in the mine for a year's supply for the 10-stamp mill, and about 30,000 tons of $20 ore on the dump. The track of the O. C. & E. railway traverses the property within 600 ft. of the mill. The Ivanhoe mine on Palmer mountain, which has been idle for several years, has recently been under examination for an Eastern syndicate. The shaft on the Ruby mine, at Nighthawk is now down 750 ft. There is now developed on this property enough $15 to $20 ore to keep a 30-ton concentrator running two years.

JOHANNESBURG, TRANSVAAL

ADDRESS OF RETIRING PRESIDENT OF CHAMBER OF MINES.—INCREASED COSTS.—VALUE IN DEPTH.—ROCK DRILLS.—WHITE LABOR.—ELECTRIC POWER.

The retiring president of the Chamber of Mines, M. G. Elkan, had much to say that was interesting regarding the mining progress made during his year of office. Referring to the Rand, a much larger tonnage had been mined and milled in 1912 than in any previous year, and although working costs had increased, the recovery per ton was higher and so were the working profits and dividends. The recovery was higher partly through improved methods of extraction, but mostly owing to a better grade of ore having been sent to the mills. With regard to higher working costs, unnecessary competition among the mines had raised the cost of native labor, but, fortunately, during the year a system of coöperation had been arranged, and native labor costs ought in the future to be reduced. Then extra burdens have been imposed, especially in regard to miner's phthisis, but underground conditions had been so improved that it is expected that this new burden will be of a temporary character only. Over two thousand cases of application had, however, been put in for relief under the Miner's Phthisis Relief Scheme, of which only two-thirds had yet been adjusted. The annuities already awarded under the Act amounted then close upon £300,000. As far as could be seen at present, the cost to the mines for this relief varied according to circumstances from 3d. to 9d. per ton milled, so that on the average it may be as high as 6d. per ton. Against this might be set the reduced railway rates and native wages, so that in the long run, working costs may be expected to come down to the old figure. Much importance was attached by Mr. Elkan to better ore exposed at the deepest workings at Geduld, Modderfontein, Cinderella Consolidated, City Deep, Crown Mines, Consolidated Main Reef, and Princess Estate, and taken as a certain cause for encouragement. In case of at least three of these illustrations, however, the reef has only just been found, and true values over an extended area have not yet been established, so that it is premature to attach much importance to these finds. Take Geduld, for instance; where phenomenally rich ore in both shafts and boreholes have been found, it has always been difficult to establish them even when confined to the shaft, the second sampling failing to confirm the first high values, so that Geduld was an unfortunate example to cite. At the Consolidated Main Reef, too, the development results of the past three months, where 2321 ft. was driven, raised, and sunk, only about 30% of the footage was through profitable ore, which is far more convincing than the mere finding of a reef by a shaft, close to a dike at that. The Crown Reef instance was apparently one of abnormal local development, but the other instances quoted are more convincing and satisfactory. Reference was made by Mr. Elkan to the success attending the use of small stoping drills, the total number of rock-drills having increased

from 2425 in 1908 to 5530 last year, and there is now every prospect of the quest of a satisfactory stoping drill for all local underground conditions being discovered. Stores consumed last year aggregated £9,753,751, European wages cost £7,865,939, and native wages £5,691,401, white wages having averaged £330 per head throughout the year. Nevertheless the supply of white skilled labor on the Rand was far below requirements, the bulk of the white labor engaged in supervising the negroes and underground mining operations being very inefficient and therefore costly. Native mortality, including accidents, had been reduced from 34 to 28 per thousand during the year, while special efforts were being made to reduce the deaths from pneumonia, particularly among the tropical natives. The marked extension of the use of electrical power on the Rand during the year was next mentioned, the Victoria Falls Power Co. having in five years increased its plant capacity from 5700 to 94,000 kw., and soon the total capacity will be 140,000 kw. electric power and 61,500 kw. air-compressing plant, all supplied to the mines by one company. Three individual mines have also their own large power plants. In conclusion, Mr. Elkan said that the mining industry of the Rand possessed great inherent soundness, and that the average value of the residue did not exceed 1s. 6d. per ton.

BUTTE, MONTANA

SOUTHERN CROSS READY TO SHIP.—BUTTE CENTRAL.—CORBIN BRANCHING OUT.—GOLD PRODUCTION INCREASES.

The Southern Cross mine at Georgetown, which was purchased some time ago by the Anaconda Copper Mining Co., is about ready to begin shipments on a large scale. The new electric hoist and steel head-frame are about finished, and the mine has been put in shape for steady production. The oxidized gold-copper ore from this mine makes a desirable flux for the silicious sulphide ores from Butte. Tuolumne Copper Co. will pay its regular quarterly dividend of 10c. per share on May 15. Local stockholders of

PART OF BUTTE.

Butte Central Copper Co. are seeing stars these days since the stock has declined from $8 to $2 per share. Everybody seems to be wondering what has happened. The mill seems to be there ready to treat ore in good shape, and the surface buildings are intact. Somebody says that somebody sent an engineer to see if the ore was there, which ore said engineer said he failed to find. Since which time the said somebody has been regarding his stock with aversion, and unloading it on the still hopeful insiders at any old price. The Butte gullibles are now wondering just what caused them to buy the stock, and are sagely remarking that mining is still a horrible gamble. The Corbin Copper Co. apparently does not believe in putting all its eggs in one basket. The company is experimenting with four properties now, one at Corbin, one at Elkhorn, one at Rochester, and one at Butte. No egg has hatched yet, although the stockholders lost $62,502 last year in trying to keep the basket warm. The east section of Butte is still attracting capital. The latest venture there is the Butte Main Range M. Co., organized by the controlling interests of the Tuolumne and Pilot-Butte companies. The new company is capitalized for $1,500,000, and owns 45 acres of mineral ground east of the Pittsmont property.

For development purposes, stock is to be offered at par. The directors of the new company are: Ed Hickey, Ed. Hickey, Jr., P. J. Brophy, Frank X. Girard, Ray J. McDonald, M. S. Largey, C. R. Leonard, Pat Sheehan, and J. J. Harrington. A shaft will be sunk in search of copper. The revival of operations by the Barnes-King Development Co. again throws Fergus county into the lead of Montana's gold counties. The United States Assay Office at Helena reports the Montana gold production for March at $116,000, of which Fergus county yielded about $42,000, mostly from the Barnes-King property. Next in importance is Madison county, with $37,000, mostly from the Alder gulch dredges. The Marysville mines produced most of the $22,000 from Lewis & Clark county. Choteau county furnished about $14,000 from the gold properties in the Little Rockies. No other county is credited with as much as $1000. In spite of persistent rumors that all is not lovely with the copper leaching plants on the east side, the promoters of these enterprises are going ahead enlarging their plants, and raising money for more extended operations. Somebody must be mistaken. Let us hope that it is the critics of the method, for the sake of the stockholders who have their money at stake. The Butte & Superior Copper Co. is going quietly ahead with the development of its ground and the improvement of its zinc mill. From all accounts, progress appears to be satisfactory. The long north cross-cut from the Black Rock to the Colonel Sellers shaft on the 1200-ft. level is to be continued on north to prospect the Mastodon and other veins of that section.

BOSTON

OLD DOMINION.—CORBIN.—BUTTE CENTRAL.

The first of April, Godfrey Hyams secured from the District Court of Portland, Maine, an injunction restraining the Old Dominion company of Maine from voting its stock in the Old Dominion company of New Jersey. The court order permitted only the voting of the New Jersey stock on the question of adjournment. The Old Dominion company of New Jersey therefore adjourned its meeting out of respect to the court, though it did not concede its jurisdiction in the matter. The hearing on the injunction proceedings will take place on April 14 at Portland, Maine. R. M. Edwards, the veteran Michigan mining man, father of the drill system, is now at Butte, looking after the interests of the Corbin Copper Co., which is making payments on the Gambrinus claim in Butte. The Corbin interests propose to open the property at once by shaft sinking. Mr. Edwards believes that the Gambrinus claim carries the extension of the Anaconda-Parrot vein. The United States Smelting interests, of Boston, are now supporting Mr. Edwards in his handling of the so-called Dow-Edwards properties in the Lake country, and it is presumed that their reports will also extend to the Corbin enterprise.

A sensation, if not a near-scandal, has developed here over Butte Central. A raid was made on the stock, which carried it down from 5⅜ to 1½, closing around 2⅜, which is about its average price at present over a period of days. The occasion of the raid was a report made by Samuel H. Treloar, stating that the mine, instead of having a million or more tons, has 35,000 tons from the 100 to the 300-ft. level and 3000 tons on the 300-ft. level, making 38,000 tons in all. Many angry controversies and ugly charges have arisen. The vice-president, Mr. Davison, claims that a Curb firm here made an effort to levy blackmail upon him by offering to turn the report over to him, squelching it and giving the mine a clean bill of health for a consideration. He refused and the smash came. Witnesses were lacking, so Mr. Davison could not press blackmail charges. This leaves the disparity between Butte Central claims and Treloar's estimate of ore reserves to be reconciled. The Butte Central interests claim that no misrepresentation has been made and that the mine has been done a very great injustice by Mr. Treloar. The claims as to Butte Central ore reserves are based largely on statements made by Mr. McConnell, mine superintendent, and John E. Rothwell, mill engineer, who have credited it with 1,500,000 tons. Other experts who have visited the mines have in a casual way confirmed the Rothwell-McConnell estimates.

General Mining News

ALASKA

Fairbanks

Four inches of a vein carrying up to $2000 per ton has been found in the Homestake property on Wolf creek. It was cut 315 ft. from the mouth of the main adit. The total width of the vein is 12 in., and the other 8 in. averages $40 per ton. The last shipment to the mill returned $77 per ton. Miners on Fairbanks creek are getting ready for the coming season.

Iditarod

The Idaho 'association,' at the head of Flat creek, which was recently optioned to T. Aitken, was purchased from the original owners for $20,000. Rich 'pay' was found during March. An eighth interest in the Upgrade 'association' was also purchased for $15,000, while the balance was sold for $32,000.

Valdez

The Thompson-Ford company, at Shoup bay, has driven an adit 600 ft. during the past six months, and also a raise for ventilation. Two veins, 14 and 24 in. wide, have been opened.

ARIZONA

Gila County

(Special Correspondence.)—Nevada people are working a fine property, belonging to Sam Thorpe, under lease and bond. They have a shaft down 50 ft. and have made one shipment of ore, from which they received good returns. Good ore containing gold, silver, and copper is being taken from a property adjoining the old Silver King mine north of Globe. The new owners of the Silver King mine are preparing to begin work on that famous old property. Several lessees are working in the vicinity of the King, and prospectors are quite active. The Magma Copper Co. is continuing the development of its property, and shipping between 300 and 400 tons of high-grade ore per month to El Paso. The force employed has been reduced temporarily, on account of the recent wet weather, which damaged the roads, and also because of the increased flow of water into the shaft, which is difficult to handle, as the capacity of the compressor has been reached. Development in the Magma continues to be favorable, and at the 800-ft. level the ore is even richer than it is on the upper level. The company is prospecting with diamond-drills, with the object of locating a working shaft.

Globe, April 2.

Ray Consolidated produced 4,420,000 lb. of copper in March, making a total of 12,312,000 for the first quarter of 1913.

Maricopa County

(Special Correspondence.)—William Dilthey, president of the Copper Belt Mining Co., has returned from his home in New York and is at the property in the Black Rock district. The company will resume operation on a large scale soon. One of the properties of the company joins the Monte Cristo, and another adjoins the Keystone.

Wickenburg, April 2.

Mohave County

Rich ore has been opened in the Boundary Cone mine, near the Tom Reed. It is reported that another gold discovery has been made in the Wallapai mountains, 18 miles south of Kingman.

Pinal County

(Special Correspondence.)—Mr. Guild, manager for the Tortolitas Copper M. Co., is making preparations for a resumption of work in the Yankee Girl shaft, which is now 100 ft. deep. He has enough lumber on hand to timber the shaft to a depth of several hundred feet, and is framing the sets for the first 100 ft., so as to expedite the work when he puts on a crew of timbermen. The Yankee Girl mine has yielded exceptionally rich ore in the past, which was shipped to El Paso and yielded the owner a large return in gold, silver, and copper. This ore was taken from near the surface, where it had been subjected to leaching. The new shaft will have a 6 by 6-ft. hoist-way and a 2 by 6-ft. man-way, and pumping compartment. The hoisting engine and blower have been moved from the Cloudburst to the Yankee Girl shaft. It is of 500-ft. depth capacity.

Florence, April 2.

Yavapai County

The Crown King mill has ceased treating the old tailing dump of that mine until weather conditions moderate. The deep snow, together with the cold days and nights,

MAP OF ARIZONA.

in that elevation, were a great disadvantage, and resumption will not take place before the end of the present month.

Prescott, April 2.

CALIFORNIA

Amador County

The shaft of the old Keystone mine has been sunk to 2600-ft. depth, the last 1000 ft. having been sunk during the past 10 months. A station is to be cut at 2600 ft., and a cross-cut driven 400 to 500 ft. west to cut the vein, which produced rich gold ore in the old workings. This property is stated to have yielded $17,000,000. The gold-mining industry in and around Jackson and Sutter Creek is said to be in a flourishing condition.

Butte County

The California Diamond-Drill & Engineering Co., which has been operating near Magalia, has pulled up its drill and gone to Chico. Only one hole was drilled, to 404-ft. depth, and the hole started and ended in a serpentine rock. Local miners state that there was no chance of finding a gold-bearing channel there, and another object was in view. The power-line from De Sabla to the Crystal Hill mine has been completed, and all connections made.

Calaveras County

(Special Correspondence.)—The Springfield Tunnel & Development Co., situated about two miles from Columbia and a half-mile north of Springfield, is doing extensive work on its property. This company owns about 500 acres of ancient river channel at Table mountain and has spent considerable money in underground work that will enable the handling of a large volume of water at a minimum of expense, and also reach the gravel in the cheapest manner possible. This channel is a part of the ancient river system which crosses the country from the northeast and, as far as known, terminates in Tuolumne county. This company made a record in sinking its new

shaft, which is of three compartments with square-set timbering. The work started on February 25 at 7 a.m., and on March 27 at the same time, 30 days later, the shaft was down 195.5 ft. and completely timbered. Twelve men were employed, four men to a shift, and two more framing timbers. The shaft men did all the necessary work of timbering and 'mucking,' using a 1-ton skip in handling the rock. Two Damas machine-drills were used. An adit is being driven in from the mill to the new shaft, and will be about 700 ft. long, connecting with the new shaft 180 ft. above the channel. This will facilitate the handling of the gravel as well as supplying the water which will be used in the mill. Mr. Homer, the superintendent, thinks he has solved the problem of handling the water. He is now installing a pump which will handle about 1500 gal. per minute. The equipment throughout is modern, being electrically driven.

Angels Camp, April 3.

Eldorado County

Considerable mining activity is reported in the Fairplay district, and good results have been obtained in working the old river channels.

Humboldt County

(Special Correspondence.)—The Horse Mountain Copper Co. is doing considerable development at its property. One adit is in 300 ft. and has opened sulphide ore and a good deal of native copper. A lower adit is in 600 ft. In the New river district there is 5 ft. of snow.

Eureka, April 5.

Nevada County

The Grizzly Ridge Mining Co. is developing the Oustomah quartz mine, near Nevada City, and also the Oak Flat and Eddy properties. A full account of the North Star operations during 1912 appears in another column. A large dredging plant is to be built on Deer creek, under the direction of Frank Porter. The dredge will be 40 by 60 ft., and will move about on rollers. Electric power will be used. Seventeen students, under A. C. Lawson, professor at the University of California, are at Grass Valley to study geology and practical mining.

Plumas County

The Los Angeles lessees of the Five Bears copper mine in the Genessee district expect to start work in a few days. The ore is to be concentrated, and the product shipped. At the Droege, 25 stamps are dropping, and 35 men are employed. The adit of the Leitrum mine, in the Bullfrog district, has to be driven 100 ft. more to cut the rich vein worked some time ago in the upper workings. C. L. Moseley and R. L. Stone, of San Francisco, have bonded the Glazier mine on North fork. The adit will have to be driven 200 ft. farther to cut the old channel. Seattle and Alaksa men own the Altona mine, and during last summer did 400 ft. of development work, with encouraging results. Now the snow is melting, work is to be resumed. Colorado people have acquired a property on the western branch of the old Jura river channel, and will thoroughly prospect it by test-pits and ground sluicing.

Shasta County

The aerial tram-line from the Reid mine, at Old Diggings, to the Southern Pacific siding is almost finished, at a cost of $20,000. There are 12 towers, and each of the two cables is 4400 ft. long, while the 30 skips of 600-lb. capacity can deliver 25 tons of ore per hour.

Tuolumne County

(Special Correspondence.)—The payment of $227,500 by the Black Oak Development Co. for the Black Oak mine was made on April 3 to the First National Bank of Sonora, where the deed to the property is in escrow, and simultaneously suit was brought in the Superior Court by the purchasing company against S. A. Knapp and others, to be adjudged owner of the property and for the deed of conveyance, which, it is alleged, Knapp refuses to deliver. The defendants in the action, excepting Knapp, have answered the complaint and admit that plaintiff has complied with the conditions contained in the agreement between the parties and is therefore entitled to the deed in escrow. A company whose purpose will be to develop and promote the sale of mining properties is being formed by J. W. McAllister, of Jamestown, and J. J. Beatty, of Nevada. It will be known as the Tuolumne County Exploration Co., and will have a capital stock of $25,000, divided into 100 shares of the par value of $250 each, all subscribed for. The Atlas Consolidated Mines Co., incorporated under the laws of West Virginia, has filed articles of incorporation in this county. The capital stock is $250,000, with 25,000 shares of the par value of $10 each. The incorporators are J. D. Hubbard, C. C. Concannon, Frederick Julian, Frank P. Pape, and Robert Oehmig, all of Chicago. The company is operating the Atlas mine, at Tuttletown, from which the first bar of gold was last week sent to the mint. An air-compressor capable of running 8 machine-drills has just been added to the equipment. John Witney is superintendent of the property. The company operating the Black Oak, near Soulshyville, will shortly begin active work on the Burns' mine, an adjoining claim. Considerable machinery will be installed, after which sinking will begin, and driving will commence as soon as sufficient depth is attained. Electric power will be used. A crew of men will shortly begin development work on the claim adjoining the Atlas, at Tuttletown, owned by John Richards.

Sonora, April 5.

COLORADO

Clear Creek County

(Special Correspondence.)—F. Nelson, manager for the Bard Creek M. Co., has gone to Tulsa, Oklahoma, where he will confer with a number of large stockholders regarding the construction of a 50-ton mill. The plant will be situated on Bard creek, and will be electrically driven, valuable water-powers being controlled. It is stated that the new mill will be completed within 90 days. H. B. Clifford, of New York, is here with a representative of Thomas A. Edison, and the two men have been making an examination of the Waldorf mines in East Argentine. It is stated that the present mill will be remodeled at once, and that the Edison machines for ore dressing will be installed. A. L. Stephens and associates, leasing on the fourth level of the Smuggler mine on Brown mountain, have been realizing $50 per foot net from extending the west drift. A 5-in. vein of 1100-oz. silver ore is being followed, and stoping will be started this week, when enlarged shipments will be made. The Mendota Mines Co., leasing above the Victoria level, on the Mendota mine, has doubled the force during the past week. Heavy shipments of smelting ore, and lead and zinc concentrate are being made. A. Robert, leasing on the Virginia City mine on Lincoln mountain, has started stoping on an 18-in. vein of solid ore that returns 79 oz. silver per ton. A large scheme of development has been started at the Ruler and Comet mines, situated on Griffith mountain, and operations

IDAHO SPRINGS, CLEAR CREEK COUNTY.

will be conducted through the Capital adit. C. H. Rowland, of Syracuse, New York, is manager. Shipments have been started from the East Griffith mine, of which F. A. Maxwell is manager.

Georgetown, March 31.

GILPIN COUNTY

Sinking of the East Notaway shaft has been stopped temporarily, and driving east and west on the 750-ft. level started in good ore. Twelve tons of ore sent to the Globe smelter returned 4.62 oz. gold and 7 oz. silver per ton. Nine men are working at the Troublesome mine and are keeping the Polar Star mill, at Black Hawk, working full time. Ore averages $45 per ton. The Gilpin-Eureka mill is working on ore from the mine. The Alps mine is producing fair ore for the lessees.

TELLER COUNTY (CRIPPLE CREEK)

According to local statistics, the March production of the district was as follows:

Plant.	Tonnage treated.	Average value.	Gross value.
Golden Cycle	32,000	$20.00	$ 640,000
Portland at Colorado City	10,000	21.00	210,000
Portland at Cripple Creek	15,700	3.26	51,182
Stratton's Independence	10,390	2.80	29,092
Ajax	4,500	2.80	12,600
Wild Horse	1,200	4.20	5,040
Kavanagh-Jo Dandy	1,800	2.15	3,870
Gaylord, Dante	1,500	3.00	4,500
Isabella	1,100	2.00	2,200
Smelters	3,750	65.00	253,750
Total	81,940		$1,162,234

The Acacia Gold Mining Co. has adopted the Isabella scale of royalties on lessees' ore. The El Paso company produced 145 cars of ore in March, and has paid a 2½c. dividend. Ore shipments from the Isabella ranged from $8 to $90 per ton, the latter value coming from the Kellum shaft. Another shipment of ore from the 1600-ft. level of the American Eagles mine has been made, the last averaging $115 per ton.

IDAHO

BOISE COUNTY

(Special Correspondence.)—The Pearl district at the present time is almost entirely a lessees' 'camp.' Those at the Whitman have taken out ore to the value of $9000, of which 52% was profit. This amount represents the actual gross value of the product shipped, which consisted of 158 tons of concentrate and 34 tons of crude ore, there being 386 tons mined. The ore contains gold and silver. No amalgamation was attempted, as the Whitman mill is equipped with rolls, jigs, and tables. Lessees working on the Checkmate property are driving on a vein south of the Checkmate vein. This property has been idle for several years. It is opened to a depth of 500 ft. and has produced $500,000. The Checkmate lessees built a three-stamp mill and are milling ore from other claims in the district in addition to handling their own output. No figures are available as to the amount of bullion produced. The Dewey property has been operated under lease for more than three years. At the present time the lessees have a considerable tonnage of mill ore on the dump, and expect to use the Black Pearl mill in treating it. Placer property on the Payette side of the ridge are also being worked by lessees. Four men are working the Church ground. They are working a 10-ft. bank that gives good prospects from top to bottom. This ground has not been prospected by drilling or sinking. The auriferous gravel covers a considerable area, and in places is known to be more than 30 ft. deep. There is water enough to keep one 2-in. machine running 16 hours.

Pearl, April 4.

CLEARWATER COUNTY

The Sprague Gold Placer Mining & Dredging Co., with a capital of $25,000, is working 180 acres of ground at Pierce, and during the past 14 months has made a net profit of $70,000. The coming season is expected to be a good one, as there is plenty of water available.

IDAHO COUNTY

(Special Correspondence.)—Hydraulic stripping to make lode-mining possible is the unusual treatment to which the Iron Crown mine, in the Newsome district, will be subjected by W. V. Garrett, and associates, of Spokane. The stripping of the property is not to be without its profit, a liberal panning of the surface in earlier years having disclosed the presence of much gravel that attracts the placer miner. It will be handled in the usual way, and operations are to begin as soon as the snow leaves. The property is equipped with a mill and other plant.

Newsome, March 28.

SHOSHONE COUNTY

(Special Correspondence.)—Elimination of overhead trolley systems will result in the Coeur d'Alene if experiments with storage-battery motors, being conducted in the Bunker Hill, prove practicable in the movement of large tonnages. A number of mine accidents are attributed to low-hung trolley wires. Electricians and master machanics in the Coeur d'Alene region are watching the experiments with interest, and should they prove successful, other companies using electric power will adopt the new system.

Wallace, March 28.

The overlapping of claims covering three acres is the cause of another lawsuit between the Stewart Mining Co., controlled by F. A. Heinze, and the Bunker Hill & Sullivan M. & C. Co. The Tuscumbia property, in the Sunset district, has been bonded to New York people. It is said that 4 ft. of ore assaying 7% copper has been cut in the Black Traveler, about five miles from Saltese. The Blue Bell adit, at Big creek, is in 2200 ft., and about 50 ft. more driving should cut the vein outcropping at the surface. The Yankee Boy, nearby, is worked by lessees, who employ 25 men, and are mining rich ore. The Stewart mine is employing 250 men, and produces 500 tons of ore for the mill daily, and 120 tons of ore per week for the smelter at Tooele, Utah, and makes a net profit of about $55,000 per month. The court has decided that the Stewart company must pay $10,000 to the widow of L. Chiara, who was killed on an ore-train employed by the company. Another case, involving $15,000 damages, is being defended against D. Barter.

According to Sidney Norman, who is representing the Federal Mining & Smelting Co. in its fight against the American Smelting & Refining Co., recent investments in new mines and their development will total about $1,000,000. The company's president, H. Day, draws $15,000 per year and $350 monthly expenses, while the chairman of directors, F. H. Brownell, draws $12,000 and expenses.

MONTANA

SILVERBOW COUNTY

The output of the various producing companies for March of the Butte mines is reported as follows:

	Ore, tons.	Copper, lb. per ton.	Total lb.
Boston & Montana group	98,800	65	6,422,000
Anaconda group	130,000	61	7,930,000
Butte & Boston	11,110	62	688,200
Washoe	6,900	61	420,900
Parrot	2,800	60	168,000
Trenton	11,220	61	684,420
North Butte	28,320	68	1,925,760
Butte Coalition	32,600	70	2,282,000
East Butte	10,620	110	1,168,200
Tuolumne	6,000	120	720,000
Original	9,110	60	546,600
Alex Scott	6,700	110	737,000
Davis-Daly	1,700	110	187,000
Total	355,870		23,880,080

NEVADA

CHURCHILL COUNTY

Shortage of water interfered with operations at the Nevada Hills property in February, and only 1527 tons of

ore was treated, yielding $20,744. Costs were $21,577, and the total loss was $1153. Mill recovery was 20.6% by concentration and 66.3% by cyanidation, and costs were: mining, $7.85 per ton; milling, $3.79; marketing, 61c.; taxes, and general expenses, $1.70 per ton.

ELKO COUNTY

(Special Correspondence.)—The most important deal in the history of the camp of Jarbidge was consummated this week, when J. A. Jess, representing the Potter Palmer estate, of Chicago, purchased control of the stock of the Buster Consolidated Gold Mining Co. The plans of the new owners are not fully matured, but it is definitely decided that a large mill, in which to treat the Buster ores, will be erected. The Buster is one of the best developed of the Jarbidge mines, and though it has no high-grade ore, such as was recently uncovered on the Flaxies, a big tonnage of free-milling ore averaging between $15 and $30 per ton, with occasional lenses that will yield about $100 per ton, is reported. This is not the first investment of the Palmer estate in Jarbidge, as it owns the Alpha mine, which it purchased for $50,000 cash some weeks ago.

Jarbidge, April 5.

ESMERALDA COUNTY

The preliminary estimate of March production of the Goldfield Consolidated is 30,100 tons of ore yielding $650,000, at a cost of $185,000, leaving a profit of $465,000.

STOREY COUNTY

The Truckee River General Electric Co. has served a notice upon the United Comstock Pumping Association, stating that if the sum of $15,000 is not paid by May 1, power will be cut off from the mines. The feeling in Virginia City is that this action is unreasonable, as the Comstock mines helped to finance the power scheme and have been an important source of income to the power company.

NEW MEXICO

EDDY COUNTY

(Special Correspondence.)—The Dayton Oil Co. (a Doheny subsidiary) is now operating its standard rig on the Cass-Hammond lease, making approximately 100 ft. per day. R. T. Coovert is in charge, coming here from the Bakersfield field. This is the first company to begin deep operations here. The Pecos Valley Oil & Gas Co. is working with standard rig (rotary) on the Martin lease, expecting to go to the deep pool. This company owns the Brown well, which is pumping from 35 to 75 bbl. per day, the oil selling at the well at $1.25 per barrel, and is in good demand. It is a good fuel oil, of gravity 30. The same company is developing the Everest well, having packed off the water flow. No information is given out, but it is expected this well will come in a better producer than the Brown. William M. Belt has perfected arrangements to pack off the water and bring in a good pumper at his well. This well, with a flow of 600 gal. of water per minute, is producing 2 bbl. per day of a high-grade lubricating oil, selling at the well for 5c. per gallon. The Noah Oil & Gas Co. has ordered its standard rig from Tulsa, Oklahoma, and will begin drilling on a school section near the Belt well, as soon as equipment can be placed.

Artesia, March 29.

GRANT COUNTY

The March production of Chino was 4,587,509 lb. of copper, making a total of 11,658,065 lb. for the first quarter of 1913.

OREGON

JACKSON COUNTY

The Sterling Gold Quartz M. & M. Co. will hold an adjourned stockholders' meeting April 13 to consider financing of the company. At the regular meeting in March it was resolved to ask the stockholders to submit to a voluntary assessment to raise funds for patenting the ground and working the property.

UTAH

BEAVER COUNTY

The Newton mining district, which extends along the range from North to Indian creek, is attracting attention. Electric power is to be used at the Sheep Rock property, and transmission poles are being erected. An electric hoist and drills will be installed. The 5-stamp mill, with plates and tables, is treating 12 tons of $20 to $40 ore per day. J. Robinson is in charge. The Beaver Butte, about a mile distant, is being prospected. The Oak Leaf shaft is to be sunk from 150 to 250-ft. depth. Other properties will be opened in a short time.

SALT LAKE COUNTY

A preliminary statement covering operations of the Utah Consolidated Co. for 1912 shows that the main shaft is down to No. 12 level, and development at that depth has only recently begun, while considerable diamond-drill work is under way. While the grade of the copper ore has continued to decline with depth, it is intended to sink another 100 ft. The lead ore opened occurs in more or less irregular deposits, but it is of good grade, and present shipments total 200 tons per day. The mine produced more lead than copper in 1912, this being partly due to the strike and subsequent period. The year's output was 6,506,814 lb. copper, 8,734,398 lb. lead, 230,004 oz. silver, and 14,042 oz. of gold, net earnings being $603,923.

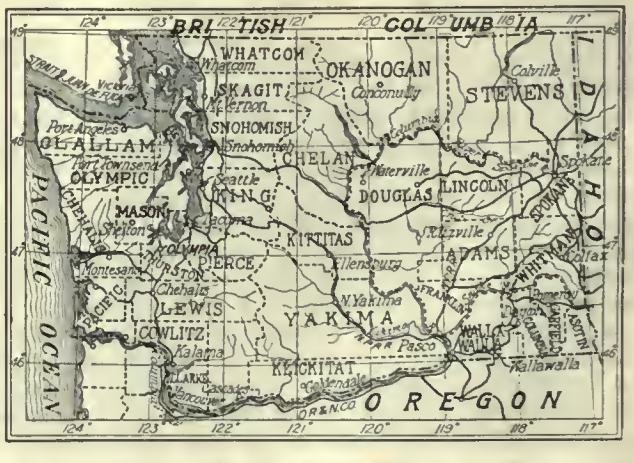
The annual report of the United States Smelting, Refining & Mining Co. states that the Bingham mines produced 57,106 tons of lead and 186,165 tons of copper ores, production being affected by the strike, while the Centennial-Eureka mine yielded 117,950 tons. The smelter at Midvale, Utah, and custom and Mexican ores, produced a total of 21,152,620 lb. copper, 56,385,769 lb. lead, 12,059,829 oz. silver, and 140,183 oz. of gold. The year's profit was $4,232,965, and $2,589,882 was paid in dividends.

The February copper production of the Utah Copper Co. was 7,819,900 lb., against 7,560,521 lb. in January and 8,612,729 lb. in February of 1912.

WASHINGTON

STEVENS COUNTY

The Hecla Copper-Silver Mining & Milling Co. has been organized with a capital of $1,000,000, to develop six claims south of the United Copper and near the Blue Star, 3½ miles northeast of Chewelah. Four veins have been discovered, the main one being from 6 to 14 ft. wide, and



MAP OF WASHINGTON.

trenches and shallow shafts sample 5.4% copper, $1 in gold, and $1.80 per ton in silver. An adit will be driven on the vein. There is plenty of water and timber, and a good millsite available.

Electric power will be delivered to the Chewelah district during the coming season.

CANADA

BRITISH COLUMBIA

During the past 10 days of March the Granby smelter at Grand Forks treated 35,005 tons of ore, and produced 717,000 lb. of copper, making a total of 308,077 tons of ore, and 5,588,245 lb. of copper for the first quarter of the current year.

ONTARIO

(Special Correspondence.)—According to W. C. Crowther, of New York, who has spent about six months in the Porcupine district, a vein of pitchblende has been discovered near the shore of Lake Mechemanda, and by analysis shows a greater percentage of radium and allied metals than the Austrian and Cornish mines, which produce practically all the present supply.

Ottawa, April 1.

A new vein has been cut on the 600-ft. level of the Pearl Lake mine, at Porcupine, assaying $17 per ton in gold, and is the third vein opened on this level. No. 3 level of the McIntyre has cut two veins which had been opened on the upper levels. A diamond-drill is at work at the Dome mine. Experiments with concentrating and cyaniding are being tried at the McEnaney mill.

The annual meeting of the Hollinger Gold Mines, Ltd., was held in Montreal last week. Ore reserves are estimated as 644,540 tons, worth $11,271,400, and development covered 5201 ft. Ore is assured to a depth of 300 ft., and there are 34 veins upon which no work other than sampling outcrops has been done. Ore from the mine and dumps totaled 45,195 tons, yielding $933,681, of which net profit was $600,664. Dividends absorbed $270,000, and $351,802 was carried forward. Costs in February were $5.97 per ton. The strike cost the company $100,000.

JAPAN

The Echigo oilfields are developing rapidly. Introduction of California rotary drills by the Nippon Oil Co. has resulted in successful completion of a number of good wells. At present there are in the field about 500 wells, most of which are small and shallow. The newer wells yield 50 to 500 bbl. per day of 42° to 43° oil. This commands a high price locally, and the industry is flourishing. Within the last year, a new oilfield has been brought in on the northwestern coast of Hondo. The oil is of low grade, but suitable for use as fuel. The full importance of the field has not yet been determined.

MEXICO

During February, development in the mines of Esperanza, Ltd., at El Oro, covered 906 ft., and drifts on the San Carlos vein advanced 235 ft., the average width being 5 ft., assaying 1.75 oz. gold per ton, while the raises advanced 160 ft., showing 5 ft. of 2.25 oz. ore. The mill worked 26 days, crushing 4522 tons of ore and treating 10,065 tons of tailing, while 273 tons of concentrate was shipped to the smelter. The total yield was $96,640. Total expenses were $72,412, and profit $24,228.

AUSTRALIA

WESTERN AUSTRALIA

(Special Correspondence.)—The Hainault mine and mill is shut down pending amalgamation with the South Kalgurli, when in all probability the ore will be treated in the latter's dry-crushing and roasting plant. The various labor unions decided by a large majority to settle their differences with the Chamber of Mines by arbitration. The new university is still being organized. The Victorious mine, of the Associated Northern company, at Ora Banda, is attracting a lot of attention. In January the Huntington mill plant treated 9600 tons of ore, yielding $60,000. Mining costs were $1, milling $1.10, general expenses 19c., development 45c., and the profit was $34,000. Salt water used in the mill gave trouble with the filter-cloths, but this was overcome by adding make-up water at the circulating-solution tank, instead of just prior to filtering. Great hopes are built on the volatilization process at the Gwalia Consolidated, described in this journal of March 29. The complex ore from the Transvaal mine, Southern Cross, is being experimented on at Broken Hill. This ore contains arsenical pyrite and graphite, and about $14 per ton in gold. It is stated that the Murex process at the Whim Creek copper mine is a failure, and the recently appointed metallurgist returned to Kalgoorlie. The Queen of the Hills mill should soon be in operation.

Kalgoorlie, February 15.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

T. J. GRIER is in San Francisco.

W. M. BREWER is back in Victoria.

C. S. HALEY has gone to Siskiyou county.

S. H. BALL was in San Francisco this week.

DESAIX B. MYERS has gone to Calaveras county.

RALPH ARNOLD has gone to Venezuela again.

L. S. AUSTIN is at Georgetown, British Guiana.

FRANCIS P. BAAY left London for Melbourne, April 4.

CARR B. NEAL has returned to New York from Arizona.

E. NORRIS HOBART is now engineer at the Tiro General.

JOHN MOCINE is general manager for the Goldfield merger.

P. H. ARGALL has been elected Mayor of Victor, Colorado.

SIDNEY NORMAN has returned to New York from Spokane.

LIONEL HILL has gone to London from British Columbia.

EMILE HUGUENIN has returned to San Francisco from Venezuela.

J. D. HUBBARD has been looking at placer properties in Butte county.

R. A. JOHNSTON, of the Canadian Geological Survey, is visiting California.

C. H. MUNRO, who has been in Peru, was expected in New York this week.

L. H. METZOAR is underground superintendent for the Goldfield Consolidated.

J. J. COLLINS has gone to Northern Nigeria for the Naraguta Extended, Limited.

F. A. BRISTOL died at Banning, California, March 28, after a year of failing health.

G. F. BECKER has been nominated for president of the Geological Society of America.

LOUIS A. WRIGHT married Miss ELLA WARD BIRDSALL at Newburgh, New York, April 2.

V. C. BARNELT will leave New York for a month's vacation in England the first of May.

A. J. CHAPPLE has been appointed metallurgist to the Mt. Boppy Gold Mining Co., New South Wales.

A. C. LAWSON has been at Nevada City with a party of advanced students from the University of California.

JOHN I. KANE has been transferred from the Tiro General at Charcas to the general staff of the A. S. & R. Co. at Mexico City.

H. KENYON BURCH, chief engineer for the Inspiration Con., is making a tour of the southwest and will spend a few days in Los Angeles before returning to Miami.

E. J. DUNN, formerly director of the Geological Survey of Victoria, has been appointed consulting geologist to the Clunes Goldfields, Ltd., an English company operating in Victoria.

JOHN G. KIRCHEN is president, and ALBERT BURCH and FRED SIEBERT vice-presidents, of the Nevada Mine Owners Association. W. B. ALEXANDER is secretary and will devote his whole time to the work.

S. H. BROCKUNIER, superintendent for the Pennsylvania G. M. Co., Westville, California, who has been seriously ill with pneumonia for several months, is now convalescent at his home in Nevada City.

N. H. LAWRIE, W. C. FELLOWS, T. S. MANN, J. F. REDDY, and C. T. PRALL have been appointed by the Governor of Oregon on the board of managers of the newly created State Bureau of Geology and Mines.

JAMES HEBARD, of the Central mine, Broken Hill, has been appointed president of the Australasian Institute of Mining Engineers, which body will hold its annual meeting at Broken Hill commencing May 26.

S. F. SHAW is back at Charcas and work has been resumed, though with a reduced force. Mr. Shaw and his British and American associates have received the thanks of the State Department at Washington for taking a locomotive and cars and rescuing 15 people penned in a church at Charcas by rebels, and protected by a priest.

Market Reports

LOCAL METAL PRICES

San Francisco, April 10.

Antimony	12—12¾c	Quicksilver (flask)	41
Electrolytic Copper	15¾—16c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, April 10.—The copper market has been active this week with large buying here and in Europe. Prices have accordingly been firm. Lead still remains unchanged. Spelter is under pressure on account of producers forcing metal on the market and prices have been weak. Average daily prices for the past week in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Silver, per oz.	Electrolytic Copper.	Lead.	Spelter. St. Louis
April 3	58⅜	15 10	4.30	5.65
" 4	58	15.12	4.30	5.63
" 5	58¼	15.15	4.30	5.60
" 6	Sunday.	No market.		
" 7	59	15.18	4.30	5.60
" 8	59	15.23	4.30	5.60
" 9	59	15.25	4.30	5.60

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	April 10.
Camp Bird Ltd	$ 4⅛
El Oro	3⅞
Esperanza	6⅞
Oroville Dredging	1⅛
Santa Gertrudis	6⅜
Tomboy	6¼

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. April 10.		Closing Prices. April 10.
Adventure	$ 2	Mohawk	$ 53½
Allouez	36¾	North Butte	30½
Calumet & Arizona	67	Old Dominion	50
Calumet & Hecla	481	Osceola	92½
Centennial	15½	Quincy	70
Copper Range	45	Shannon	11
East Butte	12¾	Superior & Boston	3½
Franklin	6⅜	Tamarack	32
Granby	62½	U. S. Smelting	41½
Greene Cananea	7¾	Utah Con.	9
Hancock	21¾	Victoria	1
Isle-Royale	26¾	Winona	2½
Mass Copper	4½	Wolverine	61

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 10.

Atlanta	$ .16	Mizpah Extension	$ .73
Belmont	6.40	Montana-Tonopah	1.85
Big Four	.85	Nevada Hills	1.00
Buckhorn	1.00	North Star	.38
Con. Virginia	.17	Ophir	.26
Florence	.50	Pittsburg Silver Peak	.50
Goldfield Con	2.40	Round Mountain	.51
Halifax	1.10	Sierra Nevada	.33
Jim Butler	1.22	Tonopah Extension	2.50
Jumbo Extension	.25	Tonopah Merger	1.07
MacNamara	.22	Tonopah of Nevada	5.72
Manhattan Consolidated	.10	Union	.14
Mexican	.77	West End	1.30
Midway	.55	Yellow Jacket	.22

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. April 10.		Closing Prices. April 10.
Alaska Mexican	$12⅛	McKinley-Darragh	$ 2
Alaska Treadwell	41⅛	Miami Copper	25¼
Alaska United	23	Mines Co. of America	3
Amalgamated Copper	78⅛	Nevada Con.	18
A. S. & R. Co.	72	Nipissing	9
Braden Copper	9	Ohio Copper	⅞
B. C. Copper Co.	3⅛	Ray Con.	19⅞
Chino	42⅛	Tenn. Copper	36
First National	2½	Tonopah Belmont	6½
Giroux	3	Tonopah Ex.	2⅜
Goldfield Con.	2½	Tonopah Mining	5⅜
Greene-Cananea	7⅞	Trinity	4½
Hollinger	17	Tuolumne Copper	2⅜
Inspiration	18½	Utah Copper	54⅜
Kerr Lake	3½	West End	1⅛
La Rose	2⅜	Yukon Gold	2¾
Mason Valley	7½		

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, April 9.	Unlisted.	Closing prices, April 9.
Associated Oil 5s	100½	Natomas Dev. 6s	99
E. I. du Pont 4½s	93½	Pac. Port. Cem. 6s	99
Natomas Con. 6s	94¾	Riverside Cem. 6s	77
Unlisted.		Standard Cem. 6s	92
Associated Oil 1st ref.	85	Santa Cruz Cem. 6s	84
General Petroleum 6s	64¾	So. Cal. Cement	80

STOCKS.

Listed.	Closing prices, April 9.	Unlisted.	Closing prices, April 9.
Associated Oil	43⅞	Mascot Copper	2½
Amalgamated Oil	88	Noble Electric Steel	15
E.I. du Pont Powder pfd.	90	Natomas Consolidated	13
Pac. Coast Borax, pfd.	100½	Pac. Coast Borax, old.	206
do com.	80	Pac. Portland Cement.	60
Pac. Crude Oil	40c.	Riverside Cement	50
Sterling O. & D.	1.05	Standard Cement	17
Union Oil of Cal.	91½	Standard Oil of Cal.	187½
West Coast Oil, pfd.	70	Santa Cruz Cement	42

Copper Producers' Association Report

The Copper Producers' Association statement, April 8, shows a decreased surplus. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, March 1, 1913	122,302,198
Production of marketable copper in the United States from all domestic and foreign sources during March	136,251,849
Deliveries for consumption, March	76,585,471
Deliveries for export, March	77,699,306
Stock of marketable copper of all kinds on hand and at all points in the U. S., April 1	104,269,270

Recent changes in surplus have been as follows, in pounds:

	Increase.	Decrease.
March 1912	.....	572,431
April	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....
October	13,679,380	.....
November	9,419,095	.....
December	19,148,523	.....
January 1913	17,885,770	.....
February	.....	896,134
March	.....	18,032,928

JAMES LEWIS & SON'S REPORT

European copper stocks on March 17 were as follows:

	Tons fine.
Chilean in—	
Liverpool and Swansea	3,627
France	560
American in—	
Liverpool and Swansea	1,930
France	2,409
Sundries in—	
Liverpool and Swansea	972
London and Newcastle	3,095
Birmingham	104
France	888
English in—	
Liverpool and South Wales	13,277
Total in England and France	26,862
Sundries in Germany and Holland	9,502
Total European stocks	36,364
Afloat as advised—	
From Chile to Europe	2,775
From Australia	4,500
Total visible supply	43,639

Company Reports

MYSORE GOLD MINING COMPANY, LTD.

The results of this great concern, which has produced $58,700,000 and paid over $33,500,000 in dividends, during the year 1912 may be summarized as follows:

Ore reserves, tons	1,337,990
Ore treated, tons	299,660
Tailing treated, tons	247,340
Slime treated, tons	7,476
Gold produced, 232,738 oz., worth	$4,339,200
Mining and treatment costs	1,396,000
Profit	2,467,000
Dividends paid	1,830,200
Capital expenditure and depreciation	364,000
Reserve fund total	600,000
Carried forward	180,300

MT. BISCHOFF TIN MINING COMPANY

This company's property is situated at Waratah, and smelting works at Launceston, and is the leading tin producer in Australia. The capital of the company is 12,000 shares, with a total of $142,000, and dividends to date total $10,944,000. Ore is mined principally by open-cut, hydro-electric power is available, and the smelter treats custom ore. Results for the last half of 1912 were as follows:

Ore reserves, tons	3,000,000
Ore treated, tons	117,328
Tin concentrate produced, tons	600
Smelter work:	
Concentrate smelted, tons	2,065
Metallic tin produced, tons	1,448
Analysis of tin, per cent	99.88
Profit for half-year	$205,000
Dividends paid	190,000
Assets	275,000
Liabilities	14,000
Working costs:	
Mining, per ton	$0.66
Aerial ropeway, per ton	0.04
Milling and concentrating, per ton	0.28
Prospecting and development, per ton	0.06
Electric power, per ton	0.01
Surveys, assays, water system, per ton	0.03
Administration, per ton	0.04
Total	$1.12

McKINLEY-DARRAGH-SAVAGE MINES OF COBALT, LTD.

During 1912 mining operations in the McKinley section covered 5336 ft. On the 150-ft. level, No. 2 Swamp vein yielded the highest grade of ore ever mined by the company, but most of it has been stoped out. An extension of the vein is being stoped on the 200-ft. level. The Lake, No. 6, and No. 20, on the 150, 110, and 150-ft. levels, respectively, produced rich ore. Small branches of the Blind vein were developed on the 200 and 250-ft. levels. No. 3 Swamp and No. 14 veins have added considerably to the existing reserves. The Princess vein, situated in the southwestern part of the property, does not appear likely to produce much ore. Ore mined totaled 52,040 tons, and rock 14,292 tons, while 52,482 tons was milled. Reserves are estimated as 100,400 tons, containing 4,133,500 oz. of silver. Development to date has covered 25,402 feet.

In the Savage section, No. 2 vein has been opened on the 245-ft. level, proving short lenses of ore, although above this level is a considerable tonnage. An extension of No. 4 vein on the 140-ft. level yielded some high-grade ore. No. 14 vein is small, but carries rich ore, while No. 12 is also small, carrying fair silica content on the 190-ft. level. A large amount of development work is under way. The aerial tramway connecting the Savage with the McKinley mill of 10 stamps was completed, and 20 stamps and one tube-mill are being added to deal with the Savage ore, when the Savage sorting plant will be shut down. The mine produced 17,990 tons of ore and 14,804 tons of rock, and 17,888 tons of ore was milled. Reserves are estimated as 52,400 tons, containing 1,235,000 oz. of silver. Development to date has covered 9375 ft. The year's results from the whole property may be tabulated as follows:

Ore treated, tons	70,370
Silver produced, ounces	2,717,383
Production to date, ounces	10,770,176
Net profit	$1,141,753
Dividends paid	674,307
Current assets, including cash, ore at smelters, supplies	947,238
Current liabilities, including dividend paid January 1, 1913	482,521
Surplus	422,326

NORTH STAR MINES COMPANY

This well known property is situated at Grass Valley, Nevada county, California, and mining operations are being conducted at a depth of 5300 ft. on the incline. The past year's tonnage of ore was derived from stopes above the 3000, 3400, 3700, and 4000-ft. levels, and development covered 4601 ft., the 5000 and 5300-ft. levels opening a considerable body of fair-grade ore. Generally speaking, the mine is in its usual condition, and at the present scale of operations will last for several years. Prospecting work covered 2088 ft. in the Cincinnati property, but with little encouragement, so work was stopped in August, after an expenditure of $91,355 since 1910, the mine only yielding 650 tons of ore worth $3653. The company advanced $2000, making $74,500, to the Middle Yuba Hydro-Electric Power Co., which is now practically self-supporting. The Champion mines at Nevada City are held under option, and during 1912 development covered 8500 ft. The Ural and Meinfield veins were opened on the 1000 and 2400, and 1600-ft. levels, respectively. The prospective value of the property is sufficient to justify its acquisition, and it will be bought before July 1913. In 1911 and 1912 a total of $369,334 was spent on the Champion, in development and on account of purchase price. The 20-stamp mill was repaired and ran on a test of ore from the 1800 and 1600-ft. levels, the average value being $8.80 per ton. A cyanide plant is being erected at the mill. The results of the past year's work may be summarized as follows:

Ore treated from North Star mine, tons	101,181
Total production	$1,038,372
Average per ton	10.26
Production from Cincinnati and Champion mines	34,002
Ore production from North Star properties since 1884, tons	1,035,194
Total value	$14,045,092
Operating expenses in 1912 at North Star mine	558,892
Expenditure on other properties	262,078
Dividends paid	300,000
Dividends paid to date	3,786,989
Cash and investment account	907,305

CALUMET & ARIZONA MINING COMPANY

The annual report of this company states that development work covered 25,787 ft., including 441 ft. of diamond-drilling. In the Irish Mag section of the mine, cross-cuts driven on the 850 and 950-ft. levels to the oxidized ore-body found last year opened no ore. Cross-cuts driven on the 950 and 1050-ft. levels in the east corner of the claim disclosed considerable oxidized ore. A small shoot of sulphide ore was opened east of the shaft, on the 1250-ft. level. In the Oliver section, north of the shaft, work was abandoned on the 950-ft. level. Low-grade oxidized ore was mined between the 950 and 1050-ft. levels of the Senator claim, while other work on the 1150, 1250, and 1450-ft. levels proved no extension. Considerable sulphide ore was opened on the 1250 and 1350-ft. levels, near the west end of the Senator. Work on the Buckeye claim was not profitable, excepting good extensions of sulphide ore on the 1350 and 1450-ft. levels. During July 1912 the Courtland mines

were reopened, and 785 ft. of development was done, while shipments of ore have averaged 600 tons per week. Reserves in these claims amount to 23,000 tons of 5% copper ore. The future is doubtful. In the Ajo district, Pima county, Arizona, considerable work was done on a number of the New Cornelia Copper Co.'s claims. Two fractional claims were purchased, and options taken on 19 others. The carbonate ores will require special treatment, which is now being investigated. An option was taken on the Daggs-Newman group in the Pioneer district, Pinal county, also on 26 other claims. An adit will be driven 600 ft., and a shaft sunk 600 ft., before any results are expected.

Regarding surface equipment, there was no change at the old smelter. Good progress was made with the new plant, which should be ready for operation in August 1913. The report gives a fairly complete description of this smelter, which will include a sampling mill and crushing plant, bedding system for ores, roasting, blast-furnace, reverberatory, and converter plants, chimney and flue connections, and power-plant improvements. The year's results were as follows:

Ore mined, tons	179,788
Ore smelted, tons	159,513
Fluxing ore smelted, tons	17,054
Copper content of ore, per cent	5.07
Copper recovered, per cent	4.60
Copper content of fluxing ore, per cent	1.23
Copper recovered, pounds	16,490,229
Silver yield, ounces	233,092
Gold yield, ounces	9,066
Value of production	$2,897,024
Expenses of production	1,734,926
Profit	1,190,376
*Income from other sources	1,742,342
Dividends paid	2,542,781
Cash, supplies, ore, and bullion, value	1,215,660

*Interest in Superior & Pittsburg Copper Company.

BROKEN HILL SOUTH SILVER MINING CO., N. L.

The report of this company for the half-year ended December 31, 1912, may be tabulated as follows:

Men employed: surface, 362; underground, 804; total	1,166
Development of mine, including diamond-drilling, feet	5,182
Filling delivered to stopes, cubic yards	58,571
Ore reserves, tons	3,250,000
Ore mined, tons	178,547
Average metal contents:	
Lead, per cent	13.7
Zinc, per cent	13.8
Silver, ounces	6.4
Ore treated, tons	180,080
Concentrate produced, tons	27,238
Metal contents:	
Lead, tons	18,755
Zinc, tons	1,695
Silver, ounces	617,679
Zincy tailing produced, tons	128,446
Zinc content, per cent	15.8
Old tailing sold to Zinc Corporation and Amalgamated Zinc companies' flotation plants, tons	182,833
Zinc content, per cent	.17
Products on hand, tailing, and slime, tons	1,368,670
Costs per ton:	
Mining and filling stopes	$3.20
Development	0.56
Concentrating	0.86
Total	$4.62
Water consumption, gallons	33,019,000
Value of mine production	$1,560,000
Value of tailing sold	370,000
Total costs	830,000
Dividends	820,000

During the year, No. 1, 4, and 5 shafts were sunk to 1164, 1137, and 378 ft., respectively. The 725, 970, and 1070-ft. levels contributed 89% of the ore mined. Development on the 1170-ft. level covered 359 ft., making 489 ft. from No. 2 shaft. At 285 ft. south of the shaft ore was cut and driven on for 85 ft., assaying 11.7% lead, 8.6% zinc, and 3.3 oz. silver, followed by 40 ft. of 7.8% lead, 7.5% zinc, and 2.7 oz. silver ore, then 79 ft. of ore assaying 14.6% lead, 12.6% zinc, and 3.6 oz. silver, the present face being in similar ore. Metal recoveries were: from concentrating, 76% lead, 6.8% zinc, and 53.8% silver; and from zincy tailing, 15.7% lead, 82.2% zinc, and 34.9% silver; making a total of 88.7% lead, 89% zinc, and 88.7% silver. The report is accompanied by interesting surface and underground plans.

PHELPS, DODGE & COMPANY

The authorized capital stock of this important company is $50,000,000, of which $45,000,000 has been issued, and it controls operations of the Copper Queen Consolidated Mining Co., Moctezuma Copper Co., Detroit Copper Mining Company of Arizona, Burro Mountain Copper Co., the Stag Cañon Fuel Co., and the Phelps-Dodge Mercantile Co. The company also has large interests in the Old Dominion Co., Old Dominion Copper Mining & Smelting Co., United Globe Mines, Commercial Mining Co., and the El Paso & Southwestern railroad. As well as marketing the products of its own mines, the company acts as a selling agency for various other concerns.

The report of the president, James Douglas, for the year ended December 31, 1912, states that the term was one of normal operation. The total copper production from the various mines under direct control was 139,759,515 lb., which realized an average price of 15.51c. per pound, net cash in New York. Of the total quantity delivered, the domestic sales were 98,267,037 lb., and foreign sales 94,030,337 lb., of which 52,537,859 lb. was the product of other mines sold on commission. Four dividends of 2½% each, an extra one of 2%, and another of 3%, in all 15%, were paid during 1912, amounting to $6,750,000.

The general manager, Walter Douglas, stated that owing to the high price of copper during the last nine months of the year, the mines and plants were operated to full capacity. The costs per ton of ore and per pound of copper were higher in the Arizona porperties, by reason of higher wages and taxes. Ore mined from the various properties totaled 1,893,244 tons, of which 1,098,528 tons was concentrated and 794,716 tons smelted. The total amount of copper-bearing material smelted was 1,051,315 tons. In addition to this, there was produced 11,626 tons of lead ore from the Copper Queen, yielding 30,434 lb. copper, 2,953,685 lb. of lead, 326,962 oz. of silver, and 3889 oz. of gold. Of the total products smelted, 97,574 tons was purchased. Production was as follows:

	Copper, lb.	Silver, oz.	Gold, oz.
From companies' ores	140,628,798	1,104,510	16,002
From custom ores	8,050,091	584,642	11,685
Total output	148,678,889	1,689,152	27,687

The Stag Cañon Fuel Co. mined 1,383,562 tons of coal, of which 646,061 tons was consumed in the manufacture of 319,222 tons of coke.

The tonnage extracted from the Copper Queen mines was the greatest in their history, and, in view of this great tonnage, it was considered advisable to increase development work in order to maintain the ore reserves, so no less than 78,000 ft. of exploration was done. Three large mining properties were purchased by the Detroit company. Development in the West Yankie country continues to expose ore at a greater depth than was expected. Political disturbances in Mexico interfered with operations of the Moctezuma mine, the Nacozari railroad having to suspend service for 30 days. Development at the mine was satisfactory. On No. 5 level of the Burro Mountain mine, considerable low-grade ore has been opened. In August the Chemung Copper Co.'s property was purchased. Total gross sales of the mercantile company reached $6,321,411, on which a net profit of 9.21% was made. The balance-sheet of Phelps, Dodge & Co. shows cash and bills receivable, $6,133,550, and accounts payable, $5,257,683, and a surplus

of $6,163,561. Dividends received from subsidiary companies were $10,005,458, and other earnings were $406,077, while dividends paid amounted to $6,750,000, the balance being made up of expenses and taxes, $126,349, transferred to reserve against stock owned, $1,500,000, and to surplus account, $2,035,185.

Copper Queen Consolidated Mining Company

The report of Gerald Sherman, superintendent of the Copper Queen, states that mine development covered 78,135 ft., and great credit is due to A. Notman and the geological department of the company for efficient work. The amount of timber used in mining is being reduced by better methods, and top-slicing is being introduced. There are 8.3 miles of main haulage track, operated by electricity, in the mine, and the average number of miles trammed by electric locomotives was 2452 per car, against 626 by mules, and 210 by hand. The Sacramento was used as the main hoisting shaft, and a new man-hoist is being installed there. Slag shipments to Douglas totaled 64,480 tons.

The general manager, S. W. French, reported that shipments to Douglas were 669,399 tons of ore, and 75,179 tons of precipitate, slag, and lessees' ore; to El Paso, 11,626 tons of lessees' and company ore; and to Globe, 30,164 tons of sulphide ore; a total of 786,368 tons. The yield was 88,280,908 lb. of copper; 2,953,685 lb. of lead; 18,023 oz. of gold; and 1,027,130 oz. of silver. The reduction works treated 962,914 tons of Copper Queen, Moctezuma, and custom ores, yielding 123,876,100 lb. copper, 27,687 oz. gold, and 1,689,152 oz. silver. The stocks of ores and metal contents on hand at January 1, 1913, were: 100,716 tons of ore, 11,999,650 lb. copper, 232,211 oz. silver, and 3875 oz. gold.

The Hospital Department had an income of $90,054 from employees' fees, and other cases, and the expenditure was $81,102. The staff of physicians and surgeons numbers 10, with Dr. F. E. Shine as chief surgeon. The Employees' Benefit Association had an income of $71,708, and the expenditure was $48,864. Wages were increased during the year.

F. Rutherford, superintendent of the smelting department, states that the entire plant dealt with 1,151,949 tons of charge, of which 884,814 tons was smelting ore, 73,720 tons of silicious ore for the converters, and 193,415 tons of 'secondaries.' The blast-furnaces treated 1,095,861 tons of charge, and used 139,955 tons of coke, equal to 12.78% per ton of charge. The ash in the coke accounted for 45,765 tons of slag. Flue dust recovered was 64,662 tons, or 5.9% of the total charge. The cupola furnace produced 180,522 tons of matte, giving a matte-fall of 20.97%. The reverberatory plant was only operated since June, and treated 56,086 tons, producing 15,163 tons of matte, or 29.84%. Since April, the acid process of converting was gradually changed to the basic process, and now the Great Falls type is working satisfactorily. The converter plant treated 195,685 tons of matte, with 6.16 stands operating per day, producing 62,458 tons of bullion, or 27.77 tons per stand per day. The average for the large and small converters was 44.9 and 23.2 tons per day, respectively. During the year 6970 samples were made from 352,547 tons of ore, and 86,389 determinations were made in the laboratory. The reverberatories used 53,164 bbl. and the boiler plant 119,831 bbl. of California oil. The cost of power was $55.12, that used by the smelter being $58.92, and from the turbo-generator $38.26 per horse-power. Net earnings of the Copper Queen in 1912 were $6,977,378, and $5,707,351 was paid in dividends.

Detroit Copper Mining Company of Arizona

The general manager of this company, A. T. Thomson, reported that the mines at Morenci yielded 519,632 tons of ore, producing 24,802,789 lb. of bullion. The increase in wages added 10c. per ton to the cost of mining, and the reduction of working hours from 8 to 7½ per shift cut the quantity mined from 3.95 to 3.68 tons per man. By better mining methods the consumption of timber has been decreased. The mill produced 70,438 tons of 16.69% copper concentrate, from 501,928 tons of 3.08% copper ore, extraction being 77.06%. The number of men employed was 1414.

The report of M. H. McLean, mine superintendent, shows that 10 classes of ores were mined for the concentrator and smelting plant, totaling 519,632 tons. A fire in the Yankie mine caused a reduction in output of that property. Reserves on No. 6 and 7 levels are 194,939 tons of 2.36% ore. Ellis W. Honeyman, smelter superintendent, reported that 160,649 tons of charge was smelted, using 18,450 tons of coke, and the metallurgical saving was 93.86%. The Detroit company's net earnings were $1,406,170, and dividends paid were $1,464,610.

Moctezuma Copper Company

In the general manager's report by J. S. Williams, Jr., it is stated that development and mining at the mines at Nacozari, Sonora, covered 31,431 ft. On the 800-ft. level of the Guadalupe an orebody of large size was developed, and contains high-grade ore. On the 800, 900, and 1000-ft. levels from the Martinez shaft, fair ore has been opened. The total ore opened during 1912 was 460,000 tons, and broken ore in reserve is 331,518 tons. The Geological Department proved of great benefit. The concentrator treated 596,000 tons of ore assaying 3.49% copper, and produced 131,062 tons of concentrate worth 13.37% copper, the saving being 85.95%. Milling practice was without change, but new classifiers, vanner feed distributors, and Deister tables will be installed. Net earnings of the Moctezuma company were $2,735,061, and dividends amounted to $2,118,569.

AMERICAN SMELTING & REFINING COMPANY

The business of this company during the year ended December 31, 1912, was satisfactory in all departments. Political disturbances in Mexico interfered with traffic between the mines and smelters in that country, but through various economies effected, and higher prices for the smelter products, the gross profit was $1,647,374 greater than the previous year. The sum of $367,823 was appropriated from the year's earnings, and partly distributed among the company's employees, the balance being added to the pension fund, which is now $500,000. In spite of many unusual charges, and increased amounts written off from the book value of investment securities, depreciation, and amortization of property, the net income is $508,173 greater than for 1911. Regular quarterly dividends were paid on the preferred and common stocks, and the surplus, after these payments, was increased by $3,059,676. There was spent during the year the sum of $2,447,300 on repairs and replacements at the plants; also $3,113,338 at refining and smelting plants and mining properties. Further heavy expenditure will be made during 1913. The total book value of all securities now owned is $1,010,538. The pension fund of $500,000 is to be devoted to caring for all men employees over 65 years of age, and women over 60 years, who have been continuously employed by the company for 20 years. No pension will exceed $200, nor be less than $20 per month, subject to exceptions recommended by the Pension Board.

A summary of the consolidated income of the American Smelting & Refining Co., and the American Smelters Securities Co., is as follows, fractions being omitted:

	Year ended Dec. 31, 1911	Year ended Dec. 31, 1912
Net earnings of smelting and refining plants, etc.:		
Amounts before deducting repairs and replacements	$14,045,334	$15,016,135
Less repairs and replacements	1,944,573	2,447,300
Remainder	$12,100,761	$12,568,835
Net earnings from mining properties	2,000,186	3,113,104
Total net earnings of operating properties	$14,100,947	$15,681,939
Other income—net:		
Interest, rents, dividends received, commissions, etc.	1,011,177	1,077,559
Gross income	$15,112,125	$16,759,499

Charges against gross income:		
Administrative expenses	767,982	758,176
Research and examination expenses	.....	159,618
Corporate and excise taxes	114,198	123,917
Interest and discount on debenture bonds	870,833	950,000
Depreciation and amortization	1,887,399	3,013,543
Appropriations for employees' bonuses and to pension reserve	.....	367,822
Book value of investment securities written down	900,210	306,745
Total charges	4,540,622	5,679,823
Net income for the year	$10,571,502	$11,079,675
Profit and loss surplus at beginning of the year	11,148,223	13,699,726
Profit and loss gross surplus	$21,719,726	$24,779,402
Less dividends on preferred stocks:		
American Smelting & Refining Co.	3,500,000	3,500,000
American Smelters Securities Co. preferred "A"	1,020,000	1,020,000
American Smelters Securities Co. preferred "B"	1,500,000	1,500,000
Total on preferred stock	$6,020,000	$6,020,000
On American Smelting & Refining Co. common stock	2,000,000	2,000,000
Total dividends	$8,020,000	$8,020,000
Profit and loss surplus	$13,699,726	$16,759,402
Assets are as under:		
Property account:	Dec. 31, 1911	Dec. 31, 1912
Net cost of plants and properties	$139,963,733	$140,063,528
Investments in other companies	1,585,670	1,010,537
Metal stocks:		
Ore, bullion, products on hand and in transit	32,473,186	36,141,013
Less unearned treatment charges	5,980,205	6,479,994
Net value	$ 26,492,981	$ 29,661,019
Working assets:		
Material and supplies	$ 2,566,872	$ 2,783,114
Prepaid taxes and other accounts	400,149	327,184
Total working assets	$ 2,967,021	$ 3,110,298
Current assets:		
Cash on hand and in transit	$ 5,890,707	$ 3,809,373
Demand loans	3,192,050	5,935,874
Advances to affiliated companies	333,705	349,744
Accounts receivable	4,236,518	4,387,563
Total current assets	$ 13,652,980	$ 14,482,554
Cash and securities in funds	232,555	229,601
Unextinguished discounts on bonds	704,166	654,166
Total assets	$185,599,108	$189,211,705
Liabilities are as under:		
	Dec. 31, 1911	Dec. 31, 1912
Preferred capital stock:		
Amer. Smelting & Refining Co.	$ 50,000,000	$ 50,000,000
Amer. Smelters Securities Co.	47,000,000	47,000,000
Common stock:		
Amer. Smelting & Refining Co.	50,000,000	50,000,000
Net debenture bonds	15,000,000	14,495,000
Current liabilities:		
Accounts, drafts, wages payable	5,165,065	6,773,297
Deferred payments, interest, etc.	3.645,045	3,014,790
Total current liabilities	$ 8,810,110	$ 9,788,087
Reserve and suspended accounts	1,089,271	1,169,215
Profit and loss surplus	13,699,726	16,759,402
Total	$185,599,108	$189,211,705

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

OIL AND GAS LEASE—VOID ASSIGNMENT

Where a bona fide assignee of an oil and gas lease, with the consent of the lessors, surrenders the lease to them, a person claiming to own the lease under an earlier assignment without any evidence to support it except a void record, cannot prevent the lessors from making a new lease to other parties by inducing them, through false representations, to accept rentals under the original lease.

Midland Gas Co. *v.* Jefferson County Gas Co. (Pennsylvania), 85 Atlantic, 853. Nov. 7, 1912.

OIL AND GAS LEASE—CONSTRUCTION

An oil and gas lease provided for the drilling of wells and payment of royalty on their product or a fixed sum in lieu thereof for a period of ten years and as much longer as oil might be produced. The lessee elected to pay the quarterly rental in cash and did not sink a well until the last quarter of the tenth year, when he drilled a well which produced oil, although in unremunerative quantities. Held, that the lease was binding on the lessor as long as the lessee continued to produce oil and pay the stipulated rental.

South Penn Oil Co. *v.* Snodgrass (West Virginia), 76 Southeastern, 961. Jan. 14, 1913.

RIGHT OF STOCKHOLDER TO INSPECT MINE

A stockholder in a mining corporation has a right to inspect the company's mines. Where such permission is refused by the directors of the corporation, a writ of mandamus will lie to compel them to issue to him written permission to inspect the mine. While this writ may not be enforceable against the persons actually in physical charge of the mine because the properties lie without the state and without the jurisdiction of this court, still the Board of Directors meet within this state and the writ may be enforced against them.

Hobbs *v.* Tom Reed Gold Mining Co. (California), 129 Pacific, 781. Jan. 14, 1913.

INJUNCTIONS IN MINING SUITS

In actions for trespass for removal of ore where an injunction is sought to prevent further taking, it is proper for the court, if there is any doubt in its mind as to the title to the property, to grant an injunction *pendente lite* or to require security to be given, pending the determination of the issue as to the ownership of the ore. However, in this case the appellate court was unable to say that the trial court had abused its discretion in refusing such an injunction and accordingly affirmed the order.

Stewart Mining Co. *v.* Ontario Mining Co. (Idaho), 129 Pacific, 932. Jan. 20, 1913.

DISCOVERY—ELEMENTS OF

The elements of a valid discovery on a mining claim are:

1. A vein or lode of quartz or other rock in place.

2. The quartz or other rock in place must carry gold or some other valuable mineral deposit.

3. The two preceding elements when taken together must be such as to warrant a prudent man in the expenditure of his time and money in the effort to develop a valuable mine.

The requirement of such a discovery is mandatory and cannot be waived by the Department to meet peculiar conditions existing in some mining district. Where in an alleged discovery shaft the country rock was shown to be a granite containing as a constituent element quartz, and there are occasional segregations of the quartz, this does not constitute a sufficient discovery of a lode of quartz or other rock in place.

Jefferson-Montana Copper Mines Co., 41 Land Decisions. 320. Sept. 5, 1912.

Book Reviews

PAST AND PRESENT METAL MARKETS. By W. E. Figgis. Pp. 64, accompanied by two charts, 30 by 38 inches. Published by Critchley Parker, Sydney and Melbourne, 1913. For sale by the *Mining and Scientific Press*. Price $6.

This is a compilation of London monthly average prices for the five metals, copper, tin, zinc, lead, and silver, from 1890 on. Space is left on the charts and in the book for recording similar averages up to and through 1919. The text is brief, but illuminating. The world's production of each metal is stated by countries in percentages, and the chief producing districts indicated. The whole publication affords a convenient means of obtaining quickly a comprehensive view of the world's trade in the chief metals.

MINING WORLD INDEX OF CURRENT LITERATURE. Vol. II, July-December, 1912. By George E. Sisley. Pp. 234, index. Mining World Co., Chicago, 1913. For sale by the *Mining and Scientific Press*. Price $2.

The second volume of this excellent compilation of the current literature of mining, metallurgy, and allied industries, follows the general style of the first volume, issued six months ago. There are improvements in that subjects have been more closely divided and entries are repeated under more subjects. The book includes an excellent author's index. One helpful feature, that will be especially appreciated in mining camps, is the noting of republished as well as original articles. As a whole, the book is an extremely useful one and will save time to workers in many fields.

TOPOGRAPHIC MAP OF COLORADO. By R. D. George. Scale, 1 to 500,000. Denver, 1913.

Only a preliminary edition of this interesting map is as yet available, the main printing having been delayed to permit of making changes in county boundary lines if any such be authorized by the legislature this year. The map has been compiled from data furnished by the United States Geological Survey, the Reclamation Service, Forest Service, General Land Office, railway surveys, and other sources, and incorporating the earlier work of the Hayden, Wheeler, and King surveys. All this has been digested and then supplemented by surveys made by the State Geological Survey, with the net result of furnishing an excellent base map; much the best extant. Topography is shown both by contours and tints in brown. All land lines and cultural features are represented in black, while streams and lakes are in blue. The map is sold by the Colorado Geological Survey, Boulder, Colorado, at prices ranging from 50 cents to $1.55, depending on the styles of mounting. It is announced that a companion geologic map will shortly be issued.

TWELFTH BIENNIAL REPORT, BUREAU OF MINES, COLORADO. By T. R. Henahen; for the years 1911 and 1912. Pp. 200, index. Denver, 1913.

This little book contains, in addition to statistics of production and of accidents, the rules and regulations of the United States Surveyor General's Office and the United States Land Office, tables of altitudes, the official code of signals, instructions for resuscitation from electric shock, and a discussion of the future of mining in Colorado, a review by districts in which a general account of development throughout the state will be found. Incidentally, there is a large amount of technical information. For example, J. R. Curley discusses the carbonate of zinc found at Leadville and the market conditions in the trade; A. W. Forstall tells about carnotite as a supply of radium; the metallurgy of tungsten is described by R. D. George; H. J. Reilling gives brief notes on gold dredging; J. T. Milliken briefly outlines the Golden Cycle mill, while W. H. Staver does the same for the Liberty Bell, T. B. Crowe for the Portland, Philip Argall the Stratton's Independence, and other metallurgists still other mills. Victor C. Alderson describes the experimental plant at Golden, and C. E. Anderson and J. T. Milliken respectively give brief notes on the Smuggler and Golden Cycle electric pumping plants. According to figures collected by Mr. Henahen, Colorado has to date produced metals to the value of $1,187,543,778, and undoubtedly, as he contends, the state is capable of long continued and large production if the industry be properly encouraged.

GAS POWER. By C. F. Hirshfeld and T. C. Uibricht. Pp. 209, ill., index. John Wiley & Sons, New York, 1913. For sale by the *Mining and Scientific Press*. Price $1.25.

The modern gas-engine, whether it derives its power from the gas produced from solid, liquid, or gaseous fuels, is doing good and economical work in all parts of the world, and its use will certainly increase. Up to quite recent times there has been a feeling of distrust in the operation of such types of prime movers, but little can be said on this score now, and units of from 5 to 3000 hp. are in successful service. In many instances it has paid to scrap steam-driven plants for gas-engines, and suction-gas plants, using gas generated from coal, have reduced costs to as low as 12c. per hp-day. With the advent of the Diesel oil-engine, great results are predicted, and have been accomplished, and it seems as if this type will have a wide scope in steamships and power-stations. In the United States, on account of the quantity and cheapness of oil, engines deriving their power from this fuel are used a great deal. The system is also flexible, as in temporary installations an oil-engine can be moved about and set to work as easily as an electric motor. In Europe, the utilization of blast-furnace gas for power purposes has led to the construction and satisfactory operation of large units. In Australia, the suction-gas plant has made great headway, using coal, charcoal, and other fuels, and numbers of installations using from 10 to 250 hp. are working well. In one plant in New Zealand the cost of suction-gas is so low that it is equal to power produced by a hydro-electric station.

The volume under review gives a good insight into the theory of the heat-engine problem, use of fuels as gas producers, development of gas power, details of gas-generators and modern types of gas and gasoline engines, and other interesting information. Every automobile owner and driver should be well versed in the working of his engine, and by a little study of this book should learn something of value.

PROVISIONAL GEOLOGIC MAP OF ILLINOIS. Published by the State Geological Survey, F. W. DeWolf, director. Lithographed by A. Hoen & Company.

This map, which is upon the scale of 1 to 500,000, approximately 8 miles to the inch, affords a graphic summary of a large amount of extremely useful information. In addition to presenting a revision of the mapping of the formations, there is a brief outline of the geologic history of the region and, through colored columnar and longitudinal sections, the revised classification and structure of the rocks is exhibited. Such a map summarized a large amount of detailed work, and, comparing it with the map compiled from then existing material by Stuart Weller and furnished with the first bulletin of the Survey in 1906, it shows what substantial progress has since been made in the study of Illinois. Aside from the scientific material, much that is primarily economic in character is furnished. The oilfields are outlined, the coal, zinc, and fluorspar mines indicated, and a rough summary of the mineral production made. It is not easy to realize the mineral wealth of Illinois, when crossing the level and well cultivated prairie land within its border. In fact, Illinois ranks third among the mineral producing states. In a recent instructive and at the same time interesting address delivered before the American Institute of Mining Engineers, E. W. Parker showed that the geographical centre of mining in the United States falls within Cass county, Illinois, and suggested that the mining experience of a citizen drawn from there might well have been "obtained from digging fresh-water clams in the bed of the Kankakee river." Probably the

Illinois or Sangamon was meant, as the Kankakee does not flow through Cass county, but an inspection of Mr. DeWolf's new map suggests that the erstwhile clam digger need not despair. He may yet become a 'coal baron' or an oil magnate, as both coal and petroleum are found near the borders of the county in question.

ELECTRICAL ENGINEERING FOR MECHANICAL AND MINING ENGINEERING. By H. J. S. Heather. Pp. 332, ill., index. D Van Nostrand Co., New York. For sale by the *Mining and Scientific Press*. Price $3.50.

This book consists of a series of lectures delivered at Johannesburg primarily for resident mechanical engineers connected with the mines. As the author states in the preface, previous to the introduction of electric power through the Rand Mines Power Supply Co., Ltd., and the Victoria Falls & Transvaal Power Co., Ltd., electricity had only been used in minor work upon the Rand. The engineers in charge were used to steam and compressed air, but unfamiliar with electricity in any large way. On the other hand, the electrical men along the Rand, having occupied only minor positions, had no familiarity with the management of men and affairs in a large way. To meet the situation, A. C. Whittome arranged for this course of lectures, in which the problems of electricity are stated, as nearly as may be, in terms of steam and compressed air. Much use is made of analogy, and while stated simply, the book is written for trained and mature men. It is well calculated to meet a widely felt want among mining engineers and will be generally useful. Among chapter headings are: The Electric Circuit; Resistance; Alternating Currents; Electrical Measurements; Continuous Current Dynamos; Alternating Current Generators; Synchronous Motors and Parallel Running Alternators; Transformers; Polyphase Systems; Induction Motors; and The Effects of Running Under Abnormal Conditions.

Cost of Supplies at Montana-Tonopah Mill

During the year ended August 31, 1912, the stamp-mill and cyanide plant treated 53,874 tons of ore, at a total cost of $2.96 per ton, current supplies being as follows:

	Per ton.		Per ton.
Cyanide	$0.58	Water	$0.20
Zinc	0.08	Power	0.54
Lime	0.07	Heating	0.20
Lead acetate	0.04	Refining	0.05
Acid	0.01	Assaying	0.01
Shoes and dies	0.04		
Pebbles and linings	0.07	Total	$1.91

A Land Dredge

Numerous attempts have been made to perfect a small machine operating on land and handling gold-bearing gravel as is done on dredges. The Stephens-Adamson Mfg. Co. has recently built a plant of this type* for the Buffalo Placer M. & M. Co., operating near Dillon, Colorado. It includes: (1) a steam-shovel which delivers to a hopper from which the material is carried by belt-conveyor to (2) a portable gravel-washing plant, tailing being distributed by means of an industrial car system with a belt-conveyor for coarse material. The gold-washing plant is mounted upon quadruple swivel trucks and includes a grizzly made of manganese steel, delivering the fine material to a trommel. The latter has internal projecting bars to break up clay lumps. The gold is caught in ordinary sluice-boxes. Two motors of 25 and 50 hp., respectively, are used. The rated capacity of the machine is 3000 cu. yd. and about 20 men are needed in its operation.

*Described in *The Labor Saver*.

Recent Publications

REPORT OF THE SITUATION ON THE COMSTOCK. By Whitman Symmes. P. 183. Virginia City, Nevada, March 1913.

COMMONWEALTH CLUB OF CALIFORNIA. *Transactions* on Conservation. P. 314. Map. San Francisco, June 1912.

COMMONWEALTH CLUB OF CALIFORNIA. *Transactions* on Judicial Procedure. P. 53. San Francisco, February 1913.

RAILWAYS AND AGRICULTURE, 1900-1910. Bulletin No. 45. P. 31. Ill. Bureau of Railway Economics, Washington, 1913.

CANADIAN MINING INSTITUTE. *Transactions* for 1912. Edited by the Secretary. P. 680. Ill., maps, index. Montreal, 1912.

GEOGRAPHICAL LABORATORY OF THE CARNEGIE INSTITUTION OF WASHINGTON. Annual report of the Director for 1912. P. 14. Washington.

CLASSIFICATION OF THE PUBLIC LANDS. By George Otis Smith and others. Bulletin 537. P. 197. Index. U. S. Geological Survey, Washington, 1913.

THE PONCA CITY OIL AND GAS FIELD. By D. W. Ohern and R. E. Garrett. Bulletin 16. P. 30. Ill., maps. Oklahoma Geological Survey, Norman, 1912.

SAMPLING COAL DELIVERIES. With types of Government specifications for the purchase of coal. By George S. Pope. Bulletin 63. P. 68. Ill. Bureau of Mines, Washington, 1913.

PROCEEDINGS OF FIFTH ANNUAL DRAINAGE CONVENTION. Held at Raleigh, North Carolina, November 26 and 27, 1912. Compiled by Joseph Hyde Pratt. Economic Paper 31. P. 56. Ill. Raleigh, 1913.

PYRITES IN CANADA. Its occurrence, exploitation, dressing, and uses. By Alfred W. G. Wilson. Bulletin 167. P. 202. Ill., map, index. Department of Mines, Ottawa, 1912.

CHARACTERISTICS AND LIMITATIONS OF THE SERIES TRANSFORMER. By A. R. Anderson and H. R. Woodrow. Bulletin 61. P. 45. Ill. University of Illinois Engineering Experiment Station, Urbana, 1912.

GEOLOGIC STRUCTURE OF THE PUNXSUTAWNEY, CURWENSVILLE, HOUTZDALE, BARNESBORO, AND PATTON QUADRANGLE, CENTRAL PENNSYLVANIA. By George H. Ashley and M. R. Campbell in coöperation with the state of Pennsylvania. Advance chapter from Bulletin 531, 'Contributions to Economic Geology, 1911,' Part II. P. 23. Ill., chart, map. U. S. Geological Survey, Washington, 1913.

Water-Supply Papers by the U. S. Geological Survey, Washington, 1913, as follows:

GAZETTEER OF SURFACE WATERS OF CALIFORNIA. Part III. Pacific Coast and Great Basin Streams. Prepared under direction of John C. Hoyt by B. D. Wood. No. 297. P. 244.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1911. Part X The Great Basin. Prepared under direction of M. O. Leighton by F. F. Henshaw, H. D. McGlashan, and E. A. Porter. No. 310. P. 210. Map, index.

WATER POWER OF THE CASCADE RANGE. Part II. Cowlitz, Nisqually, Puyallup, White, Green, and Cedar drainage basins. By F. F. Henshaw and Glenn L. Parker. No. 313. P. 170. Maps, ill., index.

SURVEY of a bore-hole drilled by the Vermont Copper Co. in a micaceous and sometimes garnetiferous schist, also occasional hornblende gneiss, showed the following deflection in 1000 feet:

Depth, ft.	Corrected dip.	Depth, ft.	Corrected dip.
100	56°40′	600	32°20′
200	53°40′	700	31°15′
300	49°45′	800	20°15′
400	41°50′	900	20°30′
500	36°50′	1000	26°40′

The hole was started with a dip of 61°30′, and at a depth of 1000 ft. the hole was inclined only 26°40′ with the horizontal.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

ASBESTOS is an alteration product found in veins in older crystalline rocks.

ORE-BEDDING pits at the Copper Queen smelter are 11 by 38 by 800 ft. in size.

WATER pumped from the Superior & Pittsburg mines at Bisbee, Arizona, totaled 1,620,218,296 gal. in 1912.

FLOAT is a term used by miners and prospectors for all fragments of vein matter not in place, however transported.

ANTHRACITE MINING, according to E. W. Parker, is conducted on a margin of 13c. per long ton, equivalent to 11.6c. per short ton.

ORE received at the Mason Valley smelter in 1912 came from 130 different mines, situated in 30 mining districts of Nevada and California.

SAMPLING at the Calumet & Arizona smelter is to be done by Snyder machines so arranged that they will make four cuts, producing a sample weighing 1.6 or 3.2 lb., as desired, per ton of ore passing through.

CHROME-VANADIUM and carbon steel springs have been given service tests by the Illinois Central Railroad Co., and showed 248 and 129% in favor of the former steel in mileage run, and 31 to 54% less in cost.

RADIUM is extremely valuable and sells for a high price. It is quoted at about $80 per milligram. However, the price is largely due to its scarcity and if even a relatively small quantity were made commercially available the market would soon be satisfied.

ELECTRIC POWER used by the Mysore company in India amounts to 3000 hp., which is supplied by the Mysore government hydro-electric power station at the Cauvery falls, 91 miles from the Kolar goldfield. Power is now supplied at per horse-power year.

THE rescue station at the Stag Cañon coal mines of Phelps, Dodge & Co. at Dawson, New Mexico, has eight helmets ready for instant use. A sufficient quantity of oxygen and potash to meet any ordinary emergency is carried on hand. During 1912 there were six fatal accidents at the mines, which produced 1,383,562 tons.

TALC and soapstone are soft minerals that have presumably originated from alteration of other minerals. Soapstone, a talc schist, occurs with other rocks of various kinds, usually crystalline or metamorphic; talc occurs in beds intercolated in schistose limestone and in lenses or pockets in certain intrusive rocks. Miners often use the word talc for any very fine grained soft material found along the edge of a vein. Often such talc is really fine wet clay.

CONTRACT WORK at the Broken Hill South mine accounts for 96.5% of the ore mined and 99.5% of the handling of ore from the stopes to shaft stations, the wages earned per shift of 8 hours being, on development, $4.48; stoping, $4.04; and trammers on ore, $3.38, and on waste, $3.12. All mining at the Waihi mine is done on contract, also a large portion of the work at Kalgoorlie. Filling depleted stopes of the Broken Hill South mine with tailing and ash costs $1 per cubic yard of filling, and 30c. per ton of ore mined.

A TURBO-GENERATOR of 500 kw. of the Allis-Chalmers type, worked continuously for 640 days at the Calumet & Arizona power-plant. It was shut down for two days in October 1912 and the only work necessary in the way of repairs was the truing up of the collector rings of the rotor and cleaning of the oil and water circulation systems. According to the company's engineers, the machine has made an unprecedented record, it having worked for 1637 days between April 22, 1908, and October 8, 1912, with only six days' stoppage.

EFFICIENCY TESTS run on two 5000-hp. hydraulic turbines at the Schaghticoke power-plant, New York, under 56.5 to 86.5% load, gave the following results.

Second-feet of water	208.70	307.43
Effective head, feet	146.91	145.42
Theoretical horse-power	3473.76	5068.46
Kilowatts on switchboard	2007.68	3117.91
Horse-power on switchboard	2691.26	4179.50
Generator efficiency, per cent	95.32	96.68
Turbine brake horse-power	2823.40	4323.02
Turbine efficiency, per cent	81.28	85.30

CARNOTITE ores are found in various counties in southwestern Colorado, and afford a potential source of radium. According to investigations of A. W. Forstall, the radium salts may be extracted more readily from carnotite than from pitchblende, but the process is a delicate one, and for the present the ores can probably be best marketed in the shape of (1) sulphates, including sulphates of barium calcium, and lead with radium sulphate; and (2) uranium and vanadium oxides with impurities. The market is, for the present, in Europe, but active chemical research is being conducted at Denver with a view to establishing an industry in the United States.

A PULP SPECIFIC-GRAVITY BALANCE, invented by H. Stadler, is an apparatus carefully adjusted, with a poise weight sliding on each of three bars, and has a capacity of from 1 to 2000 gm. A glass flask is taken with a capacity of 1000 c.c. of water. The flask being empty and dry, is accurately balanced by the poise weight on the first bar. It is then filled with water, and the poise weight on the second bar, when balanced, will indicate 1000 gm. If the water is emptied out, and the flask filled with a sample of pulp to be tested, the poise weight on the third bar being moved to indicate the accurate balance, the percentage of water in the pulp can then be read off. The apparatus was constructed for Rand slime, and pulp from other districts would need a factor of correction if of different specific gravity.

A UNIQUE COAL-STORAGE BIN has been in successful use at the plant of the Ashland Iron & Mining Co., Ashland, Kentucky. The coal to be stored is crushed fine and is frequently damp, allowing it to pack solidly in the bin and to build up almost vertical. It was consequently necessary to use for storage a cylindrical tank, set vertically, and provided with a conical bottom of slight pitch tapering to the automatic bottom gate. Under this arrangement it is practically impossible for the coal to bridge over the gate under any circumstances. The steel bin is 11 ft. diam. and 35 ft. high, supported on a structure 27 ft. above ground, and has a capacity of 75 tons. It is filled by means of an 'S-A' bucket-elevator, fed by a track hopper and feeder, and is used to supply fine coal to larry cars which feed the coking ovens.

FAILURE to perform annual labor on a claim does not lose or forfeit it; it becomes forfeitable by the locator and locatable by others. It is only when it has been appropriated by another through a new location—a re-location—that it is lost and forfeited by the old owner. Up to the time of re-location, the old owner may, by resuming work upon the claim, redeem his claim from being forfeitable, as provided by statute. Even after re-location has begun, and while the various acts of location prescribed by federal and state statutes are being completed within the allotted time, the old locator may resume work at any time before the completion of all the acts of re-location and thereby render the attempted re-location void, except in Montana, where a forfeiting claimant cannot resume work after a re-locator has posted his notice.

Motor-Driven Charging and Slag Cars

Where cars such as larries and charging-cars are used singly, or at the most in twos and threes, it is often better practice to have them self-propelled by electric motors than to employ a locomotive to move them. With self-propelled cars the system is much more flexible. A car can be moved whenever wanted, without delays incident to waiting for the locomotive, so that operations can be carried on more rapidly and there is much less danger of congestion at any point. The Westinghouse Electric & Mfg. Co. has recently furnished such cars for use at Tooele, Utah, and supplies the following data regarding them.

It has been the usual practice in smelter work to tilt slag-cars by means of compressed air, but motor-tilted cars have been thoroughly tested in certain smelters and are heartily commended by their users. They are low in cost and are simple. Motors for this purpose have proved reliable. Their use does away with the large compressor on the locomotive and with air dumping through the main line, which has often proved troublesome to maintain. Energy for motor operation is obtained from the locomotive trolley. The illustration (Fig. 1) shows a slag-car of the International Smelting & Refining Co., Tooele, Utah, with a Westinghouse No. 6, type K, direct-current motor mounted on the end of the car and protected by a canopy. It is series wound, entirely enclosed, and is dust and weather-proof. It is geared to the tilting mechanism and is designed especially to take care of heavy service of this character and to withstand the high temperature to which it is subjected. At one plant where these motors have been in use for three years, no trouble from any source has been experienced with them.

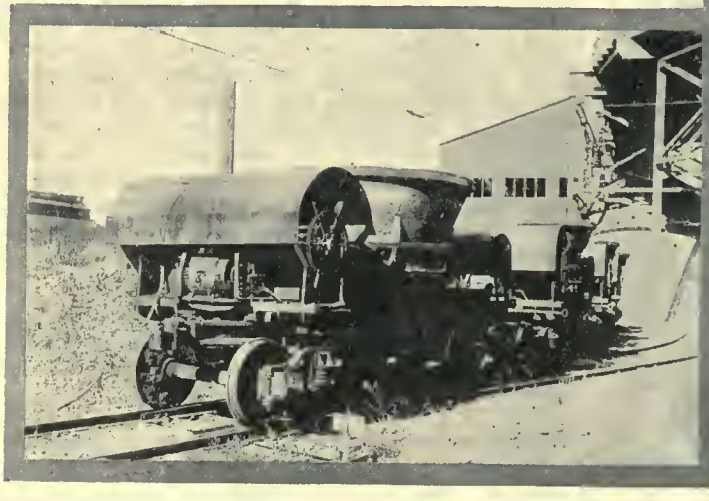


FIG. 1. THE SLAG CAR.

FIG. 2. THE CHARGE CAR.

Fig. 2 shows a motor-driven charging car with two No. 64 motors—one on each truck—of the lead department of the International Smelting & Refining Co. The controller is plainly seen mounted in a horizontal position at the end of the car. Motors and controllers are designed in accordance with street railway practice, but the motors are modified to suit the requirements of this special service. The ability to develop great power in small space is one of their most important characteristics. Another one is great reliability, ruggedness, and ease of inspection. They are built to reduce the amount of attention required to the minimum. Excellent commutation has been secured by the design of brush-holders, commutators, and bearings, and as a result these parts can be kept in service for long periods without necessitating the renewal of any of these parts. The lubrication is simple and adequate for long periods of operation.

The motors for both the charging and slag-cars are made by the Westinghouse Electric & Mfg. Co. and may be adapted to any of the usual type of these cars.

Commercial Paragraphs

JOHN H. BERRIAN, Seattle, formerly with Meese & Gottfried, is now with the Mill & Mine Supply Company.

The sales department of the WAY'S POCKET SMELTER CO. will hereafter be handled at 224 South Spring street, Los Angeles, California.

JOHN WILEY & SONS, publishers of scientific books, will move their offices about May 1 to the eighth floor of the building at 432 Fourth avenue, New York.

CHAS. C. MOORE & CO., ENGINEERS, announce the temporary removal of their offices to 40 First street, San Francisco, during the erection of their new structure to be known as The Engineers Building, at First and Mission streets.

On May 1, 1913, the New York office of the DWIGHT & LLOYD CO., INC., and DWIGHT & LLOYD METALLURGICAL CO., will be removed to the Columbia Bdg., 29 Broadway, New York. Owing to the rapid growth of the business of the Dwight & Lloyd Metallurgical Co. it has been found expedient to form two companies, and the former will handle the North American territory and the latter other countries.

The POWER & MINING MACHINERY CO. is about to open an office at 153 Queen Victoria street, London, E.C., England. A. W. Catlin, formerly of the Allis-Chalmers Co.'s London office, has been appointed manager and he will have entire charge of the sales of the machinery manufactured by this company.

J. W. White, engineering salesman for THE JEFFREY MFG. CO., until recently at its Athens, Ohio, offices, has been transferred to Duluth, Minnesota. Mr. White will look after the sales work of the above company in the following territory: The eastern part of Minnesota, northern Wisconsin, and the entire upper peninsula of Michigan, with headquarters at 1905 East Superior street, Duluth, Minnesota.

WALTER L. GIBSON, who for the past five years has been a silent partner in the FALKENAU ASSAYING CO., of Oakland, has now purchased the entire business and will conduct it under his own name. Mr. Gibson has been associated with the concern more than 16 years and is favorably known all over the Pacific slope. Professor Louis Falkenau remains with the company as general manager and consulting specialist. The same high standard of commercial work and instruction that has made this concern so well known in the past will still be maintained.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

WASHINGTON is to spend $12,500 on stream gauging and $5000 on geological and soil studies through its State Geological Survey. Mr. Henry Landes has been reappointed State Geologist.

WATER-POWER regulation within the National Forests does not seem to have checked development unduly in California, as permits have now been granted for development of 700,000 horse-power in that state, 80,000 within the last twelve months.

RESEARCH on problems relating to mining and metallurgy has become so important at the Utah School of Mines that a special appropriation of $7500 per annum has been made for support of the work, and the Director is now looking for a metallurgical engineer who can devote his whole time to the department.

IMPORTANT papers on 'Secondary Enrichment of Silver Ores' by Mr. H. C. Cooke and 'The Geology of Luzon' by Mr. Warren D. Smith, appear in the January-February number of the *Journal of Geology*. Mr. Cooke's paper contains details of an elaborate investigation of the chemistry of silver-bearing solutions, and is an excellent illustration of the service of modern laboratory research to geology. Mr. Smith's paper puts in convenient and eminently readable form a summary of knowledge of the geology of the largest Philippine island.

POSTPONEMENT of further payments on the Boxer indemnity, in order that the Chinese Republic may have opportunity to reorganize its finances, appears to be an excellent suggestion. International relations offer as good opportunity for the exercise of consideration and common sense as does the business world, and despite individual profit that might be won in a scramble to secure preferential advantage in China, it is evident that the greatest good to all nations will follow from aiding China in her struggle to promote civic liberty.

STATE GEOLOGISTS, representatives of the United States Bureau of Mines, mine inspectors, and coal, oil, and gas operators, at a recent conference at Pittsburg, agreed upon a general outline for legislation considered desirable in order to lessen danger due to drilling oil and gas wells through coal beds. In the Appalachian fields in particular the necessity for drilling into or through the coal measures in order to tap the oil and gas has led to grave danger to mines and mine workers. A system of inspection, with rigid requirements as to casing and plugging wells is recommended.

POLLUTION of streams by mill tailing is creating trouble in widely scattered districts. The Coeur d'Alene companies joined in buying easements on property affected and so have cleared their road of difficulty. Mother Lode companies in California have been buying valley land and the Kennedy and other concerns are preparing to stack their tailing. An agreement was recently reached as to the length of time before the new arrangements must go into effect. At the Chino and El Tigre the companies were fortunate in owning riparian rights for miles along the stream. On the western slope of Colorado, where fruit farming contests with mining for popular attention, stream pollution is a live topic. Conferences are being held, and we are glad to note a general disposition to arrange matters amicably, with an appeal to the courts only as a last resort.

ENGINEERS engaged in building construction of any kind have a deep interest in seismological studies, since it is important to avoid earthquake rifts where known, or to take proper precautions when buildings, dams, or other structures must be erected near them. Just seven years ago this week San Francisco suffered from the famous earthquake which taught many lessons in structural engineering. In a recent thoughtful essay in the *Bulletin* of the Seismological Society of America, Mr. John C. Branner points out the immense benefit that would follow from systematic recording of all earthquake observations. At present the Seismological Society is itself the only agency in the United States for collecting and recording such notes. It deserves the hearty support of all engineers. Earthquakes are not nearly so dangerous as cyclones and floods and cause much less damage. They will result in still less when systematic coöperative studies show how to avoid danger zones and how to build to meet shocks.

IMMIGRATION and its problems have been much to the fore in San Francisco this week. It is anticipated that after completion of the Panama canal, 20 to 25 per cent of the immigrants coming to the United States will land at San Francisco, and to provide for them will temporarily tax the community, whatever may be the ultimate benefits. If immigration does not produce problems, it at least intensifies many that are inherent in human relations. The result is largely determined by the mental attitude assumed by the immigrant and the community. In all too many Western towns and districts the incoming immigrant is merely a 'hunkie'—a working machine of uncouth appearance and no human likeness to those of us who came earlier. To those who have this attitude we commend a letter received recently from a Montenegrin soldier, written us from the battlefield before Scutari. No doubt when Mr. Savo M. Dobrkovich worked in the Arizona mines he was merely an 'ignorant foreigner' to the young American who made out his pay check. His letter, however, reveals the fact that in his mental makeup he is much like the rest of us, and his attitude toward war would highly commend itself to Mr. Charles W. Eliot and his associates of the Peace Society. Incidentally, Mr. Dobrkovich is a poet and the author of a small volume of verses published at Cettinge. Have a care, Mr. Shift-boss, the next time you 'cuss out' a clumsy workman: he may be at least as human as yourself.

Flotation and Copper Ores

A small matter is often big with significance, and the recent announcement that the tests with the Minerals Separation, Ltd., process of concentration by flotation, which the Inspiration Consolidated Copper Company has been conducting in a 50-ton experimental plant at the Joe Bush shaft of the company, have proved so successful as to warrant the construction of a 600-ton plant for testing the application of the process to this ore on a working scale, has a greater importance than might at once be inferred. The original plans for the development of the Inspiration property included a 5000-ton mill for the concentration of the ore by ordinary wet methods. The construction of this has been deferred during the tests on concentration by flotation, and if the work of the 600-ton plant proves as satisfactory as have the preliminary experiments, it is reasonable to suppose that the entire tonnage of the mine will be put through the flotation plant, which will be of corresponding size. The experience of the Britannia Mining & Smelting Company, Ltd., will thus be improved upon. The Britannia company, as mentioned in our issue of January 11, after years of unsuccessful experimental work with ordinary wet methods of concentration, has begun the construction of a 400-ton flotation plant. The Inspiration company, in the light of its careful preliminary experimental work, will probably be able greatly to decrease necessary capital expenditure, as the cost of construction of a flotation plant is not over forty per cent of that of an ordinary wet-concentration plant, with a corresponding decrease in overhead charges.

While the matter of capital expenditure in plant construction is an important one, the greatest significance of the success of oil flotation in the concentration of the Inspiration ore, which may be taken as typical in some degree of the porphyry coppers, is the increase in recovery of the copper content. As a round figure, it is safe to say that the companies now engaged in the concentration of ores of this character make about a seventy per cent recovery of the copper. As the copper production of these companies now amounts to nearly one-fourth of the total for the United States, it is evident that the margin for saving is a wide one. Even if the increase in recovery does not exceed ten per cent, the net result is an improvement of one-seventh of the saving now made. The development of a large new mine is an event of great importance; it is worth while, therefore, to point out that such an increase in recovery is equivalent in effect to discovery of new mines. From an economic standpoint, it is a matter of congratulation that such a fundamental change is effected through the use of a patented process, on which a royalty is exacted by the patentees. If by some simple change in ordinary methods production might be so increased by certain companies at no increased cost, the resulting

lowering of what may be designated as the normal standard of production cost would cause the suspension of many other companies which are operating at a cost close to the margin of profit. But where the increase in recovery is offset by a royalty, the law of compensation comes into effect, and working conditions are stabilized. The royalty demanded of the users of oil flotation processes, though it may appear as an unmixed evil to the one who pays, is not utterly iniquitous, as all managers of plants which cannot use oil flotation processes to advantage, will agree. In short, the general use of oil flotation would inevitably lead to a decrease in the cost of producing copper, and, presumably, in its selling price. Such a readjustment would unquestionably prove in the end beneficial to the general public, but, unless it came about slowly, would as unquestionably work hardship on individuals. It is to be expected that in brokers circulars the use of oil flotation by the Inspiration will be designated as "heralding a revolution in concentration methods." It is worth while to point out, therefore, that revolutions are to be avoided wherever possible, as their effects are usually disastrous to industry, for the time being. If the work of the 600-ton plant of the Inspiration proves as satisfactory as has the plant of that size at the Braden mine, in Chile, it is to be assumed that concentration by flotation will be adopted by a number of mines in Arizona and in other parts of the West as well. It is too early as yet to venture a statement as to what changes in the cost of copper production such a change in methods will cause, but we hope they will exhibit themselves slowly.

The Alien Land Bill

California's Assembly has passed a bill restricting ownership of land by aliens, and as a similar bill has already been passed by the Senate, it is expected to become a law. A number of states already have such acts, though they vary as to details. Arizona last year passed a law prohibiting aliens from holding land however acquired, for more than five years. The Arizona statute, however, does not apply to mining claims or lands necessary to the operation of mines. Several of the prairie states impose restrictions on alien ownership of agricultural lands, though the fact is seldom remembered. The right of a state to pass such a law can hardly be questioned, but the policy of doing so is quite another matter.

In our judgment, the California statute is foolish and unnecessary. It provides in effect that no alien may own land for more than one year, or lease for more than five; with proper provision for present owners and their direct heirs, and for minors who may inherit land. This bar to ownership is removed upon the alien taking steps for naturalization. As to corporations, it is provided that "every corporation, the majority of the issued capital stock of which is owned by aliens who are ineligible to become citizens of the United States under the naturalization laws thereof, shall be considered alien within the meaning of this act." This is a direct slap at the Japanese, since their right to become citizens is in doubt, never having been passed upon by the Supreme Court, and the lower courts having held against them. It is probable that the new statute will force the issue and that a final adjudication will be obtained. Almost certainly also, the new statute will lead to strained relations between Japan and the United States, and this is all unnecessary. The number of Japanese in the United States is not increasing, and immigration of Japanese laborers to this country has almost ceased. Whether, in view of the undeveloped condition of our industries, this is a good thing is an open question, but at least the fact is indubitable. It is further to be remembered that the coming of Japanese laborers to the Pacific slope was stopped not by our Government but by the Japanese themselves as an act of courtesy to us. Under these conditions it is peculiarly unwise and discourteous to enact legislation that places them in a different class from other aliens.

California may pay dearly for her new whistle. The rest of the country, which looks at the matter from an entirely different standpoint, is not likely to allow the whole nation to be drawn into serious foreign complications to meet the exigencies of a local political squabble. The remedy is too simple and too easily applied. Congress can at any time remove any supposed bar to Japanese becoming citizens, after which, as they will stand on exactly the same basis as any other foreigners, treatment guaranteed them by the 'most favored nation' clause of treaties, they will have no just cause of complaint. That would not be a bad solution of the problem. The Japanese already here would make excellent citizens. They are thrifty, industrious, and it needs but short experience as an employer to convince anyone that they have no disposition to become 'pauper labor.' The records show that they do not contribute unduly to the criminal and dependent classes, and they have persistently refused to settle in any 'Japanese quarter' or otherwise to be more clannish than circumstances forced. It is worth recalling in this connection that under the preceding state administration the Labor Commissioner was empowered to make an exhaustive report upon the Japanese in the agricultural industries of California. It was popularly supposed that this report would 'make a case' against them sufficient to influence public opinion to the point of passage of an exclusion act. The exact reverse proved true. The report showed such favorable results from introduction of Japanese laborers, and such strong need for more of them, that agitators for Asiatic exclusion have let it severely alone. We believe that in passage of the alien land bill the California legislature has misrepresented local sentiment, as it has undoubtedly failed to appreciate national opinion. We are disposed to trust the President and Congress to find a satisfactory way out, and in the meantime counsel our good friends at Tokyo to have a bit of patience. Prejudices in race matters run deep and are not to be overcome quickly. Japan withdrew from the family of nations for several hundred years and it is not surprising that her complete re-entry involves difficulties.

Mining in the Belgian Congo in 1912

By Sydney H. Ball

*The more important developments of the year 1912 in the Belgian Congo were: (1) stabilization of the copper industry in the Katanga; (2) the successful advance of the placer gold industry; (3) the satisfactory extension of diamond and tin discoveries. Important results may be expected from further developments of either of the latter minerals. The value of the 1912 mineral production of the colony approximated $1,500,000, a paltry sum perhaps, but one gained from a portion of that great white blotch in Central Africa, which in our youth was marked unknown upon even the best maps. In the *Mining and Scientific Press* of April 12, the railroads and other means of transport in Central Africa have been described by S. H. Ball and M. K. Shaler. The successful application of wireless telegraphy in this tropical colony is worthy of the attention of mining engineers operating in isolated regions. In certain influential quarters, public opinion opposed to the Draconian import duties, licenses, and royalties, paid by the mining industry in the Belgian Congo, is growing, augurring for the future a more liberal spirit on the part of the Belgian Government in the development of this distant and difficult country.

REMOVAL OF THE FOREST IS A LARGE FACTOR IN TROPICAL PLACERING

Copper Production

The copper produced in the Belgian Congo in 1912 came from the Katanga copper belt in the southeast part of the colony. The mines are operated by the Union Miniére du Haut-Katanga, in which the Tanganyika Concessions, Ltd., has a 45% interest. The production from this field in 1910 was about 168 tons of copper ore, containing probably 60 tons of copper; in 1911 about 1000 tons of crude copper; the 1912 product is difficult to determine. The single furnace was blown in June 30, 1911, and ran for only 83 days, owing to coal shortages, accidents, and stoppages due to necessary alterations. In 1912 it ran from January 3 to March 4, and from March 23 to April 11, and having started again September 25, continued to run to December 25. Prior to November 25, 1912, the product for 1912 was 2040 long tons, and to December 25 about 460 long tons was produced, so that the total year's product was some 2500 long tons of unrefined copper, equal to about 2300 long tons, or 2575 short tons of refined copper. The crude copper is sold at Antwerp and contains cobalt, which, in instances, reaches 6%. The 1911 product consisted of about 89 to 90% copper, 5½% cobalt, 0.3% iron, and 0.5 to 1% sulphur; but the later shipments, through more complete scorification, had the following composition: 95.5% copper, 1.8% cobalt, 0.86% iron, and 1.1% sulphur. That now being sold contains about 95.15% copper, 3.1% cobalt, 0.74% iron, and 0.76% sulphur. The copper carries no precious metals.

During the past year the technical management of the property has passed from British hands to those of a technical committee at Brussels, composed of two Belgians and two representatives of the Tanganyika Concessions, Ltd. About 100 whites and 1500 blacks were employed at the mines and smelter in Africa, October 12, 1912. The joint committee sent out by the Belgian and English capitalists financially interested in the property at the end of last year, confirm the presence of important tonnages of high-grade ore in the two mines visited (the Star of the Congo and Kambove). They estimate between 270,000 tons of 11% and 180,000 of 11.6% ore above water-level (at a depth of a little less than 100 ft.) in that one of the three portions of the former mine is now under exploitation. Up to an early date in 1912, 20,000 tons had been treated.[1]

The Star of the Congo mine, from which alone at the present time ore is being drawn, is worked by open pits and adits; at present two shafts are being sunk to assist in exploitation. It is hoped that this mine will soon be in condition to furnish ore to two water-jacket furnaces. The Kambove mine, which with others should be connected with the smelter by the Elisabethville-Kambove railroad this coming spring, has a main gallery about 1375 ft. long and some 1300 ft. of cross-cuts. It should be ready to furnish its quota of ore upon the arrival of the

*For comparison see 'Mining in the Belgian Congo, West Africa, for 1911,' by Sydney H. Ball, *Mining and Scientific Press*, January 20, 1912.

[1]Note.—The following estimate of tonnage of ore proved, largely the results of visits made by engineers four or five years ago, may be of interest: Kambove, 1,800,000 tons of 12% (Frecheville); 2,500,000 tons of 14% (Atherton); 3,000,000 tons of 12% (Gibbs, chief engineer for R. Williams of the Tanganyika Concessions, Ltd.); Star of Congo, 435,000 of 14%, and 91% (Frecheville); 1,500,000 tons of 11% (Atherton); 1,200,000 tons of 15%, and 6% (Gibbs); Fungureme, 1,500,000 of 7% (this and the following are Atherton's estimate); Kwatabala, 1,150,000 of 7%; Likasye, 1,000,000 tons of 12%; Kababeba, 1,000,000 tons of 7%; Dikurwe, 800,000 tons of 12%; Musonoi, 600,000 tons of 9½%; Kolwezi, 450,000 tons of 13%; Kakanda, 350,000 tons of 9%. These figures indicate about 884,500 tons of copper, of which perhaps 600,000 tons will be recoverable. In addition, there are 90 other deposits, most of which are much smaller, and on which little or no work has been done. Although the estimates differ greatly, they are sufficient to prove the importance of this field.

railroad. Two prospecting shafts have been begun at Luiswishi, and five at Luishia, two of the copper deposits more accessible to this railroad soon to be completed. In addition to the smelter now in operation, a second water-jacket has been shipped, and will presumably be blown in about June. If labor and fuel warrant it, probably one or more other water-jackets will be erected later in 1913 or in 1914. Early in 1912 a rough sorting and washing plant was erected at the smelter, and by it the silica, alumina, and magnesia content of the ore is diminished and the copper content increased from about 12 to about 16%. A permanent sorting and washing plant is now approaching completion. Further, the fine ore, which gave trouble at first, has been experimentally briquetted, and by June next a briquetting plant with 200-tons daily capacity will be finished.

Smelting at Katanga

The process to be followed in treating the ore is then, rough washing with part concentration, briquetting the fine, and direct smelting. J. Jadot, the chairman of the technical committee, addressing the Union Minière du Haut-Katanga, on December 2, 1912, gave the following summary of smelting:

Period of smelting.	Quantity of ore treated long tons.	Copper-content of ore, %	Total long tons.	Average daily, long tons.	Copper, %	Coke used, total tons.	Coke used per ton of copper.
August 4 to October 23, 1911 (88 days).....	10,341	12-13	996	11.3	90	3434	3.44
January 3 to April 11, 1911 (79 days).....	10,053	13-15	1002	12.7	95	3249	3.24
September 25 to November 25 (61 days).....	7,600	16	1038	17.0	95	2730	2.65

The recovery for the three periods was respectively 69.3, 66, and 80%. Improvements under way will presumably better the latter extraction somewhat. In 1911, European coke, costing about $63 per ton, was used in smelting, but in 1912, a contract was made with the Wankie Colliery Co. to deliver up to 1200 tons of coke per month at something over $28 per ton at the smelter. This coke contains considerable ash and sulphur, but with the completion of a washing plant at Wankie early in the present year its quality should be improved. In 1913 coke ovens are to be erected at the smelter itself, the coal being coked and the gas used for boilers. These ovens should produce from 2500 to 3000 tons per month. In April 1912 a satisfactory trial run was made with Wankie coke and from October 14 to November 25 this fuel was used almost or quite exclusively. Mr. Jadot states that the copper cost at the works during a month when the furnace was in continuous operation, about $155 per long ton of 95% copper, not counting European charges. To this should be added about $45 freight to Europe and market charges. This brings the cost to a little over 9½c. per pound of copper without counting European general charges, interest, and presumably amortization. The cost at the works is expected to be reduced by using washed coal for coking, by coking at the works, by briquetting of fine ore, and by cleaner concentration.

In 1911 a coalfield was discovered at Luano, about 50 miles southeast of Broken Hill, in Northern Rhodesia. A drill-hole about 325 ft. deep is reported to have passed through six coal seams, several of which are exploitable, and one of which is 7 ft. 6 in. thick. The coal is rumored to be about the grade of that of Wankie. This coal is but 375 miles from Elisabethville, but as the route from Broken Hill to the coal is very mountainous, this source of fuel cannot be drawn upon for several years. Reports are current of the discovery of coal six miles from Lake Tanganyika on the Lukuga river not far from Albertville. This is near the survey of the Belgian railroad now being built from the Congo river to Lake Tanganyika. The coal is reported to be a good steam coal of non-coking grade, and its discovery may be of importance if the extent and thickness of the seams, as yet unknown, proves considerable. The coal is said to occur in eight beds, of which one at least is 6½ ft. thick, and to underlie at least 450 square miles. Work preliminary to exploitation will be pushed. Unfortunately, the distance of this coal from the copper fields, together with several transshipments now necessary, prevent its being of much immediate value to the copper belt. Recently, also on the west side of Lake Moero, some carbonaceous shale which may have coal associated with it was found, and drilling is to be done there. Other Katanga localities where coal or indications of coaly matter have been found, are Shiwa and Luweisha, on the Upper Lualaba, and the region of the Lubudi and Lovoi rivers (both western tributaries of the Upper Lualaba river).

Electric smelting is still being seriously considered and 50 tons of ore sent to an electric steel furnace at Ugine (Savoy) is said to have been treated with

GETTING OUT THE PAY. SLUICING ON A CONGO PLACER.

success. The furnace is to be adapted to copper smelting, and, if satisfactory after experiments on a large scale, electric smelting may be undertaken in the Katanga where waterfalls exist suitable for the generation of electric power. A subsidiary company will be floated to finance it.

Labor Problems

To date there has been no apparent shortage of labor at the smelter, but with the enlargement of the plant it is almost certain to come. The country to the south is but sparsely settled by blacks, while to the north the sleeping sickness is a scourge. Prospectors leaving for the northern Katanga country have, however, had great difficulty in recruiting porters even at almost prohibitive prices. The Katanga Labor Bureau was formed in July 1910 to remedy this condition if possible. The introduction of Chinese labor is a possibility. Elisabethville, the principal town of the copper belt, although continually improving as a city, suffered a year of depression. This was due in part to the arrival of more workmen, clerks, etc., during the boom than the country could support, to the intermittent character of the operation of the furnace, and to the unusually severe governmental land laws, and to the, for new country, excessive taxation. Although no particularly large production can be expected in the next year, Katanga should, a year hence, with good luck, become one of the larger copper producers, and certainly the business has in the past six months, taken on a more solid aspect.

Gold Mining

The state budget for 1913 appropriates for operating its gold mines and for prospection, about $477,750. The total gold production of the colony for 1912 will amount to some 1045 kg., valued at about $625,000.

At Kilo, the chief state placer in 1912, about 30 white and 2500 blacks were employed. In the first three months of 1912 about 192 kg. was produced and the year's production was presumably about 750 kg. Previous productions have been 1905, 20 kg.; 1906, 211 kg.; 1907, 325 kg.; 1908, 290 kg; 1909, 659 kg.; 1910, 876 kg.; and 1911, 638 kg. A giant has been installed and a road is being constructed to get in a dredge to work gravels of a large stream nearby the Chari. Pay dirt is also reported from the Nizi.

As described by H. Buttgenbach (*Annales* de la Société Géologique de Belgique t. XXXVI, Bull., 1909, p. 79-86) the region of Kilo is rugged. The valleys are heavily forested, but on the higher points only grass and bamboo grow. The stream bottoms show a greenish homogeneous plastic clay which in places contain white veins, merely the diorite country rock decomposed. Gold penetrates the top 4, occasionally 8, inches of the clay. On this clay rests the pay dirt, consisting of sand and somewhat rounded pebbles, usually one inch in diameter, but in instances 18 in. diameter. The pebbles are largely of diorite and quartz (some of it bearing tourmaline), although others are granite, chlorite, or talc-schist. In some of the quartz pebbles are cavities filled with limonite, containing a little gold, the remains of altered auriferous pyrite crystals. Considerable gold concentration has occurred immediately above the 'bottom.' Both overburden and pay streak vary much in thickness, and either may be 4¾ ft. thick, but average about 1⅓ ft. The gold occurs in grains and nuggets, which are frequently very thin, and is widely distributed throughout the region, but the value from point to point is variable. Workable gravels range in value from $0.45 to $37 per cubic yard. Presumably the gold is derived from pyritiferous quartz veins, but up to the time of Buttgenbach's investigations none had been found in place, and to date, although rumors of rich quartz finds are common, none have as yet been confirmed. Buttgenbach notes that the amount of gold decreases rapidly where the streams pass from diorite to biotite granite country rock, and soon thereafter stops. He found as float a quartz conglomerate showing free gold. The gold is said to be worth about 3470 francs per kilogram.

Sluicing began at Moto, situated about 325 miles southeast of Stanleyville, in the Savanna country, in November 1911. The country rock is said to be diorite and granite, and the gold content, as at Kilo, decreases rapidly where the streams leave the former rock and enter the latter. It presumably produced in 1912 about 200 kg. of gold. Twelve whites (through illness, etc., this number recently dropped to 5) and about 1500 blacks, are employed. The gold is said to be rather fine, and large nuggets rare. Ninety cents to $1.20 worth of gold per yard of gravel is considered profitable. Gravels treated early in the year ran from 2 to 10 gr. ($1.20 to $6) per ton. The deposit is less rich than that of Kilo, but in August 1912 about $720,000 worth of gravel is said to have been proved.

The Nebula-Bokwama state placer was exhausted during the year, its product having been approximately 27 kg. for 1912. The nearby Tele placer of the Belgo-American Forminiére Co. produced during 1912 about 70 kg. Sluicing is here being done on recent creek gravels. The pay, which is quite free from clay, is up to 4 ft. thick, and has a maximum width of 250 ft.. The discovery of several other placers is reported both in the northeastern quarter of the colony and near the German frontier to the north of Lake Tanganyika. It is probable that the exploitation of one of the former will begin in the near future.

Iron Ores and Ore Genesis

A number of the placers in the northeastern part of the colony, which to date has proved to be the most important gold region of the colony, are situated in countries in which hematite-rich rocks (in part, at least, clearly a replacement of schists) occur, and the placers are intimately connected with them. In places these rocks are banded and resemble the itabarites of Brazil. In the latter country gold is frequently associated with itabarite, either as auriferous pyrite disseminated in certain layers of the itabarites (Serra Mantiqueira and Serro do Espenhaco) as in secondary veinlets in them, or as in veins parallel to the schistosity, as at Passagem (Minas Geraes). At the latter camp a vein of quartz, tourmaline, auriferous arsenopyrite, pyrite, and pyrrhotite, dipping parallel to the bed-

ding of the enclosing itabarites, mica schists, and quartzites, has been worked for over a century. In South Carolina, Leiber reports somewhat similar rocks to be gold bearing. Further, similar occurrences are widespread in Africa outside of the Belgian Congo. The gold-bearing quartz lenses at Msalala (German East Africa) are, according to Dantz, in a ferruginous quartzite resembling the

Brazilian itabarites. At Steynsdorp, south of Barberton in the Transvaal, and at the Grant mine in Rhodesia, similar rocks are associated with gold deposits. Ralph Stokes[2] states that the gold-bearing orebody of the Wanderer mine in the Selukwe district, Rhodesia, is an impregnation in banded ironstone, and that the gold content rises with the increase in the amount of iron present (hematite and limonite). In Manicaland, masses of ferruginous quartzite are used by prospectors as gold 'pointers', much as they are in the northeastern part of the Belgian Congo. To date the significance of this association in the Belgian Congo is unknown, for no gold has been found in the hematite itself, and although cut by quartz veins, the latter are apparently barren. The actual source is perhaps the stringers or lenticular veins in the schist nearby (rich gold quartz is found from time to time in the sluices), or in pyrite which in places is abundantly disseminated in the schist. The hematite schist may have merely furnished solutions capable of precipitating the gold, or it may be that the great differences in hardness of the hematite-rich rocks and the adjacent schist or granite, may cause near the contact fractured areas favorable to ore deposition. The analogy between the geology of the Central African plateau and Brazil is close, and the mineral resources of the two regions resemble one another. Not only are diamonds widely distributed over these two regions, but also the association of gold deposits with hematite schists is similar. Further, there are many analogies between the iron-ore deposits of the two countries.

Certain tentative generalizations upon the characteristics of gold placers in tropical countries may be of interest, for in certain characteristics they appear to differ from those of either arid, temperate, or frigid countries. In tropical countries, because of the rapid break-down of the country

[2] 'Mines and Minerals of the British Empire,' p. 242.

rock, both mechanically and chemically, an originally small gold content is collected into profitable placers, where in a country of less active erosion no workable deposit would probably exist. Placers in tropical countries are thus believed to be, even more frequently than in other countries, unassociated with payable original deposits. Due to this same rapid break-down, important detrital deposits are comparatively common in tropical countries. Some occur above or down the slope from well defined veins, as the well known *mantos* of Nicaragua, and the detrital deposits down the hill-slope of the Ruwe gold mine in the Belgian Congo; others are unassociated with well defined veins, as the gold-bearing laterites of French Guiana, which are the more chemically resistant ferruginous portions of auriferous basic igneous rocks. The *flor de tierra* and the veined *canteras* of Venezuelan Guinea are stated by Longridge to be, to all intents and purposes, detrital deposits. In Sarawak, Borneo, much gold is washed from clays, the weathering of auriferous country rock in place. F. P. Gamba[3] states that in southern Colombia "In general the mines of the belt present two types of ore deposits: first, the *mantos*, that is the impregnated rocks transformed into an earthy (saprolitic) material; and, second, the veins more or less regular in formation." At the Eastern mine,[4] on the central part of Kalakabo hill, Araroy district, "the entire hillside to the northeast is covered with quartz from the wash of these veins." This material has been extensively worked for gold by the natives. Due also to the rapid break-down of the country rock and the high transporting power of tropical streams, it is not unusual that natives, with their low working-costs, are enabled, after the rainy season, to return to, and gain a pittance of gold from, streams exhausted the year before. This is frequently the case in tropical South America, and also in Madagascar. Regarding somewhat similar conditions in the diamond region of India, Gardner F. Williams[5] states that "In some of the diamond-bearing districts of India today the native villagers are searching for diamonds exactly as their fathers did in days of remotest tradition. After heavy rains that wash away loose soil, a sprinkling of diamonds may be found in exposed sandstone breccia, and sharp-eyed Hindoos scrape the face of the ground for the precious crystals." And he adds further (page 19): "At the opening of the dry season, thousands of villagers, men, women, and children, began to search every cleft and cranny in the river bed for diamonds. With *ankovas*, or light picks, the men broke and scraped out the diamond-bearing bed and piled the broken ground on the river bank." Not only is the gold of tropical placers, because of frequent shifting of the gravels by the torrential streams and heavy rains, apt to be concentrated to an unusual degree at bedrock, and particularly in the lowest part thereof, but the same torrential rains also frequently cause a concentration at the immediate surface. The lighter material is scoured away, with a resulting gold enrichment at the grass roots. The thousands of 'riffles' formed by the roots of the luxuriant vegetation aid the process. Wallace E. Pratt[6] states that in the Pajo river region, Catanduanes Island, "Owing to the scanty clay covering on the limestone reefs, the gold is very conspicuous. After rains the natives panf over the rivulets which cross the ground, sometimes winning as much as a peso in a day's work. However, test holes over considerable area indicate that the reefs are not rich. They appear in places to be rich because specks of gold may be seen on the surface of the ground. In reality, the few specks that are visible constitute all the gold occurring in that area; consequently the value per cubic metre is low." In valuing tropical placers, these two factors must be taken into consideration. It is probable, too, that in tropical countries the solution of gold from veins and detrital material and its later precipitation upon older nuggets or around new centres of crystallization is more common than elsewhere. This is not only due to the chemical activity of the waters, but also to the abundance of vegetal matter which may act as centres of precipitation. At Ruwe, in the Belgian Congo, the vein contained gold only in a state of finest subdivision, associated with platinum, silver, and palladium, although in the streams heading at the vein, nuggets of considerable size were comparatively common, containing some silver alloyed with the gold, but no palladium. From the greater chemical activity of tropical waters it might be thought that the gold of tropical placers would be unusually fine and contain little silver. Although the gold of some tropical placers is of unusually high grade, this does not appear to be a constant rule, since the purity of placer gold is largely controlled by two factors common to all placers: first, the fineness of the gold in the veins from which the gold was derived; and second, the distance downstream from the original source at which the gold is found. For dredging, the abundance of stumps is a drawback of tropical placers only partly offset by the comparatively thorough disintegration of all bottoms except those of the most resistant rocks. Sluice operations in the tropics is handicapped not only by the rather rapid rotting of wood, but also by the attack of white ants which affect not only wooden sluices, but the timber of dams.

Discovery of Diamonds

The Katanga Special Committee and the Tanganyika Concessions, Ltd., the latter with its ally, the Zambesia Exploration Co., financed in 1911 a company called the Kundulungu-Lualaba Company, to prospect for diamonds in the Katanga. In this region diamonds were found in the gravels of Mutendele creek in 1907, and 95 miles away some eight pipes of kimberlite, the rock in which the South African stones occur, cut the Kundulungu (Permo-Carboniferous) red sandstones. During 1912 the largest pipe (at Luanza) was prospected, but because of labor shortages and the hardness of the rock progress has been slow. A number of stones about equal in water to those of German

[3] *Trans.* Amer. Inst. Min. Eng., October 1911, p. 856.
[4] 'Mineral Resources of the Philippine Islands, 1910,' p. 11.
[5] 'The Diamond Mines of South Africa,' p. 17.
[6] 'Mineral Resources of the Philippine Islands, 1910.' p. 29.

Southwest Africa have been found.[6] Work on a second pipe is soon to be started. M. K. Shaler states that the surface of the Luanza pipe is covered by grass in contradistinction to the surrounding scrubbily forested Kundulungu soil with its numerous flowers. In the decomposed yellow ground a mica (determined by Buttgenbach to be bastite), ilmenite, garnet, and olivine are readily distinguished.

D'Andrimont[7] has recently described his visit to these pipes. Structurally they are, judging from his description and figures, quite similar to the South African diamond pipes, and are as a rule several hundred yards in diameter. The largest pipe, Luanza, is elliptical, its dimensions being about 300 by 500 metres. In addition to small rock inclusions, it contains a large mass of sandstone resembling a 'floating reef.' From the surface down various pits pass through:

	Feet.
Clay, containing quartz pebbles	3 to 6½
Detrital or alluvial clay, with many pebbles, at certain points cemented by iron ('laterite')	6 to 20
Yellow ground, changing into less altered ground at the greatest depth yet reached (about 90 ft.).....	6 to 20

The much-altered yellow ground consists of chromite, amphibole, olivine, an almandin garnet (said by Buttgenbach, however, to be spessartine), and quartz, and in it are rounded masses of sandstone, a schistose calcareous rock, felspar crystals, and rolled fragments of quartz. Concentrates consist of garnet, chromite, olivine, quartz, an amphibole and black mica, besides various rock fragments. All of these minerals are found at Kimberley with the possible exception of amphibole, which may be in realty a pyroxene (omphacite), as suggested by Buttgenbach. The rocks cut by these apparent pipes are of Karoo age, as are the rocks cut by the analogous pipes at Kimberley.

In the southwestern part of the Belgian Congo exist[8] alluvial deposits of diamonds which have been already proved, at least as to certain small yardages, to be exploitable, and in the southeastern portion of the colony, as mentioned above, pipes of a rock exist which appears to resemble closely the kimberlite of South Africa. This rock is at least feebly diamond-bearing, but whether commercially so remains to be proved. The large number of noncommercial kimberlite dikes in South Africa is well known, and if the pipes in Katanga first prospected are unpayable, others may later be proved to be of value.

Tin Mining

A party consisting of several white engineers and some Chinese from the Malaysian tin districts, is soon to leave for the tinfield in the southeastern part of the colony owned by the Union Minière du Haut-Katanga. The work is to begin at Kasonso, and this field will presumably be exploited actively upon the arrival of the Elisabethville-Bukama railroad in 1915. The tin occurs both in pegmatite rock and in placers. As stated in this review last year, a continuation of the Katanga tin belt has been found by one of the companies, and at Muika, near Kiambi, on the Luvua, the same company (the Thys-Jadot group) has recently found some cassiterite-pegmatites and tin alluvium deposits which are now being exploited in a preliminiary way. M. K. Shaler states that the country rock is biotite schist cut by muscovite granite. All these rocks are intruded by pegmatite consisting of sugary white quartz, pink felspar, and muscovite, the last in plates up to one inch in diameter. Specular hematite, tourmaline, and cassiterite are accessories, the latter in crystals up to one inch in length. The tin, which appears to be very unevenly distributed in part, at least, replaces felspar. Tin showings are said to have been traced for two miles. Below the lode is a rich detrital material, probably 40 ft. in maximum width. About 15 whites are now on the ground, and prospecting and preliminiary mining is apparently to be pushed, as ground sluicing is to be started soon and a 5-stamp mill with tables and other machinery is to be erected. In prospecting, about 10 tons of ore carrying 80% cassiterite has been extracted.

The northwest face of the red sandstone capped plateau, called Monts Mitumba, is composed of mica schists, quartzite, and slate, intensely intruded by granites and pegmatites. This appears to be for a distance of about 250 miles a potential tin belt, striking from northeast to southwest. The Union Minière du Haut-Katanga has tin holdings for 175 miles along the southern portion of the belt; north thereof is an extension owned by the Thys-Jadot group, while still farther north along the strike, and in similar rocks, is Muika.

Prospecting and Petroleum

Prospecting has been actively carried on by the Colony, the Great Lakes railroad, and the Société Internationale Forestière et Minière du Congo ('Forminière'), in the northern half of the colony by the last-named company and the Lower Congo-Katanga railroad in the southwestern part of the colony, and by several companies and a considerable number of independent prospectors in Katanga in the southeastern part of the colony. Drilling for oil near Stanleyville by the Grand Lakes railroad has so far been a failure. In the Lower Congo, at the eastern limit of the coastal plain, highly bituminous sandstones outcrop and several small oil seeps occur. It is possible that an oilfield may be developed here.

In the Katanga, in addition to the seven important prospecting companies existing in 1911, two others were incorporated in 1912. There were in all from one to two hundred men prospecting in this region. The larger companies, which have a right to select for exclusive prospecting mineralized areas of from 750 to 3500 square miles, and eventually to choose therein certain areas for exploitation, have already reserved about 10,000 square miles. In addition, about 158 smaller areas for further prospecting had been staked up to July 1, 1912, by prospectors working for themselves or in the names of various companies. The greater number of these

[7] Société Géologique de Belgique, *Bull.* XL, pp. 100-113, Dec. 15, 1912.

[8] S. H. Ball, *Eng. & Min. Jour.*, Feb. 3, 1912, pp. 268-9.

blocks are held for copper, gold, and tin, although bituminous schist, iron, coal, manganese, lead, and salt are also included. Gold placers can be worked at a profit in this region if rather rich; the other finds, with the possible exception of tin, will presumably have to await better transportation facilities, and it will presumably be several years before the value or non-value of most of the blocks is known. Evidently, taking into account the area reserved by Tanganyika Concessions, about 35,000 square miles is withdrawn, at least temporarily, from prospecting in the Katanga.

Production and Stocks of Metals

In the course of his presidential address delivered before the Institution of Mining and Metallurgy, March 13, Bedford McNeill presented the following striking figures illustrating the world's production and accumulation of metals:

INCREASE OF WORLD'S PRODUCTION OF METALS

	Tons, 1901.	Tons, 1911.	Increase for decade, %.
Pig iron	41,000,000	65,000,000	58
Copper	526,000	884,000	68
Zinc	500,000	900,000	80
Lead	850,000	1,100,000	29
Tin	88,000	116,000	32
Nickel	9,000	24,000	144
Aluminum	7,500	46,000	513
Mercury	3,000	4,000	33
Silver	5,300	7,500	41
Gold	380	680	79
Antimony	10,000	23,000	130

Taking gold first, for the 108 years from 1493 to 1600, the average annual production was a little under a quarter of a million ounces. Taking the next 100 years, from 1601 to 1700, this figure approximated to a little less than one-third of a million ounces; for the next 60 years, 1701 to 1760, the output approximated to two-thirds of a million ounces. From the earliest date (1493) until 1840 there was only a gradual rise in production, but from 1841 onward the increase was marked. The discovery of gold in California was in 1848, and in Australia in 1851, and the effect of these two discoveries was shown in the output for the next 40 years. From 1851 to 1860 the average annual output was 6.4 million ounces; from 1861 to 1870, it was 6.1; from 1871 to 1880, 5.6; and from 1881 to 1890, 5.1.

This last date coincides with the starting of the Transvaal output in 1889, which owes so much to the simultaneous successful application of the cyanide process. Then followed an enormous acceleration in output, and in 1911 the total output reported for the world was 22½ million ounces. In other words, the world's present average production in one year is now equal to more than the total production for the 60 years preceding the year 1700.

Another way of bringing the gold production vividly before you is the statement that it is estimated that 653 millions sterling was added to the world's stock of gold for the 358 years from 1493 to 1850, whereas for the 11 years alone of this present century, that figure of 653 millions sterling has already been exceeded by the output of 867 millions sterling. Or again, there has been added to the world's stock of gold during the last 15 years a quantity greater than the total amount previously known to exist in the civilized world.

In the case of silver, commencing with the ten years 1801 to 1810, there was an average annual production of 29 million ounces. This figure dropped to 15 million ounces 1821 to 1830. The successive figures for average annual production are:

Period.	Million oz.
1831 to 1840	19
1841 to 1850	25
1851 to 1860	29
1861 to 1870	39
1871 to 1880	71
1881 to 1890	100
1891 to 1900	162
1901 to 1910	182
1911	252

It is remarkable that for a period of ten years (1901-1910) the weight of silver produced should have been maintained at a ratio as regards gold of 10 to 1, and this notwithstanding the great differences of locality and of the conditions under which the two metals are produced.

TOTAL PRODUCTION OF GOLD AND SILVER

		Gold		Silver	
Period.	Number of years.	Million oz.	Value in millions sterling. £	Million oz.	Value in millions sterling. £
1493-1660	168	41	173	1,490	514
1661-1850	190	113	480	3,320	952
1851-1900	50	334	1400	4,010	750
1901-1911	11	205½	867	2,062	226
Totals	419	693½	2920	10,882	2442

The total figures are not very dissimilar, namely, gold 2920 millions sterling, and silver 2442 millions sterling, but this is explained by the fact that the measurement of value is fixed by gold. The total world's production of silver, from the discovery of America, say 400 years ago, is estimated roundly to have been nearly 11,000 million ounces, and there was, of course, a large quantity of silver in the world before then. Taking the present world's stock, therefore, as being 12,000 million ounces, the value at its present price may be approximated at 1200 millions sterling, more than one-half of which has been added to the world's stock of silver during the last 60 years.

Tasmanian Mineral Output

According to the Tasmanian Mines Department, the mineral production of that state during the quarter ended December 31, 1912, was as follows:

Mineral.	Quantity.	Value.
Gold, ounces	7,774.7	$158,400
Silver-lead ore, tons	22,160	350,000
Blister copper, tons	474	210,000
Tin ore, tons	1,121	$10,000
Coal, tons	12,763	27,000
Wolfram, tons	23	9,800
Bismuth, tons	1.5	2,400
Osmiridium, ounces	142.6	5,000

Copper Mines in Chile—III

By Juan Blanquier

Las Condes District

This important copper district is situated at 33° 10′ south latitude and 80 miles in a straight line from the port of Valparaiso. The altitude is 11,800 ft. The climate is dry and cold, with abundant snow in winter. Rainfall is unusual. The only available means of communication is by wagon-road, 40 miles long, connecting this district with the Central State railroad line. The junction is at the city of Santiago. The road above referred to follows the course of the Mapocho river from its source, where the mines are situated. This river in its lower course crosses the city of Santiago and empties in the Maipo river farther down.

The mining district as a whole is surrounded by dioritic mountains; the characteristic feature being an enormous rhyolite dike over 1000 ft. above the general level of the camp and which has broken the dioritic formation and forced its way through. This dike, probably 3 miles long and 15 miles wide, runs from east to west across a creek formed by two dioritic ranges. To the north and south of the dike and extending for about one and a half to two miles in each direction, is a deposit of volcanic breccia which is bounded by the dioritic formation. A number of dioritic dikes cross the breccia which is formed of pieces of dioritic rock cemented together by a magma of tourmaline. The breccia is the ore-bearing rock.

Enormous orebodies of practically pure chalcopyrite, assaying 24% Cu, occur in the breccia deposit. I recollect that the excavation left after the extraction of the ore from one of these orebodies was approximately cylindrical, 150 ft. deep, and averaging 20 ft. in diameter. The ore extracted and still apparent on the walls of the excavation, is chalcopyrite assaying 24% Cu. There are a number of claims covering the deposits south of the rhyolite dike and a good many mines in operation, while north of the rhyolite dike the deposits have attracted little attention and no work is being done. Of the mines situated south of the dike, two of them are by far the most important of the district. They are close together and show the same kind of deposit.

The 'Disputada' mine, owned by the Perez Ovalle interests, covers an area of about 10 acres in the centre of the district, and is entirely inside the breccia deposit to which reference has been made. The underground work comprises a number of incline shafts and short levels, the deepest workings being at a depth of 430 ft. from the surface. This underground work was done while prospecting for the rich orebodies which occur in lenses. When the first of these was found, an adit 2000 ft. long was run which connected with the bottom of the underground workings. This drains all the water from the mine and is now used for the extraction of the ore mined; all work being done in the levels above the 430-ft. level. Ore is mined exclusively from the rich orebodies, the method of work consisting in connecting these with the main adit by raises. The ore broken runs by gravity through these raises into the main adit, where it is hauled in small cars of one-ton capacity to the dump on the outside.

No machinery whatever is used inside or outside the mine. All drilling is by hand and drainage and ventilation are served by the main adit. The ore coming through this is dumped in an open space. Hand picking is scarcely necessary, as practically all is pure chalcopyrite. Separation of the fine from the coarse is accomplished by hand screening. The fine and coarse are put into sacks separately and shipped to the smelter on mules or in wagons drawn by five mules. The smelter is 15 miles from the mines, and the differences in altitude between them is 7000 ft. Wages average $1.50 per day (10 hours). The cost of mining per ton of ore ready for shipment to the smelter is $1.40. Transportation to the smelter is $3 per ton. The 'Disputada' mine employs an average of 50 men, its output being 3000 tons of 24% copper ore per year. Transportation is discontinued during the three months of winter on account of the deep snow.

The total output of ore of the district averages 6000 tons, carrying about 24% copper per ton, all of which is mined from rich orebodies as described above. In mining them, enormous quantities of lower grade ores have been opened. Under the present condition and method of mining, however, these cannot be worked at a profit. There are in this district some 30,000 tons of ore on the dumps of the different mines which will average at least 6% in copper, the result of the sorting of the rich ores mined. As stated above, practically all the extensive breccia deposit, where the rich orebodies are found, is mineralized, and nearly the whole of it is susceptible of working at a profit by the adoption of modern methods.

The Braden Copper Company.—The Braden Copper Co. is an American concern which works an important copper deposit in Chile. Its property covers an area of 1190 acres and is situated in the province of O'Higgins at 34°10′ south latitude and is 94 miles in a straight line from the coast. The altitude is 7500 ft. The climate is good. There is an abundance of water in the streams and rivers. The rainfall is infrequent, but there is some snow in winter. The mines are connected with the Central railroad line belonging to the state by a private narrow-gauge line 50 miles long and by a good wagon-road 34 miles long, both built by the company. At the junction with the state railroad is the town of Rancagua, with a population of 12,000 inhabitants. This town is in the big longitudinal valley that is the major physographic feature of the country and where fruits, crops, and cattle

are raised. The climate is ideal. The company's railroad starts from Rancagua at an altitude of 1600 ft., ascends the course of the Cachapoal river up to the mines, 7500 ft. high, with a total length of 50 miles.

The copper deposit is in the crater of an extinct volcano, in the contact between the eruptive volcanic tuff that fills the crater and the outlying porphyritic rock. The mineralization occurs all around the edge of the crater in the shape of a deep ring of about five miles in circumference and 160 ft. in thickness, which has been proved to a depth of 2200 ft. from the surface. The development up to the beginning of 1912 has shown 10,000,000 tons of ore of 2.7% copper. Sulphide copper ores predominate from the surface, such as bornite, tetrahedrite,

NEW MILL OF BRADEN COPPER COMPANY

and chalcopyrite, and are found disseminated in a porphyry gangue. The ore is concentrated by water in a mill of 3000 tons capacity every 24 hours. The concentrate averages 20% copper and is smelted, converted, and refined into electrolytic copper at the reduction plant of the company, which is situated a few miles from the mine. The cost of production is given as 7.61c. per pound of electrolytic copper placed upon the market. The annual capacity of the plant is 35,000,000 lb. of refined copper. I may mention that the company has an important hydro-electric plant of 10,000-kw. capacity generated by water-power derived from the Cachapoal river, situated about 20 miles from the mines. Electric power, transmitted from this power-plant, is exclusively used in the mines, reduction plant, and electrolytic refinery. On account of the cheap and abundant power available, the electrification of the 50 miles of railroad to the mines is planned, and an experimental plant of 50 tons daily capacity for treating the concentrate by leaching and electrolytic precipitation is now in operation. If the results of this experimental plant are satisfactory, all the concentrate will be treated by this process in the future and a saving of 2½c. per pound of copper, in the operation costs, is expected. The cost of refined copper in the market would then be 5.11c. per pound. The company has $10,000,000 in stock, the par value of which is $5 per share, the actual market value being $10.37½. More data referring to the Braden Copper Co. may be had from the official reports of that company.

A Company Mine-Rescue Car

The mine-rescue car which has been in course of construction at the Lehigh Valley Coal Co.'s shops at Drifton, Pennsylvania, has now been completed and is fully equipped. Rescue outfits have been kept for the last half dozen years at four central points in the company's collieries, and the mine-rescue car is to be maintained ready to be rushed on call to any point in addition to these previous provisions. The car is a former combination baggage and smoking car. The side doors of the forward half, or former baggage part of the car, have been left as they were, and especially prepared flights of steps are carried beneath the car in order to facilitate the transportation of any injured mine-worker in through the broad doors. The forward compartment, to which easy access is thus gained, contains the operating table, surgical instruments, lockers for the men's clothes, water coolers, and the first-aid supplies, consisting of splints, bandages, absorbent cotton, Red Cross towels, Bellevue gauze, adhesive plaster, picric acid gauze for burns, germicidal soap, tourniquets, and aromatic spirits of ammonia. Hospital authorities were consulted and passed on every point, from the height of the operating table to the medical supplies.

In this compartment there are also six regular United States Army stretchers in overhead racks, a dozen rubber blankets and twice as many woolen ones. Here also are the fifteen big oxygen tanks, held in racks along the wall, and the pump for charging the Draeger oxygen helmets, a dozen of which line the wall at the forward end of the compartment. These hang above the low lockers in which the stores are kept, and which are so constructed that a cot arrangement which will accommodate four men can be placed on top of them. Rows of spare potash cartridges, and of small oxygen tanks, are kept in racks around the ceiling, with tools for any kind of inside work, saws, axes, hatchets, picks, and hand drills for mining, ventilating, and timbering.

The latter half of the car contains a stove for cooking, shelves and a sink, tables which can be stowed away in an overhead rack, and two facing seats which can be converted into a bed. The water-supply is carried in an overhead tank, and both hot and cold water are at all times available. The car is heated by steam, so arranged that a steam hose can be run to it from any colliery, and the radiators have ample heating surface so as to insure comfort for its occupants in any weather. It carries two fire extinguishers to protect the car itself from fire, and two larger extinguishers to be carried into the mines. The car can accommodate 15 men, and while primarily designed for actual rescue work, it is never idle, as it is also used as a demonstration and instruction room for teaching the men at the various collieries this most important work. It is in charge of the rescue foreman, and the men to receive instruction are selected by the mine foremen, but the company issues a certificate to them when they are sufficiently expert, and this may be withheld if they do not qualify.

Organization of Smelting Enterprises—I

By Herbert Lang

The greater number of reduction plants are built by companies or individuals who are already engaged in mining, as a necessary adjunct to their mineral properties. Others are set up in order to enter upon the business of buying and reducing what are called custom ores, that is, ores which are bought and sold in the market. While in the former case policy dictates that the works be put as near as may be to the point of production, in the latter it is generally found expedient to place them in localities central to a large number of producing mines and convenient to good facilities of transportation, which cut a great figure in this kind of enterprise, enabling the most desirable ores to be secured for the processes. Whether the works comes under the one or the other head, the procedure which governs its inception is much the same as in organizing any sort of industrial undertaking. While there is no reason why such enterprises cannot be carried on by single individuals or by partnerships, they are usually maintained by incorporations, upon whose organization may profitably be expended a few moments' study. Such incorporations are commonly managed by sundry officers, whose duties vary but little throughout all mining countries.

Functions of Directors

At the head there is a board of directors—or, as known in some regions, a board of trustees—in whom reposes all the authority of the concern, and which they may, by vote, delegate to subordinates of their own selection. The directors are chosen at regular meetings of the stockholders and hold office as a rule for one year. Their duties vary somewhat with the laws of the country, and also with the degree of their accountability to the stockholders whom they represent. In America these duties are much less stringent than in England, for example, and may be and frequently are performed in a perfunctory and careless sort of way that at times works to the prejudice of the company. Quite as often, however, this apparent looseness and carelessness works to the advantage of the organization, as it devolves the important duties upon those better fitted for it. The English system, by placing heavy responsibilities and wide powers on the directors at home, puts a premium upon ignorant intermeddling; the American, by reposing confidence in able if sometimes dangerous employees, brings out the best or the worst there is in them, and bespeaks a great success or a great failure. The American system makes the best managers and the greatest engineers; the English the best accountants and routine men. The directors in America receive no compensation, as a rule, but on the formation of the company some shares of stock are usually divided among the earlier members as a sort of payment for their services. In other countries they receive so much for each sitting that they attend. The president—in England the chairman—of the board is elected from their number, and he, if he be charged with active duties, may receive a regular salary, although in this country it is often esteemed *infra dig* to accept such. In England the managing directors, generally two in number, who are delegated to perform the services which in this country are supposed to be performed by the president, are in the habit of receiving substantial sums therefore, by vote at the annual meetings of their companies. Business ability is chiefly sought in such places, but social and political celebrity are not without their influence. Technical knowledge is of course equally important as business ability, and it is often remarked that companies are successful in proportion as the managers possess among themselves a practical knowledge of the art in which they have embarked. Although it is often quite practicable to secure technical operatives of approved skill, it is still desirable that the business managers of the enterprise should understand quite fully the requirements of the work in order that the technical staff shall be properly supported in their plans and efforts.

Briefly, the principal functions of the board of directors are: to conduct, manage, and control the affairs of the company; to make rules and regulations for the guidance of the officers and managers of the corporation; to appoint and remove for cause all officers, agents, and employees, and fix their compensation. A majority of the board constitutes a quorum, which has full power to transact business. The officers are, in America, the president, vice-president, secretary, treasurer, and sometimes a manager or general manager. The two former must be members of the board, and sometimes the secretary and treasurer also must be. They severally hold office at the pleasure of the board. The secretary almost universally, and the treasurer quite frequently, are in receipt of salaries, usually quite moderate.

The President and His Duties

The president's duties are to preside at all meetings of the board and of the stockholders; to sign papers requiring the company's signature; to sign certificates of stock; to draw checks upon the company's funds; to supervise and control, subject to the board of directors, the subordinate officers of the company; and to make reports to the stockholders, at their meetings, of the conditions of the company. Such reports are commonly made at the annual meetings of the stockholders, which are an important and in some respects an obligatory feature. The vice-president's duties are confined to serving in the presidential capacity at meetings when the president himself is absent.

The secretary has the custody of the company's seal, which he affixes to such papers and documents as may require it. He keeps a minute of the proceedings at the meetings of the board of directors, and of the stockholders. He keeps the accounts of

the company, attends to all transfers of stock, and has charge of the books. He counter-signs the stock certificates as they are issued, as well as all drafts that may be officially signed by the president. He receives the money due to the corporation and deposits it with the treasurer. He makes out the regular statement of receipts and expenditures which accompanies the annual reports.

The treasurer is the custodian of the company's funds, and pays them out upon drafts drawn by the properly constituted officers. Such is the customary organization of the corporations that carry on the great metallurgical operations of the century.

The General Manager

It has become quite common of late years for industrial companies in America to place the immediate conduct of their affairs in the hands of a manager or general manager, whose duties resemble in a measure those otherwise given to the president, while being of a more practical nature. The manager in such cases stands between the board of directors and the subordinate employees, and also between the company and its customers. All business dealings are in his hands, and the routine of buying and selling is particularly under his control. An increasing tendency is observed among such companies to erect in this manner a sort of one-man power, with the manager at the head, taking away a part of the duties and authority, on the one hand, of the president and board, and on the other of the superintendent of the works. The latter, who in addition to the direct conduct of the works often possesses considerable authority in related matters of business, now finds himself to a large extent confined to the technical management alone.

The Superintendent

The superintendents of most of the more important reduction works are men of technical education and training, as befits their calling. It often happens, however, that whatever the need be of men of this sort, such places come to be filled and well filled by persons whose time has been spent and their experience gained rather in actual practice than in theoretical training. Some of the best superintendents of metallurgical works are persons who have never entered a school of chemistry, but have grown up as it were alongside a furnace or stamp battery, and graduated into responsible places by dint of observation rather than by the study of books. But, however many instances there may be such, the fact remains and must not be lost sight of, that the technical manager of a successful works must be a technical man, and also that the best education for a technical man is acquired, or at least begun, in a technical school. If we divest the superintendent of those duties which are purely of a business cast, such as hiring and discharging employees, signing pay checks, supervising account keeping, rendering reports of the routine work done, buying and issuing supplies, and making returns on ore consignments, in the most of which he is assisted by ordinary clerks and bookkeepers, the remainder relates closely to strictly metallurgical matters, among which are the calculating of the charges for the furnaces, the supervision of the various operations, and the minutiae of tests, assays, and analyses, all devoted to the perfect working of the plant. Thus a considerable amount of business skill is expected of the man in charge, as well as, in the ordinary case, much metallurgical skill of a practical sort. Since there are two sides to these qualifications, the business and the metallurgical, it is easy to understand why the positions of this sort are filled now by metallurgists who have risen it may be from the laboratory or the assay office, and now by business men who have graduated from the counter or the desk. The latter may make the best superintendents, the more especially if they have procured enough knowledge of chemistry to enable them to understand the theory of the operations under their charge. In most cases it is probably better to have a man who has a good business ahead, along with a little knowledge of science, than a truly scientific one who knows but little of the ways of the commercial world. It may happen that the man in charge of even important works may possess no knowledge whatever of metallurgy; in which case it is essential for him to make the best use of that of others. Given the proper kind of subordinates, he may utilize their knowledge to a great extent, and by the use of tact produce equally as good results as the most skilled operators. We can see, therefore, that in these places success is more likely to be achieved more frequently by shrewd management than by individual accomplishments.

Business v. Technical Men

Given a superintendent who is merely a business man, his necessary complement is a metallurgist who is competent to plan and conduct the regular operations of the establishment. This is a scientific person who has spent it may be years in acquiring a knowledge of the principles and practice of ore treatment. He is almost necessarily a school man, and his knowledge of natural science is of first importance to the concern. In small establishments he may be the only technical man about the place, combining the duties in himself of the assayer, the chemist, and the metallurgist. In addition to these he may even act as the superintendent, a position that he is likely in the course of time to be advanced to if he shows any aptitude for the management of affairs. The duties of the metallurgist are to plan and direct the actual operations of ore treatment, he being the technical man, *par excellence*, of the establishment. He is necessarily a skilful and expert chemist, who has specialized upon the lines followed in the works, and he has under his orders the staff of chemists and assayers, his chief business being to correlate the results which they have obtained and apply them to the conduct of the processes. Being regarded oftentimes as the brains of the institution, he exercises in some situations a greater influence upon the fortunes of the company than any one else, his technical skill sometimes surpassing in its effect the best business and administrative skill at the command of the corporation. This fact

is especially true of those metallurgists who are connected with smelting works, who have in numerous cases built up the fortunes of their companies, while profiting considerably, perhaps, themselves. In such works the most marked of their duties consist in making up the charges, as it is termed; which means performing the calculations upon which the ingredients of the smelting mixture are arranged and weighed out. This, it is hardly necessary to say, demands an accurate and wide knowledge of the effects of the different components, as well as a deep working knowledge of the commercial aspects of the business, which vary from day to day and demand the closest attention that can be given.

Metallurgist and Chemist

It is difficult to discover the line of demarkation between the metallurgist and the chemist. Strictly speaking, the chemist discovers facts as to the composition of the bodies before him, while the metallurgist makes use of the facts to carry on the work. In reality, however, the two occupations are but one in many, perhaps most, cases. It is not a long step between making an analysis of an ore, and using the information thus acquired to calculate the charge of a furnace. Accordingly, many chemists perform the functions of metallurgists, and, on the other hand, many metallurgists do their own analytical work.

As might be surmised, it is only in the larger establishments where such a complete division of labor is necessary that both metallurgists and chemists are in control. In smaller and less pretentous ones there may be but a single person to combine all the functions of the metallurgist, the assayer, and the chemist. The difference between the assayer and the chemist is nominal. Originally the difference was that the former worked exclusively by fire methods, while the latter used indifferently wet and dry processes. Nowadays many wet methods, some of extreme accuracy and elegance, have been included in the assayer's curriculum, making his work almost identical with that of the chemist. Consequently the boundary which divided their crafts in years gone by has now become partly obliterated, and it seems that the division is becoming year by year more nominal. The practice in both assaying and chemical analysis has improved vastly within recent years, the increasing number of graduates of technical schools who have taken up such work having had an excellent effect upon the morale and personnel of those branches. Better methods have been introduced and better educated men have taken hold of the work. The useful effect of these schools extends to all branches of metallurgy; while everyone knows how much mining and especially mining engineering owes to the influx of the numerous well equipped young men whom the schools have turned out in increasing numbers within late years. The large majority probably of both assayers and chemists now active are from the technical schools, the most of them endeavoring to qualify themselves for higher work against a time when an opportunity may arise for advancement. Few assayers in particular look upon their calling as fixed or final.

Mining at Highland, Wisconsin

By W. F. Boericke

The Highland field in Wisconsin for nearly fifty years has been worked by lessees for 'drybone' (zinc carbonate) or galena. The field is a typical poor man's camp. The ores occur near the surface, often practically at the grass roots, and no water has to be handled. The ore is easily cleaned, either by hand sorting or by a simple jig, and commands a ready sale. A rich agricultural country surrounding makes living cheap. Timber is plentiful and can be easily obtained when needed. The ground is easily prospected, and with practically no capital but pick and shovel, a couple of men can sink a shaft and start mining. The methods and equipment used are often extremely primitive, but are adapted to the conditions, and no doubt in many cases deposits of ore are worked successfully with them that would not prove profitable with more elaborate means of exploitation. It would be almost impossible to get Western miners to work in the narrow low cramped places of many of these Highland mines, but the native miners are accustomed to it, and take it as a matter of course. They appear to be as much at ease lying on their backs and gouging out a sheet of 'bone' with picks as though they had six feet in which to work instead of four.

Primitive but Cheap Methods

Recently I had occasion to examine a prospect worked by three men on the customary 10% royalty. The shaft was some 35 ft. deep, and entirely dry. A venerable horse, which, it is scarcely necessary to observe, started the whim on the tap of the bell and stopped with mathematical exactness when the 200-lb. bucket reached the top, did the hoisting. No danger of any overwinding there. At the bottom of the shaft we dropped down on our hands and knees and crawled along the track a couple of hundred feet to the face. The drift was scarcely 3½ ft. high, and, as customary, filled on either side with waste rock, only space enough being left for a man to push the car. The lessees were after a 4-in. sheet of 'bone' and 'lead,' which 'made' along the roof in what is locally called the 'brown rock opening.' Their method of working was to gouge out the ore with picks for a distance of 12 in. or so from the face, and then 'bar down the deads,' which broke easily in the slabs, until the face was perpendicular again. The waste rock was used for filling and supporting the roof, though heavy undressed oak timbers were used between the gob walls and the face, the roof being heavy and seamy. Practically no powder was used. These men were making good wages for this country and appeared well satisfied. Under the conditions, they were probably working the little mine with the highest efficiency, for it is doubtful if the ore would have paid for working on a more extensive scale.

On account of the peculiar local conditions, it is usually cheaper to sink a new shaft than to try to handle the ore any distance underground.

Two men would have no trouble in sinking a 50-ft. shaft in a couple of weeks time, and I know of one instance where a 53-ft. shaft was sunk in 17 shifts by two men. The usual contract price is $2 per foot, and the miners figure on making good wages. The ground is so cut up by crevices and 'pitches' that it is usually possible to sink the shaft upon one, which makes breaking easy. Little shaft timbering is needed, except where the ground is loose, and long experience has made the native miners expert in handling such problems. No water is encountered. The entire hoisting equipment can be transferred from one shaft to another in a few hours, and as the ore is usually sent to a distant mill for treatment in any case, the economy of a new shaft instead of a long tram underground is apparent.

THE FIRST STAGE OF WISCONSIN MINING.

A HORSE-WHIM AS USED IN WISCONSIN.

Waste Stored Underground

Under such circumstances, it is natural that no attempt should be made to break any tonnage-per-man figures. In fact, it is aimed to hoist only pay-dirt, leaving all waste behind for filling. One top-man will attend to the horse-whim, place the bucket on the top car, and run it out to the dump, where the ore is subsequently shoveled into wagons and taken to the mill. The buckets used are wooden tubs, and hold about 200 lb. of broken ore. In many of the mines no drilling is necessary, the rock being so soft and broken that it can be taken out with the pick and shovel. Where the formation is harder, hand drilling is adopted for breaking. There are no machine drills. They tell a story of two of the native 'Cousin Jack' miners who had a hot dispute as to how a drill should be supported. One claimed it should be held under the arm, and the other that the proper place was on a man's back. The latter won the argument, and was allowed to demonstrate his theory. When his helper turned on the air, considerable trouble broke loose, and since then drills have not been popular at that mine.

The ore frequently 'makes' in different rock strata, the top being called the 'wool rock opening,' then the 'green bed,' then the 'brown rock,' and the 'glass rock' lowest. These are generally worked separately, each as a floor, with a bench between the workings below. There is considerable difficulty at times in finding a sufficiently strong cap, and heavy stull timbers are needed. Like most lessees, those at Highland have constitutional objections to leaving pillars to support the ground, and this necessitates timbering and filling. As the waste is not hoisted anyway, it makes little difference. Despite the crudeness of the mining as outlined above, the field produced in 1912 about 6500 tons of zinc ore and considerable lead, a very large proportion of which came from the small lessees, whose production in the aggregate makes a respectable figure.

Asbestos in Quebec

Asbestos, as in past years heads the list of the product of Quebec mines in 1912 with a total output value of $3,082,442. After having passed through a severe crisis, the asbestos market is steadily improving. This is especially true of the higher grades, crude, and long-fibre mill-stock. The demand for the short mill-stock is not brisk, and as a consequence, the qualities under $30 per ton have to be sacrificed to some extent. Under these conditions, therefore, with good prices for high-grade stock, and low prices for short mill-stock, it is quite easy to understand that only the mines which can produce the better qualities are able to operate profitably. By reason of these circumstances, none of the mines of the Broughton district operated during 1912, as the Broughton rock is essentially a milling rock, containing, as a rule, a good percentage of disseminated fibre but short and low in value. A similar remark applies to most of the mines of the Robertson district. On the other hand, the Thetford mines and the Black Lake mines worked steadily.

The Rio Tinto Copper Co., of Huelva, Spain, mined 2,406,969 tons of ore during 1912, of which 688,861 tons of pyrite ore was shipped, and 977,812 tons of sulphur ore delivered. Copper sold amounted to 39,925 tons which sold at an average of £73 1s. 3d. The gross profit on products sold was £2,274,000, and net profit £1,935,000. Dividends of £4 10s. per share were paid, and £194,600 carried forward. The directors state that the demand for pyrite and sulphur ore continues to increase, and the outlook for the price of copper is satisfactory. The water supply for the leaching process at the mines is lower than usual, and will need careful use.

West Australian State Mill System

*The number of state mills in commission at the present time is 36, and two tin-dressing plants. In 1910 the number was 34, and in 1911, 33. During the past year a new mill has been erected at Meekatharra and another at Mt. Ida, to replace the original mills at these centres, which had been run till worn out. In addition, newly erected state mills have been opened at Payne's Find and Mt. Egerton, which are comparatively new districts.

In the Marvel Loch district the state has, by financial assistance to private mill-owners made provision for public crushing facilities under government rates and conditions. At Mt. Jackson a plant has been leased by the government, and at Weston's public crushing has been provided by a subsidy to a private company. Construction of a mill at each of the following places has been approved: Mt. Keith, thirty miles northeast of Mt. Sir Samuel; Bamboo Creek, Ora Banda, and Norseman. Provision is also being made for the acquisition or the erection of a tin plant at Wodgina.

To the end of September 1912 the quantity of ore crushed at the state batteries amounts to 884,684 tons, which has realized gold to the value of $15,500,000. From cyaniding, an additional amount of $2,000,000 has been recovered, and from slime, $420,000, the total amount realized by the state mills being $19,080,000. The capital now invested in the state battery system amounts to over $1,440,000.

Graphite Production and Importation

†Natural graphite is the product of different geologic agencies, mostly related to the heat of the molten magma which, during periods of convulsion, has penetrated the overlying rock strata from the earth's interior. It has two forms: crystalline, or as it is known to the trade, 'flake' graphite, which occurs as small flakes disseminated through crystalline schists, and amorphous graphite, which has no grain or structure. Coal beds in some places have been turned into graphite by the confined heat of intruded molten rock, and this natural phenomenon may have suggested the feasibility of manufacturing artificial amorphous graphite, an industry which of late years has become of considerable importance in the United States. Importations of graphite, however, largely exceed domestic production, the figures for 1912, according to the U. S. Geological Survey, being for the imports 25,643 short tons, valued at $1,709,337, and for the domestic output, 2445 tons of natural graphite, valued at $207,033, and 6448 tons of manufactured graphite, valued at $830,193. The island of Ceylon is the greatest contributor to American imports of graphite.

Graphite is a mineral of great and increasing industrial importance and has many uses, though the graphite from any one source or mine is not adapted to all these uses. One of the oldest and most important applications of graphite is in the manufacture of crucibles for use in the steel, brass, bronze, and other industries. Such crucibles must have good tensile strength, and for their manufacture a fibrous or flaky graphite is used, the interlocking of the fibres adding to the strength. Ground Ceylon lump graphite is the material most in favor in the United States for making crucibles, although small amounts of American flake graphite are also used. Amorphous graphite has never been successfully utilized in crucible manufacture, except for very small crucibles.

The U. S. Geological Survey has just published, as an advance chapter from 'Mineral Resources' for 1912, a report on the graphite industry in the United States by Edson S. Bastin, which also includes figures of importations into this country as well as statistics covering other graphite-producing countries. For copies, application should be made to the Director, U. S. Geological Survey, Washington, D. C.

Petroleum Possibilities of Tierra del Fuego

‡Emanations of inflammable gases were observed at Qumas Malas, Rio Tres Brazos, Rio de las Minas, Cabo Boqueron, Rio Tres Puentes, Peeket Harbour, and Seno Otway. In the first four mentioned localities, the gas comes from Tertiary marls, and on the last three from Tertiary sands of a different age from the marls. With one exception, all of these beds are lower than the coal deposits of the region, which precludes the possibility of the gases having originated in the coal. The occurrence of gases in connection with oil seepages was observed in the valley of the Tres Puentes river, along the Tres Brazos river, and in Cape Boqueron. The gas emanations at Rio Tres Brazos, Rio de las Minas, Rio Tres Puentes, and Seno Otway, are associated with faults, which also probably occur near Cabo Boqueron and Pecket Harbour. An anticlinal fold was observed at Queman Malas, north of Cape Yarta. As the oil indications are found at different horizons throughout the Tertiary and always near faults, and other hydrocarbons derived from petroleum and deposited by the waves have been ascertained as coming only from Cretaceous rocks, it was concluded that the oil originated in rocks of Cretaceous age or older. Three wells have been drilled in the region, the deepest to about 175 metres. These wells have been placed without regard to geological conditions affecting the accumulation of petroleum, and the resulting failures in no way deter from the prospective importance of the deposit. The geological map accompanying the report shows the structure and geology to be continuous on both sides of the Strait of Magellan, and to consist of a northeastern dipping monocline of Cretaceous and Tertiary beds, covered by glacial deposits and faulted at several points which are situated apparently along a well defined zone. As a result of this investigation, it is considered that the existence of petroleum in the vicinity of Punta Arenas and in the northeastern region of Tierra del Fuego is proved.

*From notes supplied by the Mines Department to *W. A. Mining, Building & Engineering Journal.*

†From U. S. Geological Survey.

‡Abstracted from an account by Johannes Felsch, in *Bull.* 189, Sociedad National de Minera de Chile.

Steam-Stamps at Michigan Copper Mines

Details of steam-stamps in operation in the Lake Superior copper mining district are given in the *Proceedings* of the Lake Superior Mining Institute as follows:

Mills.	No. of stamps.	Maker.	Type.	Condensing or non-condensing.	Steam pressure, lb.	Cylinders, in.: High.	Low.	Stroke.
Calumet & Hecla	11	Morris	Simple cushioned	con	130	21.5	14	24
Calumet & Hecla	1	Nordberg	Steeple compound	con	165	15.5	32	24
Calumet & Hecla	16	Morris	Simple cushioned	con	130	21.5	14	24
Adventure	3	Fraser & Chalmers	Simple	..	..	20.0	..	25
Allouez	4	Nordberg	Steeple compound	con	150	15.5	32	24
Allouez	2	Nordberg	Simple	con	150	20.0	..	24
Ahmeek	4	Nordberg	Steeple compound	con	150	16.5	32	24
Copper Range	2	Nordberg	Steeple compound	con	150	15.5	32	24
Copper Range	4	Nordberg	Simple	con	150	20.0	32	24
Copper Range	2	Nordberg	Steeple compound	con	150	15.5	32	24
Copper Range	4	Nordberg	Simple	con	150	20.0	..	24
Copper Range	4	Nordberg	Steeple compound	con	150	15.5	32	24
Franklin	2	Cuyahoga	Simple	con	125	20.0	..	24
Franklin	3	Allis	Simple	con	125	20.0	..	24
Isle Royale	3	Nordberg	Steeple compound	con	..	15.5	32	24
Mass	2	Nordberg	Simple	con	..	20.0	..	24
Michigan	1	Nordberg	Steeple compound	..	..	...	..	..
Mohawk	4	Nordberg	Steeple compound	con	..	15.5	32	24
Osceola	7	Nordberg	Steeple compound	con	150	15.5	32	24
Quincy	7	.....	.....	.....	..	...	..	..
Tamarack	3	Allis-Nordberg	Steeple compound	con	150	15.5	32	24
Tamarack	1	Allis	Simple	con	150	20.0	..	24
Tamarack	2	Fraser & Chalmers	Steeple compound	con	150	15.5	32	24
Victoria	1	Cuyahoga	Simple	.....	..	24.0	..	26
Winona	2	Fraser & Chalmers	Simple	.....	..	...	..	..

During 1912 the Calumet & Hecla crushed 2,806,610 tons of 'rock'; Mohawk, 787,941 tons; Oseeola, 1,246,557 tons; and Quiney, 1,309,253 tons. Steam-stamps are peculiarly characteristic of the district.

Trinity County Gold Districts

By W. S. G. Todd

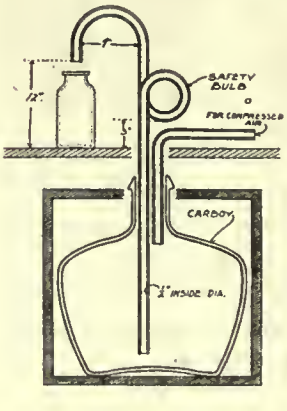
No comprehensive geological report has ever been published by either the United States or the State Mining Bureau on Trinity county, California. It is true that an incomplete report on the Carrville, or Trinity Center, country has been published, and one on the gravel deposits of Weaver basin, in which is situated the La Grange mine, the largest hydraulic mine now in operation. There is, however, nothing on the vast country lying west and north of Weaverville, which where prospected shows a network of veins and also coarse placer gold in every stream. From the east the first district in this mineral belt is that of Cañon creek, in which are situated the Globe, Chloride-Bailey, Mason & Thayer, and other mines. The three mentioned were recently purchased by the Craig Mining Co. of Canada.

The next district, to the west, is the East Fork, beyond which lie the Rattlesnake, the Grizzly, and last the New River district. The last three districts can be reached only by trail, but one may reach the East Fork district by a good wagon-road. In it is the Enterprise mine, which has a drift on the vein about 1200 ft., and is fairly well equipped with 10-stamp mill, compressor, and electric-light plant, but does no custom work. The main part of the district lies from two to five miles north, all of it being still in possession of the original locators, and all in the earlier stages of development, excepting three prospects that have been taken over by capitalists within the past four months. Development is practically all done by driving on the vein, and in amount it varies from a few feet to about 400 at each property. The main veins strike northerly and southerly, generally dipping east 65° or more, and varying in width from one to several feet. Some are traceable for a long distance on the surface. While no large orebodies have been developed, some high-grade ores have been extracted, picked samples assaying several thousand dollars per ton in free gold and sylvanite. Nearly all can show high-grade ore.

This country has a good climate, and the elevation ranges from 2100 ft. to about 8000 ft., culminating in Thompson's peak in the Salmon range. The country that is being developed is below 3500 ft. above sea-level. Three feet of snow is considered heavy. It comes in December and January, and is gone in the lower part of the district by March, and in all but the very high parts (above 5000 ft.) is gone by May. There is plenty of timber, fairly good water-power, and mineral enough in sight to justify further development. The men who are developing this district are experienced hard working miners, who are spending their time and money in development, believing that their ore dumps were their best advertisement. There is an especially good field here for a custom mill, but also other opportunities for investment.

Siphoning From Carboys

The accompanying sketch illustrates a convenient apparatus for siphoning acids and ammonia from carboys, described by E. G. Jarvis in the *Chemist-Analyst*. The larger thistle tubes are made of ½-in. glass, and are inserted into a rubber stopper placed in the neck of the carboy. Air pressure is used for elevating the liquid.



Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mine Administration and Mine Bosses

The Editor:

Sir—Genetically the race may be divided into two divisions, those who eat like hogs and those who do not. To the former belong the genus miner or those who dig for mineral.

'A Miner' complains that the superintendent eats at a private table. Well, what of it? No superintendent would mind eating at the same table as his men if the men would eat decently. But they don't. A miner imagines no one can be of any account unless he shovels food with his knife. Let the 'Super' do this and he is one of them. Try putting butter-knives in the butter. How many miners will use them? None. In go their dirty knives which have already done duty for forks and spoon. Here a miner spits on the floor when at meals, there another blows his nose with one hand while with the other he is 'mucking' food with a knife for a shovel. Any man, superintendent, assayer, or millman, that can stomach this is a marvel. Do you wonder that the 'Super' has his private table? Let the miner eat like a civilized being and the 'Super' will be only too glad to eat with him.

The miner's idea of a superintendent is an enlarged miner, one who can chew a plug a day, drink more than any two miners, and who is mixed up in all the town tragedies. The miner does not stop to consider that the days of mine superintendents have passed and we have come to the time when a superintendent must be a trained specialist in mining as well as in metallurgy. How many mines nowadays can be run by Pete? None. Pete was very well in days gone by when mines were rich from the grass roots, but poor Pete has not kept pace with the specializing of miner's work. The trouble with Pete is he is looking for the very shift-boss he has so frequently vilified. Put in a pleasant-speaking educated man as shift-boss, and Pete cannot realize that he is to be treated as a human. No, Pete expects abuse and wants it, and he often deserves it; for of all the unthankful, undeserving, shirking men, Pete the miner is the limit. Did anyone ever hear of a miner trying to help a 'Super' by doing faithful work underground? Never. His whole business in life appears to be a struggle to do as little work as possible and receive as much as possible, but for the interest of the mine, of the superintendent who is trying to make both ends meet, he does not care a rap. Why does a mine require a foreman and a shift-boss on each shift? Simply because our precious miner Pete will not do his work without someone watching him.

In all small mines—and the majority are small—Pete is the deciding factor. If he would only try to keep up his end, there would be more mines now paying. But what does Pete care? He is ready to throw his blankets over his back and hike to the next camp. Underground, does the miner Pete help the 'Super' at all by economizing in his fuse or powder, or does he try to break clean ore? I guess not. All he is thinking of is the time to quit. If Pete has had a dose of socialism thrown into him, then he is more worthless than the worst. It gives him the impression that he is as good as anybody and that he should be running the mine.

Pete imagines because he can polish the head of a drill that he understands mining. Mining in its broadest sense is far more than this. The miner knows very little about the mine, although he imagines he knows it all. Does he know how much money the superintendent has on hand for doing certain work? Does he know what the ore runs, or what the saving of the mill is? No. He knows about as much of the mining business as a conductor of a car does about the management of a city electric rail system, but such is the faith in gold mining that Pete the miner imagines he knows it all, and worst of all, he has impressed this faith to a great extent upon the public.

Any mine superintendent that takes the advice of Pete in the management of a mine is far worse off than the relative-superintendent that tries to run a mine, for in the latter case the relative may have the sense to employ under him competent men, while Pete's advice is sure to lead to ruin. Let Pete stick to his business of mining or 'mucking,' and by mining in his case I mean hammering a drill or running a machine, and let him do that business well, and let him try to help the mine superintendent to achieve results instead of hampering him in every way, and so many dead mines would come to life that Pete would always be sure of a job.

Years ago I asked a well known engineer what the main factor in successful mining was. I wonder what Pete would say—whisky, I presume—but my man probably included this when he said, "young man, the principal factor in mining is the study of men."

MINE SUPERINTENDENT.

Jackson, April 1.

Bolivian Mining and Placer Lands

The Editor:

Sir—A few words in addition to I. Dalland's article in the *Mining and Scientific Press* of March 22 may be in order. The mines and mineral lands, as well as the gold placers of Bolivia, are subject to a leasehold system, yet in the language of the law (*son perpétuas siempre que se pagan las patentes*) are perpetual as long as the dues are paid. These amount to 2 bolivianos (equal to 80 cents) semi-annually for each pertenencia or hectare, or 10,000 square metres, equal to 2.47 acres. The dues for agricultural or any surface-land on the Andean plateau are ½ boliviano, equal to 20c. per hectare annually. Besides these dues, the lessee has to take out a patent for his concession, once for all, for 1 pertenencia or any number of them. This costs 10 bolivianos, or $4. The land law in the tropical part of Bolivia, toward Brazil and Argentine, is different. The rich agricultural and grazing land where large herds of wild cattle roam, is sold for cash at 10c.

per hectare, up to the number of 20,000 hectares. Forest lands with rubber trees cost 40c. per hectare. The application for mine or placer land has to be made at the Prefecture of the department in which it lies. There are nine of them in Bolivia. There is the capital of La Paz, the department of La Paz, and the province of La Paz, with their various administrations all in the same city. The department of La Paz contains by far the greatest number and the richest of the placers and gold quartz mines, and Mr. Dalland had to get his concession in La Paz. There he had the opportunity to buy his pack-animals and the whole outfit of tools and material for his enterprise. There are good hardware stores in that city furnished with all that is necessary for prospectors and miners. It is easy to get to La Paz. All the railroads in Bolivia have Pullman and dining cars, and there are many good hotels in that city. The Government cautions all to go out first to prospect, which costs nothing, and after having found a suitable location to send or come to the Department de Fomento at La Paz to obtain the patent.

G. W. Wepfer.

Berkeley, California, March 25.

Extralateral Rights and the Prospector

The Editor:

Sir—I fear you have not quite grasped the kernel of the argument in my communication of March 12; for in your comments thereon you write: "the position taken by Mr. Van Wagenen is, in effect, that there can be no mining development without the special inducements to prospecting that have heretofore been given in the western United States." Now I cannot find any warrant for such an inference in my letter. I did say, however, that outside of our favored West "there are no new discoveries, except such as are made by pure accident." The difference is important. There is much mining development all over the world, even in such antiquated regions as Asia Minor. But these are all on *antiguas* of more or less antiquity. There are, and can be, very few discoveries in such places, for the simple reason that no one is on the search.

I shall await with interest the response from your "Canadian friends", secure in the faith that there will be none. In all the broad expanse of the Dominion, from ocean to ocean, and Lakes to the Arctic, I have yet to hear of the first new discovery during the year 1912, by a prospector. Yes, there are generally plenty of men in the hotels of Toronto and Quebec with claims to sell, but we all know that these are claim peggers and promoters, not prospectors. The real prospector would probably not be a welcome guest at these places, even if he could pay his bill. The fake ones, to whom you refer, probably could not hit the top of a drill twice in succession. And, by the way, why not print extracts from some of those letters that "burdened your mail" on this subject some time ago? It looks as if it might be a very easy way to destroy my position.

It is a pleasure to know that the veteran prospector, Pat Hannan, is still alive and hearty, but very sad to reflect that he is the only Australian example you could mention. Perhaps, in sixty days or so from now you will have a list from your Melbourne correspondent. But I note that in referring to mining conditions in general in the Commonwealth you fall again into the common error of confusing the prospector with the claim-pegger and promoter, when you say "It needs but the rumor of a 'strike' to bring them in by hordes." Too true. They hang to the skirts of the true prospector as the barnacles to a ship, and the sutlers to an army, carefully dodging all the hard work, and generally managing to reap the bulk of the harvest. But the 'strike' must come first. The 'hordes' that follow are not prospectors. Let us be a little careful about our words. I suppose it will be a few weeks before your mail will be "burdened" with the names and addresses of prospectors from Mexico and other Latin American countries, so that point may be dismissed for a while. Perhaps the most of the poor fellows in Mexico have been executed by this time.

A few words as to your final remark. You say "it is a common fallacy to assume that the old way is the only way." Well said. But the new way is the one that was inaugurated when the existing mining law went into effect, which has proved its worth by its results. The old way is the one to which you seem to wish to return. I must respectfully but firmly decline to be put in the old fogy class, but if, in this matter, you chose to line up with them, it will be quite out of keeping with the general up-to-dateness of the *Press* in all other subjects.

Theo. F. Van Wagenen.

Denver, April 1.

[One who writes as vigorously as Mr. Van Wagenen need have no fear of being placed in the 'old fogy' class, however much those of us who may be urging any particular reform may find him opposed to that specific change.—Editor.]

Costs at McKinley-Darragh Mine, Cobalt

During the year 1912, 52,482 tons of ore was treated, yielding 2,089,593 oz. of silver, and costs were as follows:

Operation:	Per ton milled.	Per ounce recovered.
Mining and development	$2.259	$0.0569
Milling	1.248	0.0315
Sampling and assaying	0.113	0.0029
Bagging and loading	0.168	0.0043
Surface maintenance	0.249	0.0063
Insurance, taxes, administration	0.735	0.0185
General charges	0.275	0.0069
Total production costs	$5.090	$0.1284
Marketing:		
Sampling at smelter	0.045	0.0011
Freight and insurance on ore	0.458	0.0116
Smelter charges	1.465	0.0370
Total marketing costs	$1.968	$0.0497
Total costs	$7.058	$0.1781

Stamp-duty at the Goldfield Consolidated mill averaged 9.44 tons per day during the 14 months ended December 31, 1912.

Special Correspondence

BRITISH COLUMBIA

NEW PLACERS ON SILVER CREEK.—TRAILS AND TRANSPORTATION

Information concerning reported finds of placer gold on creeks south of Tesline lake, in Atlin mining division, northern British Columbia, has been attracting some attention, though as yet particulars are meagre. Most published accounts lack definite details as to whether or not gold has been obtained in any quantity above a few dollars' worth, but one press despatch from Skagway, Alaska,

MAP SHOWING ROUTES TO NEW PLACER FIELD.

dated March 22, states that one man has arrived in Atlin "with several thousand dollars worth of washed gold, the first brought out from the scene of the new strike."

A communication from W. Scott Simpson, Indian agent in the Stikine River district, which lies south of Atlin mining division, dated March 2 and addressed to A. M. Tyson, inspector of Indian agencies for northern British Columbia, has been published. It is to the effect that at present there are but few of the older Indians on the reserve at Tahltan village, the majority of the men being now in the vicinity of Silver creek, a tributary of Teslin river, which joins the river about 35 miles south of Teslin lake, into which latter the river flows. Mr. Simpson reports that on February 5 a deputation of Indians waited on him and produced a letter which had been sent to them by Atlin Indians, stating that they had found new placer diggings on Silver creek. The Indians requested him to accompany them on a claim-staking expedition and to see that their record papers and lay-over permits were properly made out. Thinking it might lead to the ultimate prosperity of the Indians, he accompanied the party, which on February 7 left Telegraph Creek, a settlement on Stikine river, and on March 2 returned to that place, after having staked claims on three creeks. The Atlin Indians produced an ounce and a half of gold they had obtained there last fall. Those Indians had obtained free miner's certificates and staked claims last November on the best-looking parts of the creeks. Various Indian tribes have staked claims to an estimated number of about 300, and white men have about as many. Under existing conditions of snow and frozen ground, it is difficult to say whether or not the new diggings will prove profitable to any considerable number of miners; it is probable that many of the claims will prove hard work.

Three routes to the new field have been mentioned in newspaper notices. One is *via* Whitehorse (in southern Yukon Territory) up the Hootalinqua river to Teslin lake, and down the lake to its southern end, which is about 35 miles from the new field. Another is *via* Skagway to Carcross (Caribou Crossing) by railway, thence to Atlin, and from that camp by trail east to the creeks under notice. The third is by Wrangell, in southeastern Alaska, and Stikine river to Telegraph Creek, and thence by trail.

H. E. Young, provincial secretary in the Government of British Columbia, who late in March returned from a visit to Atlin after having made many inquiries, has concluded that the best way will be for the Government to open a trail from O'Donnell river at Atlin (on which river new placer-gold finds were made late last autumn) to the new diggings, which he is informed can be reached in 90 miles from the town of Atlin. He sent in a party of men by the old longer trail up Surprise lake to north of Gladys lake and then south—a distance of about 150 miles—and instructed them to return by the proposed shorter route to Atlin *via* O'Donnell river. On receipt of their report, he will, if it be favorable, recommend the Government to at once open the proposed new trail.

Information received from Nahlin by newspapers during the first week in April was as follows: "Two men who came down the trail on April 3 from Silver creek report that J. Fuller, owner of No. 2 Below Discovery on Silver creek, has reached bedrock after having passed through five feet of gravel. He took out coarse gold to the value of 75c. per pan, which is regarded as good pay. Prospects on other creeks appear to be favorable, but bedrock has not yet been reached on these. There is a small town of tents on Johnson creek, and other creek benches are being dotted by the tents of new arrivals." Nahlin is a telegraph station, about thirty miles from Silver creek. Still another published report is that Robert McKee, well known in Atlin camp, has been to Seattle with $400 in Silver creek gold. Among other statements made public is one that the reported finding of new diggings is only a scheme to enable Indians in the district to profit by selling placer claims they have staked. This may not be true in all cases, but it is known in Victoria, British Columbia, that a number of claims held by Indians are for sale. Remembering, too, the customary exaggeration on the part of those interested chiefly in inducing men to spend money in traveling and outfitting, whether or not there be a fair prospect of the new diggings proving sufficiently productive to warrant the outlay necessary to reach the locality, it would appear to be well for those intending to go to the Silver Creek country to await publication of authentic information from known reliable sources before undertaking what might otherwise be a profitless journey. It is not inherently improbable that important placers have been found, but as yet the evidence produced is insufficient.

NEW YORK

MARKETS CONTINUE DULL.—COPPER REPORT ENCOURAGING.—TENNESSEE COPPER TO MAKE PIG IRON.

The actual settling down to work of the two Houses of Congress, and the address delivered to them in person by the President, all looking to the earliest possible passage of a new tariff enactment, have not been without market effect. The realization that new tariff schedules are to be made, that a large part of the revenue heretofore provided by the customs service is to be wholly foregone and the deficit so created made up by the imposition of an income tax, comes with something of a shock, even though thoroughly threshed out in the recent national campaign. There is a noticeable slowing down of business and an increasing general tendency to complain of conditions that permit the carrying on of operations but preclude the winning of any profit.

The statement of the Copper Producers' Association covering March operations was about as anticipated. It had been expected that the exports might reach a record-breaking figure, but the total was 77,699,306 lb., which has been exceeded on three different occasions. In view of the unsettled conditions prevailing abroad, the reaction in Germany, the hoarding of actual cash in France, the market dullness in England, which latter country is also afflicted with an undue amount of political agitation, it is not strange that there should be some question raised as to the shipments of copper across the Atlantic. There has been quite a little open skepticism as to the destination of these copper cargoes. Should the export demand continue so close to record-breaking figures, we will probably hear once more the stories of 'hidden copper stocks' abroad. The domestic consumption for the month is the more genuinely gratifying figure, home consumption accounting for 76,585,471 lb., making a total consumption for the month of 154,284,777 lb. Production was 136,251,849 lb., which makes a shrinkage in accumulated stocks of 18,032,928 lb. Stocks on hand as of March 31 were 104,269,270 lb., which compares with 62,367,557 lb. as of March 31, 1912. The disappointment in regard to export figures was due to the fact that custom house clearances aggregated something like 94,000,000 lb., and it was rather expected that not more than 10,000,000 lb. out of this total would show as February deliveries. This figure was evidently, however, nearer 20,000,000. Inasmuch, however, as the grand total of deliveries for the month broke all previous records, it is to be expected that the metal market will stiffen up just as much as general conditions will warrant. The principal selling agencies are quoting 15⅝c. per pound, and are naturally talking higher prices. At the regular meeting of the Copper Producers' Association, F. J. Parker was elected as assistant secretary and treasurer. The annual report of the Rio Tinto has just been received. The figures are given elsewhere. The report is particularly important on account of its discussion of the copper outlook, on which point it says: "The consumption of copper has increased, although not quite so rapidly as the production engendered by the high prices ruling during the last half of 1912. The world's stocks, however, are considerably reduced below the figures of 18 months ago, and today are low compared with the increased turnover, and the future outlook in regard to the price of copper is not unsatisfactory."

It is understood that the hostilities round about Cananea, Mexico, which were so active two or three weeks ago as to enforce the shutting down of the Greene-Cananea property, are considerably less active and that the railroads will be once more operating within a few days. The annual meeting of the stockholders of the Shattuck-Arizona Copper Co. has been postponed, to be held May 5. The new management of the Tennessee Copper Co. is evidently expecting to add no little impetus to the company's operations. James Phillips, Jr., the new president of the company, is predicting a year of great prosperity, and increased production in both copper and sulphuric acid. In a letter accompanying the annual report he sets forth the possibility of Tennessee adding another important product to its output. The letter says in part: "Our engineers have made demonstrations which indicate that it will be possible to work the Eureka orebody profitably. This will have early attention with a view to developing the commercial possibility of producing low phosphorous pig iron as well as copper and sulphuric acid from the Eureka deposit." The annual report shows that during the year there was mined 443,038 tons of ore, and there was smelted 444,284 tons; copper production was 13,252,634 lb. Operating costs per ton of ore were $3.2797. Copper costs were 11c. per pound.

BLACK HILLS, SOUTH DAKOTA

HOMESTAKE DROPS CAGE, BUT RAISES DIVIDEND.—BISMARCK AND WASP NO. 2 RESUME.—GOLDEN SUMMIT BEING EXAMINED.

A cage loaded with four one-ton cars of ore fell from about the 300-ft. level to the 1850-ft. level, at the Ellison shaft of the Homestake, resulting in demolishing the cage, damaging the cable, which followed the cage down and was cut up for removal, and necessitating the suspension of ore-hoisting at the shaft for three weeks. The failure of a clutch is given as the cause of the accident, which occurred while a cageload of ore was being hoisted from the 1100-ft. level to the surface. It started to drop at about the 300-ft. level, as explained, and at the 1700-ft. level crashed through a bulkhead of 12 by 12-in. timbers. It was prevented going into a deep sump by a similar bulkhead at the bottom. The cable, which is ¾ by 7-in. flat rope, was dragged into the shaft, and the entire 2500 ft. piled on top of the cage. It was sawed into short lengths for convenience in removing. In pulling loose from the reel, some damage was caused to the reel, which was repaired by one of the new methods of welding. There was no one hurt; the engineer stayed at his post, but had narrow escapes from flying pieces of steel. Although the Ellison is the principal ore-hoisting shaft of the company, the mills were operated full time without interruption, as the other shafts were called upon to increase their output. Local stockholders were gratified, a few days ago, to receive a stock dividend of 15% on their holdings in Homestake. The local people owning stock, almost all of whom reside at Lead and Deadwood, have practically $1,500,000 worth, and they think so much of it that it is rarely offered for sale. The local people are consistent buyers, and only sell when forced to raise money quickly.

Purchases of gold bullion at the United States assay office at Deadwood were $1,748,000 during the quarter ended March 31, according to L. P. Jenkins, assayer in charge. Considering the severe weather, and the fact that some of the producers suspended altogether for a time, this figure is encouraging. The Bismarck mill, at Flatiron, which was finished early in January, has been put in commission since the weather moderated, and has been operating smoothly and satisfactorily. The plant has not as yet been worked to full capacity, 300 tons per day, but it is expected that by April 15 it will be regularly handling that quantity. Some of the lower grade ore is being milled, in order to get it out of the way, and by the time the plant is working in good shape the better grades of rock will be going to it. After a month's suspension on account of cold weather, the Wasp No. 2 resumed April 1, and is operating full force, anticipating a successful summer's campaign. Preparations are being made to start the steam-shovel at stripping, and this will be done just as soon as the frost and moisture leave the ground. Stripping on the north side of the open-cut is now approximating 15 ft. in thickness. A small electric hoist has been installed to haul the two-yard dump-cars away from the shovel.

The Golden Summit property, near Hill City, a mine containing a small shoot of wonderfully rich free gold quartz, is being pumped out for the inspection of New Yorkers who are figuring on purchasing. The shaft is 320 ft. deep, and at that level a splendid showing of ore is being made. The present owners are willing to turn the property over

to anyone with the means to equip and operate it, and allow them to take the purchase price out of the ore in the property. A new hoisting plant, a small mill, and pumps are required. A reduction of taxes, which have been unpaid for a number of years, has been asked by the Spearfish Mining Co. It is represented that if the County Commissioners will grant this petition, the company will take over some adjoining ground and resume work. The original mine is worked out, and the old mill was destroyed by fire some years ago.

JOHANNESBURG, TRANSVAAL

WILL THE RAND OUTPUT INCREASE?—FAR EASTERN, CENTRAL, AND WEST RAND CONDITIONS.

The marked increase in the gold output of the Rand last year has naturally caused the question to be asked as to how long the Rand can continue to show a yearly progressive output. An answer to the question will be found in the manner the Far East Rand will develop. It cannot be expected that a greatly increased output can be obtained from the Central part of the Rand, every inch of which, practically speaking, is now under tribute; it may, on the other hand, be expected to show a decline. From the Germiston area the prospects of an increased output also are not over bright, several outcrop properties are approaching exhaustion, and a somewhat important stretch of deep-level country has not opened up as promising as it might have done, so that the most that can be expected from the Germiston area is that it should remain for many years in a state of *status quo*. In the Far East Rand, however, there is a considerable area still untouched, a fair proportion of which has good mining prospects, while there is more new development in various stages on hand in this area than in the rest of the Rand put together. There is, for instance, the Van Ryn Deep, with over a million tons of 8-dwt. rock developed and a mill of 80 heavy stamps, supplemented by 8 tube-mills rapidly approaching completion. This plant is expected to rival that of the Roodepoort United Main Reef mill, as a duty of 20 tons per stamp is anticipated. The capacity of this plant is estimated at 40,000 tons per month, and in four months' time the Van Ryn Deep is expected to enter the list of producers. There has also seemed a kind of rivalry between the Modder B and the Brakpan mine, but the latter of late has made the pace somewhat too hot for its neighbor and left it behind. It is now reported that the Brakpan has decided to increase its mill to 200 stamps, which will leave the Modder B still farther behind, and place the Brakpan among the first half dozen mines on the Rand. Sooner or later the Modder B must also add considerably to its milling equipment and help in the early increased gold output of the Far East Rand. In a less advanced stage of development comes the Modderfontein Deep, where a promising reef is being opened. Then there are the extensive State Mines, where profitable if less promising results are now being obtained, and the less important Rand Colliery gold property. Then the Springs Mines are close upon the reef and look like adding considerably to the profitable area of the Far East Rand, and the close approach of the Daggafontein shaft to the Kimberley Reef is not without some significance as far as it goes. Tenders are also going in for the new Government areas between Brakpan and Springs, so that if the prospects of idle concerns such as Apex, Benoni, Van Dyk, Cloverfield, Grootviei, Welgedacht, and Klipfontein are disregarded, it is evident that from the Far East part of the Rand a progressive output of gold ought to be obtained for many years, especially if, as seems likely, a fair proportion of the untouched area proves profitable.

If attention be drawn to the West Rand, a fair amount of scope for further expansion will be found, but not to the same extent and promise as its counterpart on the Far East Rand.

Great things are promised and expected this year from the huge Randfontein property, and better results are looked for from the West Rand Consolidated, Princess Estate, Roodepoort United, Main Reef, Bantjes, and Consolidated Langlaagte. There does not seem to be much prospect at present of the Lancaster West, just closed, being reopened, but there are reports that indicate a resumption of work at the French Rand, and with an improving outlook the Vogel Deep mine ought not to be allowed to remain closed. Of virgin ground of promise on the West Rand, there is not an abundant area; most of the idle ground is too broken, or overlain with a huge thickness of dolomite, to induce mining operations, and a good deal of the deep-level area is not over attractive. Still, the West Rand is in a position to give a good account of itself for many years to come, more particularly if the results at Randfontein, West Rand Consolidated, and Roodepoort United come up to expectation. With regard to the prospects of the extension of the gold-bearing beds in the direction of Potchefstroom, an important paper bearing on the subject is on the point of being read before the local Geological Society by E. T. Mellor, of the Government Geological Survey, which is expected to throw light upon the probable whereabouts of the hidden outcrop of the Main Reef series, after leaving Randfontein and the West Rand Estates. If the extension of the Main Reef series can be picked up under conditions that will admit of profitable working, an immense goldfield will be added to the West Rand and possibly of only a trifle less importance than a good deal of the ground in the Far East Rand area, of which so much is expected. Some attention has, of course, in the past been given to this extension of the West Rand, but it cannot be said to have received the attention its importance deserves, or the prospecting operations to have been conducted in a thorough or methodical, scientific manner.

The mining resources of the West Rand cannot be said to have been increased by the operations of the Government Geological Survey. Mr. Mellor has shown by his work among the lower beds that no profitable reefs exist, and that for future gold production no reliance can be placed on the ill-developed and broken reefs occurring in the Lower Witwatersrand division. The Rand gold output should still continue to increase, although the Central and Germiston areas may not improve. The West Rand will continue to improve, but the Far East, more than any other part of the Rand, ought for some years to come to ensure the continuance of a progressive output.

PORCUPINE

THE STRIKE.—HOLLINGER AND DOME RETURNS.—OUTLYING DISTRICTS.—NEW TERRITORY AVAILABLE FOR PROSPECTING.—LABOR LAWS AND DECISIONS.

While the strike conditions throughout the Porcupine district are rapidly becoming normal, there have been several minor clashes between the strikers and the men working in the mines. In several instances, the strikers attacked individual workers, inflicting serious injuries. The miners finally became so incensed that they proceeded to retaliate, and the situation was considered sufficiently serious for the Mayor of Timmins to read the riot act. The superintendent of the provincial police has also detailed several officers to return to Porcupine to keep order, and it is believed that these precautions will have a salutary effect. Development throughout the district continues to be satisfactory, and both the big companies, the Hollinger and the Dome, have made record productions. At the annual meeting of the Hollinger, the report for the past year showed that the company milled $907,304 worth of ore, from which the profits were $600,664, notwithstanding the fact that the output during the strike was considerably curtailed and that the mill did not start running at capacity until some time in July. The company's ore reserves are estimated at 644,500 tons, valued at $11,271,400. The last statement for the four weeks ended February 25 shows profits amounting to $241,600, which is a satisfactory increase over the preceding periods. During that period 9201 tons, having an average value of $27.67, was milled, at a total cost of $6.74. It is expected that this cost will be considerably reduced in the near

future. At the Dome, the production for the month of March constituted a record and the development work from No. 2 shaft has been extremely satisfactory, the cross-cut to the south having opened a large body of ore, the existence of which had not been shown by diamond-drilling. While no definite action has as yet been taken, if the development during the next few months continues to be as satisfactory, the capacity of the mill will undoubtedly be increased to probably double its present output. Development on the smaller properties continues to show encouraging results, and there will undoubtedly be several new mills under construction this year.

In the outlying districts, Kirkland Lake is still the centre of interest. The Foster claims are showing up well under development, although it is believed that the claim-owners throughout this region are rather nervous as to the depth to which the conglomerate will extend and the changes that may be expected when the veins pass through the conglomerate into the Keewatin. There are also one or two other properties of merit, but development to date has not shown any veins which approach in value those on the Foster. The Swastika district has had no new developments, and the two more important operating companies are still to be considered as speculative ventures. The Painkiller Lake area has been coming in for some attention, but so far nothing has been discovered which would lead to the belief that this district is of any great importance. It is hoped that during the coming summer prospecting will be more active and that it may lead to the discovery of new goldfields. With the exception of the Kirkland Lake district, no area of any importance has been discovered since Porcupine was found, and in fact, despite the active prospecting which has been carried on throughout the areas surrounding Porcupine, the boundaries of that district have not been enlarged since the date of the original staking. Other districts, considerably removed from Porcupine, may soon be open to the prospector, and there are fair possibilities of locating new mineral areas. The completion of the Algoma Central & Hudson Bay railroad from Sault Ste. Marie to the town of Hearst on the Transcontinental, has opened a large amount of territory. The railway has a grant of 2,000,000 acres, 1,500,000 acres of which is underlain by the Keewatin series in which the greater part of ore deposits in Ontario have been found. It is probable that during the coming summer the railway company will throw open this area to prospectors. The new Hudson Bay railway from LePas to Fort Churchill will also open a large amount of interesting territory. So far, practically no prospecting has been done throughout this area, as the possible mineral belt commences 100 miles north of LePas in Manitoba, and, heretofore, lack of transportation has prevented the prospectors from going in. During the coming summer, steel will be laid at least 60 miles north of LePas and will open up a large area of Keewatin rocks which appear to run through Patricia and to New Ontario.

In a judgment recently handed down, Judge Kehoe, of Sudbury, quashes two of the convictions against South Porcupine miners who were convicted under the Lemieux act. In the other test case, he confirmed the decision of the magistrate. As the Hollinger company instituted these prosecutions for the purpose of testing the Lemieux act, the decision is most important to labor throughout the Dominion. In December of last year the Hollinger Mining Co. instituted over 300 prosecutions against men whom they alleged went on strike without giving notice. In two of these cases, the defendants, William Holowaska and Peter Cleary, were not employees of the Hollinger company, but were charged with going on the property and inciting men to strike. Holowaska has been released; Peter Cleary's conviction has been confirmed, as there was a difference in the circumstances of this particular case. When the cases came before the magistrate some time ago, Holowaska and Cleary were each fined $500 and costs or three months in jail, and the third man, Croft, was fined $50 and costs or two months in jail. No fines were paid and the three men were committed. As a result of an application, they were paroled and released on ticket-of-leave, after they had served 20 days. Appeals against the convictions were then made, and the result is seen in the decision and the action of Judge Kehoe. Hon. W. H. Hearst has introduced in the local legislature an eight-hour bill applying to underground workers. Provision is made for emergency work and for shift-bosses, pumpmen, and surveyors working longer hours. The eight hours is to be counted from the time of arrival at work till time of leaving, and is not to include lunch time.

MELBOURNE, AUSTRALIA

BROKEN HILL IRON & STEEL WORKS.—PLANS FOR THE WORK.

Particulars are at length available of the proposals of the Broken Hill Proprietary Co. for the establishment of iron and steel manufacturing works at Newcastle, New South Wales. Steel is to be manufactured from the company's own iron ore by the basic open-hearth process. The first section of plant to be erected will be capable of producing 400 tons of finished steel per diem, equal to about 120,000 tons per year. The expectations of the company are to be seen by a consideration of the official statistics of the import of iron and steel into the Commonwealth during the last three years for which figures are available. These have been:

	Tons.
Pig iron	56,000
Plate and sheet:	
Corrugated, galvanized	57,000
Galvanized not corrugated, and corrugated not galvanized	51,000
Plate not galvanized	49,000
Iron and steel scrap	22,000
Wire-iron and steel	77,000
Rails, fishplates, etc.	196,000
Total	508,000

The import duties upon some of the chief lines are as follows: Plates and sheets, corrugated, galvanized, per ton, general tariff 30s., United Kingdom preferential 20s.; plates and sheets corrugated, not galvanized, per ton, general tariff 20s., United Kingdom preferential 10s.; rails, fishplates, etc. (*ad valorem*), general tariff 15%, United Kingdom preferential, 10%. The financial expert mainly consulted by the board of directors has been David Baker of Philadelphia, Pennsylvania, who has assured the company that it can assemble at Newcastle the iron ore, coke, and limestone for pig-iron production at a lower cost per unit of iron produced than is possible for the United States Steel Corporation, the largest and cheapest producer in its country. Mr. Baker foresees a time when, after the rail mill has been placed in operation, a sheet and wire-rod mill, and a wire plant can be erected to advantage. Initially the plant will consist of one 350-ton modern blast-furnace, three 65-ton open-hearth steel furnaces, one blowing mill, and one heavy-rail mill. The ore will come from the company's Iron Knob and Iron Monarch leases, in the Spencer Gulf district, South Australia, where there are many millions of tons estimated to contain from 65 to 70% of metallic iron.

Newcastle, New South Wales, has been chosen as the site for the works on the ground that it is more advantageous to have them near the coal than to have them near the iron. Of the 264 acres held here, 230 are freehold, and the remaining 34 will be held on a 50 years' lease. The State Government has undertaken to open and maintain along the frontage of this area a channel 500 ft. wide with a low-water depth of 25 ft. It is expected that the works will be near completion in about two years' time. The New South Wales Government has already begun its dredging operations. The capital for the venture is to be supplied by the issue of 240,000 $2 shares at $10. The company has, since its inception in 1885, paid nearly $50,000,000 in dividends, and on May 31 last its liquid assets totaled over $3,000,000. G. D. Delprat, the company's general manager, has expressed the opinion that this new departure will be the most profitable branch of the company's operations. An option of the services of Mr. Baker as manager of the new works has been secured.

General Mining News

ALASKA

Cordova

It is reported that a deal has been completed at Seattle by which the Gold Bullion Mining Co. has sold its five claims on Willow creek, in the Little Susitna River district, north of Seward, to L. C. Thompson, of Toronto, for $450,000. The mine has produced well on a small scale, and a large mill will be erected.

Nome

The annual dog-team races at Nome have been taking place. Each year there are three great races: from Nome to Solomon and back, 65 miles; Solomon to Council and back, 100 miles; and Nome to Candle and back, 412 miles.

DOG-TEAM AT NOME, USED FOR PROSPECTING, HAULING FREIGHT AND MAILS, AND RACING.

The first was run in January in 6 hours 1½ minutes; the second in March, in 12 hours 40½ minutes; while the third, or 'All-Alaska Sweepstakes,' for a prize of $5000, was run on April 10, 11, 12, and 13, the actual time being 75 hours 18 minutes. The race was won by Fay Delezene, followed by John Johnson, 'Scotty' Allan, and T. Iliayok, in order.

Valdez

The new power-plant being erected by the Alaska Water, Light & Power Co. is well under way. The building is complete, pipe-line three parts finished, while foundations for machinery have been started. Valdez will soon have a good power-supply, which will help the cheaper development of mines nearby.

ARIZONA

Cochise County

Further rich ore has been found in the Little Rincon mountains near Benson. On the Massoletti, at a depth of 120 ft., the veins assay from $30 to $60 per ton; the owners of the Socorro claim are sacking ore worth over $300 per ton; and $80 to $125 gold ore has been opened in the Golden West claims.

Gila County

The transmission line from the Magma mine to Miami, to connect with the line from Roosevelt, is now being constructed. The Magma Copper Co. has two auto-trucks hauling ore from Florence to Superior. The old Reymert mine, near the Silver King, has been acquired by the Gunn-Thompson interests. The Miami mine and mill now employ 1200 men. At Live Oak No. 1 shaft, an Allis-Chalmers electric hoist is being installed. On No. 6 level of the Superior & Boston, the drift has been driven 200 ft. in ore. A large coarse-crushing plant is being erected by the Inspiration Copper Co. in Webster gulch, near the shaft, and the storage bins will be of 25,000-ton capacity.

Greenlee County

A fire at Clifton on April 7 destroyed property worth $250,000, and several lives were lost.

Maricopa County

(Special Correspondence.)—W. H. Muiser and L. G. Ochennuter, directors of the Coronado Gold Mining Co., have examined their mining properties in the Congress Junction district, and decided to install a 20-stamp mill at once. The new plant is to be equipped with concentrators and a cyanide plant, and from the tonnage on the dump and recent development they are sanguine of success. Mine work was recently resumed with a small force, but the number will be increased. The mine has been under development at intervals for several years.

Wickenburg, April 6.

Yavapai County

(Special Correspondence.)—Development work is being pushed on the Cleopatra company's property at Jerome. An open-cut on the apex of the mountain is reported to have exposed a body of high-grade copper ore 30 ft. wide. Work on the Hull company's ground has opened some good ore-shoots. G. W. Hull is president and manager of both properties. The Haynes Copper Co. is sinking on its property near Jerome. Sixteen men are employed, and Thomas Campbell, the superintendent, expects to reach the 1200-ft. level early next fall. A good deal of water is being encountered, and about 2 ft. per day is being sunk in the shaft. The Cash mine, which is an old producer near Mt. Union, is working again.

Prescott, April 8.

CALIFORNIA

Butte County

A small company has been formed to work the new property opened at Minshew, five miles east of John Adams. An adit is being driven toward the old Emma adit, which formerly yielded rich ore. After several years' idleness, the 20-stamp mill and cyanide plant of the Forbestown Consolidated Mines Co. is again in full operation.

Calaveras County

(Special Correspondence.)—The Utica Mining Co. has installed electric meters in the business houses and residences of its customers in this town, and the result is that the place is considerably darker than formerly. The Lightner mine is closed down, and there doesn't seem to be any hope of that property resuming operations for some time. The Angels mine is working with its usual force. The Morgan mine, now owned by Mrs. William Vanderbilt, is to be opened and extensively prospected. This property is being worked through the Finnigan shaft, near Melones, and is the property over which Fair and Morgan had such trouble. The Waterman Mining Co. is now sinking its fourth hole. The cores are about 5 in. diam. and vary in length from a few inches to several feet.

Angels Camp, April 11.

Eldorado County

Two gravel channels have been opened at H. M. Johnson's claim at Slug Gulch, and prospects are good.

The Big Canyon mine, near Shingle Springs, is being unwatered preparatory to being examined by mining engineers from London. Ten or twelve years ago this property was a steady gold producer. Dodge Burt is in charge.

Inyo County

The Skidoo Mining & Milling Co. is repairing its 29-mile pipe-line, which was severely damaged by the cold weather several weeks ago, necessitating closing down the mine and 20-stamp mill.

NEVADA COUNTY

The North Columbia River Mining Co. has been formed with a capital of $75,000, to operate the old Grizzly Ridge mine near the Delhi mine on Columbia hill, which has not been worked for several years.

PLACER COUNTY

The Grass Ravine mine, in the Ophir district, has been purchased by W. P. Black and W. H. Keeley, who will clean out the shaft and install a hoist. The Guest Extraction Co. has been formed to treat the black sand in the canyons near Forest Hill. The sand will be ground fine and the gold recovered by a new process.

Three shifts are working at the Rueblin, near Last Chance, and the adit is in 600 ft., and it is expected to cut the vein during the present month. The old Potato Flat mine on Forest Hill divide has been staked by three miners. The 3000-ft. adit in the Home Ticket, near Last Chance, has opened the lower channel, and gravel being mined is returning $5 per car.

PLUMAS COUNTY

J. B. Cozzaglio and associates are erecting an arrastre below the lower adit, at the mouth of North Canyon, near Greenville. A 50-ft. cross-cut opened the vein, and a drift has been driven 100 ft. along its course. It is 5 ft. wide, mineralized, and assays up to $100 per ton. The mill will crush the dump of 100 tons for a start.

SHASTA COUNTY

(Special Correspondence.)—The Mammoth Copper Co. has been negotiating for the purchase of land from some of the farmers below Redding. The farms lie in the so-called smoke zone, and their acquisition by the smelting interests would eliminate some of the most militant opponents of the copper operators. It is understood that negotiations have been hampered by the exorbitant prices demanded by the farmers for their holdings. The Hazel Gold Mining Co. disbursed its regular dividend of $9000 on April 1. This makes $36,000 for the year and $900,000 to date. The company operates the Gladstone mine at French Gulch. Further tests are about to be made with the Heslewood process of controlling smelter fume. A small experimental plant has been provided at Heroult by the Noble Electric Steel Co., but leaky furnace walls and other mechanical troubles have seriously handicapped the tests. Several small shipments of highly sulphurous ore from the Iron Mountain mine have been experimented with, and some encouraging results have been obtained. Active preparations are being made for the entertainment of delegates to the Mining Congress, which meets here in the latter part of May. An aviation meet and other features of interest are planned.

Redding, April 14.

SIERRA COUNTY

A large fan is being installed at the Tightner mine, Alleghany. The Tightner M. Co. has paid a dividend of $1000 per share on the 100 shares of the company.

TRINITY COUNTY

The Guggenheim interests have 20 men and three drills working, one at Graves' place, another at the Alta Berta Co.'s ground, and the third at Carrville. A shaft is being sunk at Poverty Flat. The Alta Berta Dredging Co. is operating its dredge steadily. A. Jacobson and associates have 120 acres of placer ground on Eagle creek, a tributary of the New river, and have just finished building a 6-ft. ditch 2½ ft. wide at bottom and of 4000-in. capacity, 1½ miles long. Their ground averages 15c. per cubic yard, and they can sluice for nine months in the year.

TUOLUMNE COUNTY

(Special Correspondence.)—A local company has undertaken to open an ancient river channel under a lava mountain a few miles north of Confidence. Under the direction of T. Demarais, an adit has been driven approximately 800 ft., and it is believed that the channel will be found within 100 ft. Rich gravel was found in the vicinity some time ago, which showed evidence of having once been the bed of a stream, and the success of the present undertaking is not doubted. Eastern men have taken a bond on the King Solomon mine, in the Tuttletown district, and are actively developing the property. The Experimental Mining Co., operating above Columbia, is milling ore, and results are said to be fully up to expectations. The company is unwatering an adjoining claim, which it proposes to develop extensively. The Japanese company holding a bond on the Manly mine, north of Jamestown, will, it is understood, erect a mill on the property. Preparatory to sinking a new shaft, a head-frame has been erected at the Louisiana mine, near Tuolumne, and a compressor is being installed. The property has not been worked for many years. The erection of a 10-stamp mill at the Columbus mine, near Tuolumne, is nearing completion. The property has been developed to a considerable extent by the operating company during the past year. A new company began work at the Carlotta, north of Tuolumne, on April 7. According to the conditions of the bond, 100 ft. of sinking must be done every four months. C. E. Uren, for many years superintendent of the famous Eagle-Shawmut mine, at Jacksonville, has resigned, and removed to Berkeley to reside. He will henceforth act in the capacity of consulting engineer for the company, with headquarters in San Francisco. William F. Copeland is now superintendent of the mine.

Sonora, April 12.

YUBA COUNTY

A new trial has been granted in the suit of the California Mother Lode Mining Co. *v.* E. Page and others, involving the ownership of a rich claim near Browns Valley. In the first trial the verdict was in favor of the defendants.

COLORADO

CLEAR CREEK COUNTY

The Edison method of treating low-grade ores is to be tried at the Waldorf mill at East Argentine, above Georgetown, within 60 days. A great part of the Waldorf property is worked by lessees, who find an increase of gold with depth, the other metals being silver and copper. Hummer & Son, lessees in the Capital mine, are mining rich ore containing copper, iron, and a little lead. Shipments last week totaled 150 tons. When the weather permits, the Bard Creek company will start erecting a 50-ton mill.

OURAY COUNTY

(Special Correspondence.)—During the quarter ended January 31, 1913, the mill of the Wanakah Mining Co. worked 87 days and treated 4105 tons of ore, producing a total of $39,148. Operating expenses were $23,519, construction $3632, and on property account $16,996. Development covered 720 feet.

Ouray, April 9.

During March the Mountain Top adit was extended 332 ft., leaving about 769 ft. to be driven to cut the vein. A good deal of water was met with, which delayed the work. At 1216 ft. in, a 3-ft. vein was cut. On the footwall was a 4-in. vein containing silver 64.8 oz. per ton, gold 0.04 oz., and lead, zinc, and iron. A large lens of high-grade ore was cut on No. 5 level of the Camp Bird mine. It is stated that the Wanakah Mining Co. will build a 100-ton smelter for pyrite ores.

PUEBLO COUNTY

A fire destroyed a large business block in Pueblo, and the total loss is over $300,000.

TELLER COUNTY (CRIPPLE CREEK)

According to H. McGarry, vice-president of the Golden Cycle Mining Co., the output of the mine is to be increased from 6000 to 9000 tons per month.

The Colorado Mining & Development Co. has acquired a lease on the Free Coinage dumps and shafts, the former containing 300,000 tons of ore worth $3 per ton. A mill has been designed embodying all-slime treatment.

The Portland Gold Mining Co. has started working a 10-ton gasoline locomotive at the Victor mill, hauling cars containing mill residue. The engine, which is the largest of its type in Colorado, is of 4-ft. gauge, running on 45-

lb. rails, and will develop 102 hp. at an altitude of 10,000 ft. It is at present working on Battle mountain, which is 10,368 ft. high.

IDAHO

Blaine County

At the Ivanhoe mine, near Hailey, 12 ft. of ore assaying 100 oz. of silver and 60% of lead has been opened. This property is owned by George Westlake, A. O'Neil, and P. Clark, of Hailey.

Bonner County

The Little Joe Mining Co. has been formed, with a capital of $600,000, to acquire and develop the old Imperial mine, on Pend Oreille lake. Former operators drove two adits about 1000 ft., the lower one having a depth of 400 ft. on the dip of the vein. A raise connects the two adits, and ore already opened assays $100 to $500 in silver per ton and 5 to 7% of lead. A 50-ton concentrating mill has been ordered, also a 3-ton auto truck for transport of ore to the railway.

Shoshone County

Diamond-drilling at the National copper mine, near Mullan, has cut good ore below the 1700-ft. level. There are

MAP OF COEUR D'ALENE DISTRICT.

at present about 5000 men employed in the Coeur d'Alene district mines, with an average daily payroll of $16,000. The Guelph group of 5 claims, adjoining the Hercules and Ambergris, is to be opened in May by sinking 150 ft. on the Cyrano vein, and cross-cutting north 100 ft. to cut the main vein.

At the bottom of the 200-ft. shaft at the Sunset mine, a cross-cut has passed through 30 ft. of zinc-lead ore. At the Copper King, near Mullan, in a drift from the adit, which is at a depth of 1700 ft., 2½ ft. of ore carrying 5% copper, 3% lead, and 5 oz. silver per ton is being mined. Faults have made mining somewhat complex, and drilling is to be done. At a depth of 1700 ft. in the National mine, a copper lode 70 ft. wide and about 350 ft. long has been opened.

MICHIGAN

Houghton County

During 1912 the Calumet & Hecla Mining Co. treated 2,806,610 tons of 'rock' which yielded 67,856,429 lb. of copper. The average price received was 16.65c., and cost 9.86c. per pound of copper. Of the tonnage produced, the Conglomerate lode supplied 1,746,960, the Osceola 1,040,600, and Kearsarge 19,050 tons. The regrinding plant treated 481,320 tons of tailing, yielding 2,155,292 lb. of copper. Dividends amounted to $4,200,000, making a total of $120,050,000.

Copper production of the Lake Superior mines in March was as follows: Ahmeek, 1,220,320 lb.; Allouez, 638,450 lb.; Baltic, 1,806,000 lb.; Calumet & Hecla, 5,030,697 lb.; Centennial, 191,310 lb.; Champion, 2,394,000 lb.; Franklin, 326,000 lb.; Isle Royale, 567,852 lb.; Mohawk, 804,000 lb.; Osceola, 1,374,200 lb.; Superior, 256,905 lb.; Tamarack, 592,770 lb.; Tri-Mountain, 942,000 lb.; and Wolverine. 802,000 pounds.

MISSOURI

Phelps County

(Special Correspondence.)—The senior class of the Missouri School of Mines is at present on the annual senior trip to various points in Missouri. One week will be spent in the Joplin district, one week in the Flat River district, and one week in the various metallurgical plants about St. Louis. The class is accompanied by C. R. Forbes, professor of mining; Durward Copeland, professor of metallurgy and ore dressing; G. H. Cox, professor of geology; A. L. McRae, professor of electrical engineering; and H. T. Mann, instructor in metallurgy and ore dressing.

Rolla, April 10.

MONTANA

Chouteau County

Results of assays from the Silver King mine, near Carter, in the east Coeur d'Alene district, show 65 oz. silver, 40% lead, and $3 in gold per ton, samples being taken from a 20-ft. face in the lower level. This property is between the Glen Metals and Iron Mask mines, and is opening the same vein, where at a distance of 700 ft. in the adit, at a depth of 400 ft., this ore was cut.

Silverbow County

(Special Correspondence.)—The electrification of the Butte, Anaconda & Pacific railway, owned by the Anaconda Copper Mining Co., is progressing rapidly, and it is expected that by June 1 the road will be fully equipped for operation. The Anaconda yards are wired, and the work in the East Anaconda yards and on the smelter lines is nearing completion. Two of the electric locomotives which were ordered some time ago from the General Electric Co. have been completed, tested at the works, and found satisfactory. Direct current, at 2400 volts, will be used in operating these locomotives. A high voltage is necessary, because of the heavy loads that will be negotiated and the steep grades on the Butte end of the line. The machinery used in furnishing the power has been installed in the new sub-stations at the Washoe smelter, and the plant is in readiness to furnish power as soon as the locomotives arrive. There is some delay in stringing the wires on a portion of the line, because of changes in a canyon between Butte and Anaconda.

Butte, April 3.

NEVADA

Esmeralda County

The Lucky Boy adit is in 1500 ft., and is progressing at the rate of 15 ft. per day. The adit is 7 by 7 ft. in the clear, and is lighted by electricity, and the air-compressor is motor-driven. It is proposed to drive 6000 ft. to cut the orebodies opened on the 900-ft. level of the Mountain King, and also to drain the country. There are 30 men employed under M. Gallagher, the mine being 5½ miles south of Hawthorne, near Lake Walker.

At Goldfield, the Yellow Tiger property, which adjoins the Goldfield Consolidated on the south, will be reopened, and $35,000 spent in prospecting. The orebody on No. 7 level will be further developed, and the main shaft sunk to 1000-ft. depth. Mr. Bates is superintendent. At the Goldfield Oro, a 60-hp. hoist has been installed, and sinking will be continued to 1000 feet.

Preparations are being made at the Silver Pick mine at Goldfield to sink the main shaft to a depth of 1000 ft. This property adjoins the Combination and Mohawk claims

of the Goldfield Consolidated, and at present a stope is being worked in the Mohawk 100 ft. from the eastern boundary of the Silver Pick. Timber, pumping, and compressing plants are being arranged for.

HUMBOLDT COUNTY

Over 150 men are employed in the Nenzel hill section of Rochester, and six properties are mining ore for shipment. The Crown Reserve Mining Co., of Cobalt, has acquired several claims from the Rochester Extension Mining Co. for $100,000. There are said to be four distinct veins in the property, and work has been started by the new owners.

The first shipment of high-grade gold ore from National for about two years was shipped by the National Mines Co. last week. The ore weighed 500 lb., and is worth from $25 to $70 per pound, and was taken from the shoot recently opened in the Charleston Hill Syndicate's ground. The situation generally at National is encouraging.

LINCOLN COUNTY

The Virginia-Louise shaft at Pioche is down 320 ft., the last 150 ft. being in ore. No. 3 level has been opened, and a total of 300,000 tons of ore has been blocked out. The shaft is to be sunk farther to water-level.

LYON COUNTY

On April 9 an attempt was made to steal the 14 amalgamating-plates of the William Donovan mill, at Silver City, which has not been working for some time.

The Copper Belt Mining & Development Co. has acquired the Baird claims in the Mason Pass district. Surface work has opened a fair quantity of ore, and a good deal has been shipped. Pasadena, California, people are interested. The magnetic concentration process at the Bluestone is making a good recovery. Ore is being hauled from the Burlington-Nevada mine to the Mason Valley smelter.

NYE COUNTY

The quicksilver industry in the Ione district is growing, and F. J. Davis states that at least one new company will install a furnace this year. The Mercury Mining Co. has been shipping about 40 flasks of the metal weekly and makes a fair profit.

The mines at Tonopah produced 10,872 tons of ore, worth $238,487, during the week ended April 12. The Belmont mill treated 13,519 tons in March, yielding 325,333 oz. of bullion, with a net profit of $150,254. On the 900-ft. level of the North Star, a total of 12 ft. of good ore was cut 200 ft. from the shaft. Eight feet of ore was cut on No. 6 level of the Jim Butler.

STOREY COUNTY

The raise from the 2500-ft. level of the Sierra Nevada is still opening good ore, and on April 11 the assays were as follows: South end of raise, 26 in., averaging $185.55; 5 ft. north, 14 in., $207.85; 10 ft. north, 30 in., $176.80; 15 ft. north, 19 in., $71.10; 20 ft. north, 42 in., $36.80; and 22 ft. north, 45 in., $16 per ton.

OREGON

MALHEUR COUNTY

The old district of Eldorado, now called Malheur, according to the *Malheur Mining News*, produced a good deal of placer gold about 50 years ago, but it was not until 1894 that anything of importance was done. The Last Chance mine was opened in that year, and after doing a lot of development, Ransom Bigelow sold his holdings to a Minneapolis company, which named the property the Black Eagle. A 20-stamp mill was erected, and crushed 250,000 tons of ore, which yielded $2.90 net per ton. A few years later, for some reason, the company was dissolved and the mill removed to the Inter-Mountain mine, below the Mormon basin. The Drexel Mining Co. has acquired the Black Eagle group and will now proceed to develop the property. Late in 1912 the old Red, White, & Blue claim was reopened, and at present six 1200-lb. stamps are at work, with nine men. The Clark's Creek Farm Co. will place a dredge on its property, just across the Malheur-Burnt river divide. The Lynn placers are worked every season. J. B. White, in Freezeout gulch, has driven an adit 500 ft. during the past four years, and expects to cut a vein at a depth of 350 ft. About 110 men are employed at Mormon basin, 6 miles northeast of Malheur, at the Humboldt and Rainbow mines. These mines have 10 and 15-stamp mills, respectively; gold in

MAP OF OREGON.

the former being recovered by amalgamation and concentration, and in the latter by amalgamation and cyanidation. The Rainbow is owned by the United States Smelting, Refining & Mining Company.

UTAH

BEAVER COUNTY

During 1912 mining at the Horn Silver Mining Co.'s property covered 1433 ft., costing $21,556. One lead and two zinc stopes were opened, and there is considerable ore available. Total receipts were $137,114, and expenses $120,517. A fair number of properties are being actively developed in this county.

JUAB COUNTY

Construction work has been started on the new Knight mill at Tintic. It will be of 100-ton capacity, to be enlarged to 500 tons if the roasting and leaching process is a success. There are large quantities of low-grade ores in the district awaiting local treatment. The Centennial-Eureka has acquired an option on the King William mine at Tintic, and will develop it through its 1600 and 1200-ft. levels, there being about 800 and 200 ft. to drive, respectively. The annual report of the May Day Mining Co. shows that the production was 2649 tons of lead ore, worth $20,501, and 5500 tons of zinc ore worth $90,113, lessees producing $23,817 of the total value. A dividend of $24,000 was paid, and cash on hand totals $13,370. Since October 1912 shipments have been 825 tons monthly, and reserves of zinc ore are about 10,000 tons.

SUMMIT COUNTY

A Wellman-Seaver-Morgan direct-connected electric hoist of 500 hp., and an electrically-driven air-compressor, are being installed at the Silver King Coalition Mines' Alliance adit, 1800 ft. underground. A chamber 40 ft. wide, 100 ft. long, and over 50 ft. high has been cut out to accommodate it, and it should be ready early in the summer.

WASHINGTON

FERRY COUNTY

(Special Correspondence.)—The annual report of the San Poil Consolidated Co. for the year ended March 31, 1913, shows that the mill produced $73,000, and shipping ore $27,000. The profit was spent in mine development and mill equipment. An option has been taken by T. Roberts, of Sheridan, Wyoming, on the Silver Leaf mine in the Enterprise district. The vein in this property is 23 ft. wide, and carries streaks of rich sulpho-antimonite ore.

Republic, April 11.

SPOKANE COUNTY

A new rock-drill has been devised by P. J. Grove, of Spokane, who has operated machine-drills in the Coeur d'Alene for ten years. The machine, which weighs 125 lb., is being exhibited at the Central Machine Shops, Spokane. It operates without compressed air, but is worked by a 3.5-hp. gasoline engine weighing 140 lb. It is a one-man machine, and with 600 blows per minute can drill 20 to 25 ft. per day in hard rock.

STEVENS COUNTY

(Special Correspondence.)—During March the United Copper Co. shipped 12 carloads of high-grade ore and one of concentrate to the smelter. The International Diamond Drill Contracting Co. has completed two deep holes for the Aurora Mining Co. and is now drilling at the United Copper mine. The Blue Star Mining Co. is opening a vein on the 350-ft. level, and an orebody having been cut on the west contact, it is intended to sink the shaft to 500-ft. depth. The Redwood Copper Co. is about to resume work. A 40-hp. gasoline engine and hoist has been installed at the June-Echo mine, and the shaft will be sunk to the 200-ft. level.

Chewelah, April 11.

CANADA

ONTARIO

The March production of Cobalt was 1886 tons of ore, while the first quarter of 1913 shows shipments of 5084 tons and 1,880,909 oz. of silver. The Nipissing mine produced 337,121 oz. silver worth $224,530 in March, from the treatment of 113 and 6233 tons in the high and low-grade mills, respectively. No. 64 shaft is down 603 ft. and No. 86 is down 140 ft. in slate. At No. 63, a raise from the 145-ft. level opened 2 in. of ore for 40 ft. worth 3000 oz. per ton, while at 60 ft. it is low-grade. The new ore-shoot in the Lawson property of La Rose company has been opened for 40 ft. on the 188-ft. level, and over a width of 6 in. shows some of the richest ore ever seen at Cobalt. In 1912 La Rose Consolidated company produced 2,816,597 oz. of silver at a cost of 25.93c. per ounce. The profit was $1,023,142, and ore reserves contain 2,796,650 oz. of silver. The high-grade ore averaged 1307 oz. per ton.

Hon. W. H. Hearst, Ontario Minister of Lands, Forests, and Mines, has introduced in the Provincial Legislature a bill prohibiting underground labor in mines for more than eight hours per day. The measure is based on the recommendations made by Samuel Price, former Commissioner of Mines, who was appointed to investigate mining conditions in the province. It covers the entire mining industry with the exception of iron mines, and applies to all underground workers except shift-bosses, pumpmen, or persons engaged in surveying or measuring, but it may be suspended in cases of emergency. If it should pass, it will come into effect January 1, 1914, and will affect about 4000 workmen, chiefly in Cobalt and Sudbury district. As the session is drawing to a close, however, it is altogether probable that some convenient excuse will be found for shelving it until the indefinite future.

MEXICO

AGUASCALIENTES

The smelting plant of the American Smelting & Refining Co. at Aguascalientes, which was shut down for two weeks through shortage of coke, has resumed operations. When the Mexican Central line of the National Railways was reopened for through traffic, the first train brought a load of coke from the Chihuahua smelter, where a large supply was on hand. The Velardeña smelter of the American Smelters Securities Co. was also shut down, but received coke from Chihuahua.

CHIHUAHUA

On April 10, rebels commanded by Pancho Villa attacked a passenger train from Minaca, shot one passenger, and made prisoners of others. The express car contained 122 bars of bullion, owned by various mining companies, valued at $180,000, and this was loaded on mules by the robbers. The locomotive was uncoupled, the throttle opened wide, and let go toward Chihuahua, but it was derailed shortly after starting. On April 6, $20,000 in cash and $15,000 in merchandise was stolen from the Conchos River Dam Co. by rebels headed by Maclovio Herrera.

SONORA

The Mines Company of America during 1912 had a gross production of $2,382,993, and mining, treatment, and general expenses totaled $1,778,998, leaving a profit of $603,995. The surplus and reserve at December 31, 1911, was $2,198,982, which added to net profits made a total of $2,779,782. Depreciation was $204,026, and dividends paid $147,487, leaving the surplus at the end of 1912 at $2,428,269. Owing to the Mexican revolution, La Dura mine was shut down for 135 and the Dolores for 60 days, while El Rayo and the Creston-Colorado worked without interruption. Generally the mines are in good condition, but the ore reserves are less than the previous year. A dividend of 1¼% will be paid on April 25, 1913. The Greene-Cananea Copper Co.'s mines produced in March 4,772,000 lb. of copper, 124,658 oz. of silver, and 686 oz. of gold.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

R. S. MCCAFFREY is in New York.

RALPH STOKES is in San Francisco.

R. B. MCGINNIS has gone to Oregon.

C. S. HALEY has returned to the city.

E. H. BENJAMIN is visiting New York.

ROBERT MCSHAW is at Contact, Nevada.

C. C. BROADWATER is going to New York.

F. L. GARAISON has returned to Philadelphia.

W. W. MEIN will be in San Francisco next week.

W. A. PRICHARD was in San Francisco this week.

H. C. HOOVER sailed from London to New York April 12.

E. H. NUTTER was in New York and has returned to San Francisco.

J. F. CALLBREATH, JR., has been suffering from ptomaine poisoning.

L. N. HAGGIN and C. V. DAEW are visiting the Cerro de Pasco mines.

J. E. CLENNELL has come up from Mexico and will live at Oakland, California.

F. A. BLAKESLEE, of Kansas City, Missouri, will be away from the United States for about a year.

CLEMENT DIXON has been appointed consulting engineer to the Susanna Mines Limited, at Rhodesia.

WALLACE MACGREGOR is general manager for the Globe Con. M. Co., at Dedrick, Trinity county, California.

N. B. ROPER has sailed for Casapaica, Peru, to install a copper converting plant for the Backus & Johnson company.

Stanford University students and former students in geology and mining held a reunion at the University last night.

L. D. RICKETTS is expected to make his headquarters in New York from now on, but for the next year will find it necessary to spend much time in Arizona.

C. E. UREN has resigned as superintendent at the Eagle-Shawmut mine to resume consulting practice in San Francisco. He was succeeded by W. F. COPELAND.

A. H. CASE has resigned his position as manager for the Tennessee Copper Co., and has accepted the position of consulting engineer for Lewisohn Brothers, New York.

RONEAT SCOTT has returned to San Jose, California, from Beatty, Nevada, where he has erected a quicksilver furnace for the Telluride Quicksilver Mining Co., Ltd., controlled by Los Angeles people.

ERIE V. DAVELER, who has been assistant superintendent of the Ray Copper Co.'s concentrator at Hayden, has resigned to accept a position with the Alaska-Gastineau Gold Mining Co., at Juneau, Alaska.

Market Reports

LOCAL METAL PRICES

San Francisco, April 17.

Antimony	12—12¾c	Quicksilver (flask)	41
Electrolytic Copper	16½—16¾c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, April 17.—Copper is very firm. Producers are almost sold out till June. Lead remains unchanged. Spelter is weak, selling pressure being due to small demand. Average daily prices for the past week in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Silver, per oz.	Electrolytic Copper.	Lead.	Spelter. St. Louis
April 10	60¼	15 30	4.33	5.55
" 11	60	15.33	4.33	5.53
" 12	60	15.33	4.33	5.50
" 13	Sunday.	No market.		
" 14	59¾	15.40	4.33	5.48
" 15	59¾	15.43	4.33	5.48
" 16	59⅝	15.45	4.33	5.45

LONDON QUOTATIONS

(By cable, through the courtesy of C. S. Burton & Co., New York.)

	April 17.
Camp Bird Ltd	$ 4⅛
El Oro	3⅞
Esperanza	7
Oroville Dredging	1¾
Santa Gertrudis	6⅜
Tomboy	7

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. April 17.		Closing Prices. April 17.
Adventure	$ 2	Mohawk	$ 52½
Allouez	36	North Butte	29¾
Calumet & Arizona	66½	Old Dominion	49¾
Calumet & Hecla	475	Osceola	90
Centennial	14	Quincy	69
Copper Range	44½	Shannon	11
East Butte	12½	Superior & Boston	3⅜
Franklin	6¾	Tamarack	30
Granby	63½	U. S. Smelting	41
Greene Cananea	7½	Utah Con.	9
Hancock	20½	Victoria	1
Isle-Royale	26	Winona	2½
Mass Copper	4½	Wolverine	60

MINING STOCK QUOTATIONS—NEW YORK

(By wire from C. S. Burton & Co., New York.)

	Closing Prices. April 17.		Closing Prices. April 17.
Alaska Mexican	$12⅜	McKinley-Darragh	$ 2
Alaska Treadwell	42⅜	Miami Copper	24⅞
Alaska United	23	Mines Co. of America	2⅜
Amalgamated Copper	77	Nevada Con.	18⅜
A. S. & R. Co.	69½	Nipissing	9⅛
Braden Copper	8⅜	Ohio Copper	⅜
B. C. Copper Co.	2⅜	Ray Con.	18⅜
Chino	41⅜	Tenn. Copper	35⅜
First National	2½	Tonopah Belmont	6⅜
Giroux	2½	Tonopah Ex.	2½
Goldfield Con.	2⅜	Tonopah Mining	5⅜
Greene-Cananea	7⅜	Trinity	4½
Hollinger	17½	Tuolumne Copper	2⅜
Inspiration	18	Utah Copper	53¼
Kerr Lake	3⅛	West End	1½
La Rose	2½	Yukon Gold	2⅜
Mason Valley	7⅛		

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 17.

Associated Oil	$42.00	Orcutt	$ .55
Caribou	.97	Palmer Union	.18
Claremont	.60	Premier	.25
Coalinga Central	.20	Republic	.15
De Luxe	.50	Sterling	1.20
Maricopa 36	.33	United Oil	.34
Monte Cristo	.86	W K Oil	2.22
New Pa Pet	.45		

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 17.

Atlanta	$ .16	Mizpah Extension	$ .70
Belmont	6.45	Montana-Tonopah	1.80
Big Four	.85	Nevada Hills	1.10
Buckhorn	1.00	North Star	.38
Con. Virginia	.08	Ophir	.20
Florence	.50	Pittsburg Silver Peak	.55
Goldfield Con.	2.15	Round Mountain	.49
Halifax	1.15	Sierra Nevada	.22
Jim Butler	1.15	Tonopah Extension	2.50
Jumbo Extension	.25	Tonopah Merger	.99
MacNamara	.20	Tonopah of Nevada	5.95
Manhattan Consolidated	.09	Union	.09
Mexican	.75	West End	1.47
Midway	.52	Yellow Jacket	.25

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, April. 16.	Unlisted.	Closing prices, April 16.
Associated Oil 5s	100½	Natomas Dev. 6s	100¼
E. I. du Pont 4½s	93½	Pac. Port. Cem. 6s	99
Natomas Con. 6s	94¾	Riverside Cem. 6s	77
Unlisted.		Standard Cem. 6s	92
Associated Oil 1st ref.	85	Santa Cruz Cem. 6s	85⅝
General Petroleum 6s	66	So. Cal. Cement	80

STOCKS.

Listed.	Closing prices, April. 16.	Unlisted.	Closing prices, April 16.
Associated Oil	42	Mascot Copper	2
Amalgamated Oil	88	Noble Electric Steel	15
E.I. du Pont Powder pfd.	90	Natomas Consolidated	14
Pac. Coast Borax, pfd.	100½	Pac. Coast Borax, old	206
do com.	80	Pac. Portland Cement	60
Pac. Crde Oil	45c.	Riverside Cement	50
Sterling O. & D.	1.00	Standard Cement	17
Union Oil of Cal.	91½	Standard Oil of Cal.	187½
West Coast Oil, pfd.	70	Santa Cruz Cement	42

Metal Statistics

TIN DELIVERIES, according to L. Vogelstein & Co., during March, in the United States were 5900 tons, which is a new high record, caused by the great activity of the tin-plate mills, while general consumption was also good. Deliveries for the first quarter of 1913 were 1000 tons above the high tonnage for that period of 1911. Straits shipments are cabled at 4800 tons. Metal brokers in London estimate that the visible supply will decrease from 600 to 1000 tons during the month, which is unusual for a Banca sale month; and April shipments will also be small, producing a low-record visible supply. Generally speaking, there seems to be everything in favor of higher prices for tin.

TIN PRODUCTION of the Federated Malay States, which include Perak, Selangor, Negri Sembilan, and Pahang, during 1912, was as follows, as published by *In Tinland*, weights being in piculs of 133.3 lb. each:

January	67,566.26	August	74,831.46
February	72,544.83	September	66,132.00
March	53,698.25	October	65,604.63
April	67,269.81	November	69,086.93
May	71,849.10	December	760,747.01
June	59,465.09		
July	71,175.26	Total	742,223.62

Exports of tin from Singapore and Penang from 1906 to 1911, inclusive, were 58,478, 55,690, 62,744, 60,649, 56,694, and 67,087 tons respectively.

L. VOGELSTEIN & Co. report the following figures of German consumption of foreign copper for the months of January and February, 1913:

	Tons.
Imports	32,395
Exports	1,520
Total	30,875

Consumption during the same period of 1912 was 32,072 tons. Of the above quantity, 26,995 tons was imported from the United States.

Company Reports

HOLLINGER GOLD MINES, LTD.

This company's annual report is the first to deal with actual production from the new mill, and is generally entirely satisfactory. The general manager, P. A. Robbins, reports that the total advance of underground work was 5201 ft., making a total of 8918 ft. Ore reserves are estimated as 644,540 tons containing $11,271,400, of which $6,026,100 is in No. 1 and $2,648,250 in No. 2 vein, the balance being in 21 other veins. Ore has been proved to a depth of 300 ft., but no ore has been included in reserves 50 ft. below the deepest working on any vein. There are 34 known veins upon which no work has been done, other than sampling the surface outcrops. From November 15, to the end of 1912, the mine was at a standstill owing to labor troubles, which cost the company about $100,000. No. 3 winze is being sunk to the 400-ft. level, and the main shaft will be raised from the 300 to the 200-ft. level, and then sunk to 400 ft. Costs have increased during the year, and the February 1913 charges may be set down at $5.97 per ton. Results of the past year are as follows:

Ore treated from mine and dumps, tons	45,195
Contents of ore	$970,305
Recovery	933,681
Net profits	600,664
Dividends	270,000
Carried forward	351,802

EXPLORATION COMPANY, LTD.

This company was registered in 1904 with a capital of $3,600,000, to acquire the assets of a company bearing a similar name formed in 1896. The company carries on a general financial business, and holds interests in real estate and buildings in South Africa, South African gold mines, shares in copper mining companies, the Tomboy Gold Mines Co., Ltd., El Oro Mining & Railway Co., Ltd., the Suchi Timber Co., Ltd., the Buena Tierra Mining Co., Ltd., and in the Exploration Company of England & Mexico, Ltd., sundry investments in the balance sheet being given as worth $2,410,000. Owing to political trouble in Mexico, the Chihuahua smelter, which deals with ore from the Buena Tierra company, was only worked intermittently, consequently the mine production was curtailed, at the same time the first dividend, of 24c. per share, was paid. Metallurgical difficulties upset predictions concerning the profits from the Santa Rosa mine. Both the El Oro and Tomboy mines have shown marked improvement during 1912. Freehold property in Cornhill, London, is worth $720,000. Gross profits for the year totaled $386,880, and general expenses, directors' fees, and sundry investigations cost $114,240, leaving a balance of $272,640. A dividend of 7½%, amounting to $180,000, was paid, and, adding the amount carried forward from 1911, there remains a balance of $92,640.

The chairman of the company, R. T. Bayliss, said in part, with regard to the mining industry generally, "there seems today a lack of activity in the search for new mines and new mining districts. There is nothing in sight, so far as my information goes, that indicates the development of a new field. It is for companies such as our own, therefore, to go afield and look for things; and as Mexico is unsettled, we contemplate examining another country, believed to be rich in minerals, but which up to the present time has received but little attention."

CALUMET & HECLA MINING COMPANY

This company's properties are situated in Houghton county, Michigan, and the capital is $2,500,000 in $25 shares, now quoted at $465. During the year ended December 31, 1912, several other properties were acquired. Work on the Conglomerate lode covered 11,185 ft. of driving, shaft-sinking, and cross-cutting, and the production was 1,746,960 tons of 'rock' yielding 5,193,245 lb. of copper, at a cost of 8.87c. per pound. Development on the Osceola lode covered 18,505 ft., yielding 1,040,600 tons containing 15,692,199 lb. of copper, at a cost of 10.36c. per pound. There was practically no change in character of the ore opened, and fully 25% of the ore came from the foot-wall stopes. Stoping operations are being conducted over the entire length of the lode, about 2⅓ miles. On the Kearsarge lode, work covered 2140 ft., producing 19,050 tons of rock containing 228,985 lb. of copper. The shaft is 500 ft. deep, and driving on No. 2, 3, and 4 levels, while showing some good ore, has not developed ground of commercial value. Diamond-drilling has given no definite information regarding the Mayflower lode, but showed a large area of trap rock and amygdaloid beds carrying copper.

The regrinding mill crushed 481,320 tons of old tailing, yielding 2,155,292 lb. of copper, at a cost, exclusive of smelting and selling, of 4.99c. per pound.

The year's work may be summarized as follows:

'Rock' stamped, tons	2,806,610
Copper production, pounds	67,856,429
Mine cost per ton of 'rock,' excluding construction	$1.91
Average price received for copper, per lb., cents.	16.65
Total cost per pound copper produced, cents	9.86
Dividends received from other companies	$ 892,775
Dividends paid	4,200,000
To date	120,050,000
Cash at mine and New York	150,584
Ore and mineral	6,667,509
Supplies on hand	1,329,810
Bills receivable	953,212
Sinking fund	1,166,999
Liabilities	844,012
Surplus	10,716,414

UTAH CONSOLIDATED MINING COMPANY.

This company has a capital of $1,500,000, and works the Highland Boy mine in Bingham canyon, besides having an interest in the International Smelting & Refining Co., at Tooele, Utah. During the year ended December 31, 1912, mining and development covered 12,320 ft., and 664 ft. by diamond-drilling. On No. 8 level, no ore was found on driving west in Highland Boy limestone, and drilling in four places disclosed the same silicious and black limestone. Several payable shoots were opened on No. 11 level, besides 50,000 to 60,000 tons of low-grade ore, which cannot be profitably worked at present. A 480-ft. drill-hole cut no further ore. Connections for ventilation on No. 12 level will enable ore opened on No. 11 to be prospected. Practically all the lead ore estimated was found in the Yampa limestone, which overlies and is separated from the Highland Boy limestone by a bed of quartzite. The limits of the ore-bearing limestone have apparently been reached. The strike affected operations for 21 days in September and October, and to the end of the year. Ore reserves are as follows:

Copper ore, tons	251,500
Contents:	
Copper, per cent	1.90
Gold, ounces	0.04
Silver, ounces	0.58
Lead ore, first class, tons	24,100
Contents:	
Lead, per cent	14.96
Copper, per cent	0.97
Gold, ounces	0.05
Silver, ounces	3.51
Lead ore, second class, tons	12,000
Contents:	
Lead, per cent	6.80
Copper, per cent	1.10
Gold, ounces	0.03
Silver, ounces	0.35

The second-class lead ore will require concentration.

The year's production was 6,506,814 lb. copper, 8,734,398 lb. lead, 230,004 oz. silver, and 14,042 oz. gold from 159,143 tons of copper ore, and 23,713 tons of first-class lead ore. The revenue from metals sold was $1,976,454, and net profit $603,923, of which $450,000 was paid in dividends. Stocks of copper bullion on hand are worth $401,430, and cash $22,918.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

STEAM consumed by fuel-oil pumps and atomizers, at the Copper Queen power-plant at Bisbee, takes 4% of the total generated.

EACH reverberatory-furnace at the Calumet & Arizona smelter will supply heat to two 712-hp. Stirling boilers, making a total of eight boilers.

DEVELOPMENT of the Copper Queen orebodies ahead of actual mining has resulted in a reduction of timber used in stoping from 16.6 ft. to 14.9 feet.

RECOVERY of gold at the North Star mines, California, is 77.45% by amalgamation and 22.55% by cyanidation, the actual total extraction being 97.5 per cent.

THREE OXIDES, lime, alumina, and silica, three of the commonest components of all igneous rocks, are the three chief ingredients of artificial building stone (portland cement).

DOGMOBILE is a term given to the dog-teams and trucks which are used on the narrow-gauge railway, 90 miles long, between Nome and Lane's landing on the Kougarok river, Alaska.

THE NUMBER of claims which may be entered by one person under the lode law is unlimited, provided he does the necessary assessment work and otherwise complies with the law for each claim.

WILFLEY TABLES are being tried in the washery of the Stag Cañon mine, New Mexico, and results prove conclusively that a profitable tonnage can be recovered from the washery refuse products, and even from the waste dump.

POWER-STATIONS on the Rand, at the end of 1912, had a capacity of 94,000 kw. electric plant, and 40,500 kw. air-compressing plant; while it is estimated at the end of March 1914 there will be available 140,000 kw. and 61,500 kw. respectively.

PEAT from certain districts of Ontario shows the following analyses: 61 to 71% volatile matter, 18 to 27% fixed carbon, 4 to 20% ash, nil to 2.7% phosphorus, nil to 1.3 sulphur, and nil to 1.9 nitrogen, the calorific value being from 7490 to 9102 B. t. u. per pound.

FORMULA for calculating the horse-power of spiral conveyors is as follows:

$$\text{Hp.} = C\,W\,L \div 33{,}000$$

When C = constant 0.33 for grain, 0.65 for coal, and 1.0 for heavier and sticky materials; W = weight of material conveyed in pounds per hour; and L = length of conveyor in feet.

MORTAR, according to A. Gaylor and T. Sanborn, containing oil up to 25% by weight of the cement, shows (1) slightly less absorption of water than plain mortar, the absorption decreasing with the quantity of oil; (2) the tensile strength is decreased considerably below that of plain mortar, the strength decreasing with the increase in the quantity of oil; while (3) oil-mixed concrete containing 5, 10, or 15% of oil, by weight of cement, is more permeable under pressures from 20 to 60 lb. per square inch than concrete without the incorporated oil; and oil-mixed mortar containing 10% of oil is more permeable than plain mortar, under pressures of 10 and 20 lb. per square inch.

CAISSON DISEASE is an ailment caused by men working in compressed air in certain mining work where it is necessary to keep back water and sand. On the Colorado river siphon, constructed by the United States Reclamation Service at Yuma, 20 seasoned men from the Eastern states remained throughout the job, but the remainder, mostly Mexicans and 'floaters' were constantly leaving. At 30-lb. air pressure, only 4 hours was worked on a shift and there were no fatal cases. The time of 'locking out,' that is, moving from the air-lock to ordinary atmospheric pressure, was fixed at 12 to 15 minutes, the rate of decompression being made constant. About 1300 men were employed in compressed-air work from start to finish; and the records show 299 cases of disability for a few hours, 38 cases of disability from one to three days, 4 cases of part paralysis, and 1 case of total paralysis, resulting in death in three weeks.

REPAIRING broken gear, spindles, or rabbles in an Edward's duplex roasting furnace does not necessitate stopping the furnace for more than a few minutes, unless the break-down is near the middle fireboxes or in either row of rabbles opposite. The job is done as follows: The furnace is stopped and the key driven out of the pinion driving the respective broken parts, and the pinion is knocked out of the way. When the machine is started again, care must be taken to see that the rabble to be repaired is clear of the sweep of others. There being two rows of rabbles, those which are working on one side will carry the ore to the opposite side, which then carry it past the break. The repairs may be made at leisure, without materially interfering with the good work of the furnace. It is advisable to have spindles ready with the crown wheels attached, and if in a hurry, two men with a light tackle can make repairs in an hour. When all is in place, the furnace is stopped, the pinion moved in gear, keyed up, and re-started slowly. The spindles are purposely made the weakest part, as a rabble is more costly and takes longer to change if broken. Clinkers form occasionally near the fireboxes, and this should be attended to regularly.

PRESERVATION of merchandise in the tropics calls for great care in regard to dampness. The following notes are from a *Daily Consular Report* from India: The effect of heavy and continuous rain in the tropics is to produce a dampness in the air quite unknown in Europe and America, and which is destructive to many articles from these countries. The moisture and heat combined, set up all kinds of fungoid growth and decay in goods, which are quite unaffected by the climatic conditions of Europe and America. Mildew attacks textile goods, leather, books, and stationery; and arms, cutlery, and metal work require constant supervision to preserve them. Furniture of wood is soon spoiled by swelling and shrinkage, or by borer worms; and liquors, excepting the strong alcoholic ones, rapidly deteriorate in the heat of India. Perishable goods soldered up in tin-lined cases are not safe, if they have been packed in wet weather. The heat of the ship's hold in the Red Sea, or that of a closed iron wagon on the Indian railways, when the iron may acquire a temperature of 160° in the sun, will start mildew in the case by the aid of the moisture within it. Straw and shaving packings hold a good deal of moisture in damp weather, and do much mischief when sent to the tropics. No merchandise, therefore, that is liable to injury from heat or moisture can be stored long in India without serious deterioration. Books, if bound with ordinary paste, are quickly attacked by mildew and by vermin. The paste should be mixed with corrosive sublimate, or other antiseptic. Beetles will eat off the surface finish from stamped cloth covers. Books on shelves, unless packed tight, are all hanging by the binding, and a warm, damp atmosphere loosens them from the covers if they are large. All large books for use in the tropics should be bound so that when placed upright on a shelf the leaves should rest on the shelf—that is to say, the covers should be cut flush with the leaves on the under side. The appearance of such a volume might provoke criticism, but it would never lose its cover in the manner described. Books sewed with wire go speedily to pieces in the tropics. Since wire sewing has been introduced, a foolish economy has substituted tinned iron wire for tinned copper. The tinning soon disappears from the iron and the book falls to pieces.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

RETURN OF PURCHASE MONEY

Where a placer claim was entered for patent and the entry was subsequently canceled by reason of an adverse report by a forest officer charging that the land was more valuable for the timber thereon and for townsite purposes than as a mineral claim, upon a finding that no fraud or attempted fraud was committed in securing the entry, upon its cancelation the claimant is entitled to a return of his purchase money.

Alfred D. Hawk, 41 Land Decisions, 350. Oct. 30, 1912.

OIL AND GAS LEASE—RENTALS

An oil and gas lease, after providing for forfeiture if a well was not drilled within one year, gave the lessee an option to keep the lease alive after that period by paying an annual rental of 25 cents per acre until a well should be drilled. Held, that the lessor could not, by keeping the lease open voluntarily, collect such rentals from the lessee by suit.

Deming Investment Co. *v.* Lanham (Oklahoma), 130 Pacific, 260. Jan. 7, 1913.

COAL ENTRY—QUALIFICATIONS

The fact that a coal entry by an individual was made for the benefit of a corporation does not affect the validity of the entry, provided the corporation and each of the persons in whose interest the entry was directly or indirectly made possesses the requisite qualifications to make entry under the coal land laws. A second coal filing by the same person may properly be allowed where sufficient reason is shown for failure to perfect title to the tract embraced in the first filing.

Anderson Coal Co., 41 Land Decisions, 337. Oct. 21, 1912.

EXCESSIVE LOCATIONS—MARKING BOUNDARIES

Where a magnesite lode claim was located in a bushy gulch, and on account of the roughness of the country and lack of proper instruments for measurement, the locator was compelled to 'step off' his lines, marking by this method a location with side lines 2000 and 1700 ft. in length respectively and one end-line more than 800 ft. long, the court held that the claim was not void because of excess ground included, but only because it was found to be insufficiently marked. Had the boundaries been properly marked, the locator would have been allowed to cast off the excess area unintentionally included, and the claim would have been valid except as to such excess.

Madeira *v.* Sonoma Magnesite Co. (California), 130 Pacific, 175. Dec. 27, 1912.

ROCK PHOSPHATE—LOCATABLE AS A LODE

Calcium as rock phosphate, occurring in horizontal or 'blanket' veins of various degrees of thickness, when found in place firmly fixed in the mass of mountain between defined strata of limestone, is properly located under the lode laws and not as a placer claim. Where the rock was formerly located and held as placers and an adverse locator enters peaceably on the ground covered by the placer locations and makes lode locations thereon, the lode claimant may successfully adverse the placer locator's application for patent. In determining the possessory rights of the adverse claimants, a court of law may pass on the question as to whether the ground is properly locatable as lodes or placers, such determination being necessary to a proper decision of the issues, and not being a question exclusively within the jurisdiction of the Land Department.

San Francisco Chemical Co. *v.* Duffield (Wyoming), 201 Federal, 830. Nov. 21, 1912.

[This decision, in effect, if not directly, overrules the decision of Judge Van Fleet reported in our issue of November 16, 1912.—EDITOR.]

Points on Mining Law

FIXTURES AND PERSONAL PROPERTY

A track laid in a mining tunnel in a more or less permanent manner is a fixture and passes with the real property, regardless of change of ownership, unless some special provision in the lease gave the lessee a right to remove improvements upon abandoning his lease. In such event he would have to remove it within a reasonable time. The car is personal property and may be recovered by its owner at any time prior to the elapse of the three-year period of limitations.

POLL TAX IN CALIFORNIA

The state poll tax of $2 is payable by all male inhabitants of this state between the ages of 21 and 60 years. Road poll taxes not exceeding $3 per year in amount may be levied by the Board of Supervisors of any county on all male persons over 21 and under 55 years of age. There seems to be no specific authorization in the Political Code for the levy of a hospital poll tax, although section 3816 provides for the accounting by the county officials for hospital poll taxes collected. The assessor may collect the poll tax from any person indebted to another person who has not paid his poll tax, and the assessor's receipt is to that extent a discharge of the debt. It is the usual custom to collect poll taxes from employers for all their employees, and the amount for which he is liable is deducted from each man's wages.

TUNNEL RIGHTS

Many questions regarding tunnel rights have never been answered in the courts. Six months is the statutory period within which one should commence work on a tunnel location, and work must be prosecuted with reasonable diligence in order to protect rights thereunder. The claim extends for 3000 ft. from the 'face,' which is the point of inception. Presumably ground for dumpage purposes could be obtained by a surface location at the 'face.' No surface rights are conferred by a tunnel location in itself. The tunnel locator is merely given the right to veins or lodes not previously known to exist which he discovers in his tunnel. If he desires surface rights in connection with such lodes, he must make surface locations upon their discovery, and this is the usual custom. The assessment work for all claims located over the tunnel may be done in the tunnel, under one claim, if it is for the benefit and development of all of them.

Recent Publications

PROGRESS OF THE MINERAL INDUSTRY OF TASMANIA. Compiled by W. H. Wallace. P. 17. Hobart, 1913.

RESOURCES OF TENNESSEE. Vol. III, No. 2. P. 54. Ill. Published by the State Geological Survey. Nashville, 1913.

RAILWAYS AND AGRICULTURE, 1900-1910. Bulletin 45. P. 31. Ill. Bureau of Railway Economics. Washington, 1912.

AMERICAN TELEPHONE & TELEGRAPH CO. Annual report for the year ended December 31, 1912. P. 47. New York, 1913.

PUBLIC ROADS ARE PUBLIC NECESSITIES. By Joseph Hyde Pratt. Economic Paper 32. P. 62. North Carolina Geol. Survey. Raleigh, 1913.

CLASSIFICATION OF THE PUBLIC LANDS. By George Otis Smith, and others. Bull. 537. P. 197, index. U. S. Geol. Surv. Washington, 1913.

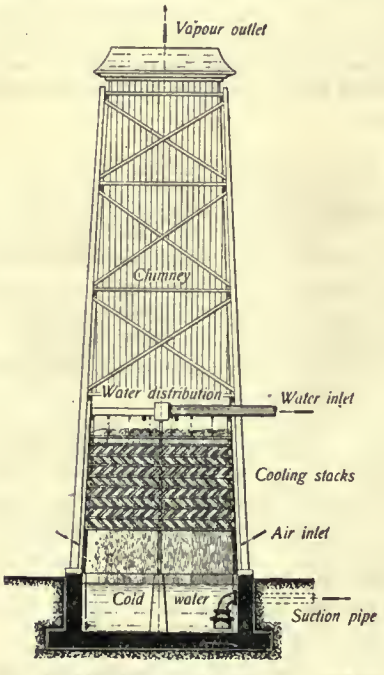
THE EAGLE RIVER REGION OF SOUTHEASTERN ALASKA. By Adolph Knopf. Bulletin 502. P. 61. Ill., maps, index. U. S. Geol. Surv. Washington, 1912.

GEOLOGY AND WATER RESOURCES OF A PORTION OF SOUTH-CENTRAL WASHINGTON. By Gerald A. Waring. Water-Supply Paper 316. P. 46. Ill., map. U. S. Geol. Survey. Washington, 1913.

The Wheeler-Balcke Tower

The substantial economies and advantages of the steam turbine, and especially the low-pressure steam turbine, have been demonstrated by repeated experiences. The low-pressure turbine can almost double plant capacity without the addition of boilers, stacks, fuel, or labor. But the condensing water necessary is scarce in the case of many central stations, electric railway plants, and especially factories, mills, and industrial plants. In such situations the use of apparatus for recooling the condensing water permits of operating condensing with or without low-pressure turbines. A cooling tower is the device most often used because of its greater efficiency as compared to spray nozzles or ponds and its simplicity and compactness. A properly designed water-cooling tower thus becomes equivalent to a natural water-supply. If it operates with natural draft and no fan is used, the only item of operating expense is the cost of lifting the water to the distributing system, and this lift may be greatly reduced by proper design of the cooling stacks over which the water falls.

The primary essentials for effective cooling are large capacity for dissipating heat to the atmosphere, so that a large volume of water is cooled, and the ability to dissipate this heat at a low temperature so that the water is cooled to a low temperature. To accomplish this, the water must present an extensive cooling surface to the air rising within the tower, and, secondly, there must be a brisk and vigorous air circulation. The Wheeler-Balcke tower is designed to meet these essentials by arranging the cooling stacks in zigzag tiers, which, while retarding the downward flow of the water, present but little resistance to the upward flow of the air. The cooling laths retard the downward flow of the water and spread it out into thin films, collect it, and break it up into drops, so that an extensive and ever-changing water-cooling surface is presented to the air. This method of cooling is known as the 'drop and film' principle. The tower is shown in the accompanying figure and is described by the manufacturers, the Wheeler Condenser & Engineering Co., of Carteret, New Jersey, as follows: Starting at the top, there is first the vapor outlet, beneath that the chimney, next the water-distributing system, which receives the water to be cooled from the water-inlet pipe and discharges it evenly over the whole surface of the tower. Beneath the water-distributing system are the cooling stacks and the air inlets, and finally, at the lowest point, the cold-water well, in which the water is collected and from which it is drawn to the condenser. The chimney and vapor outlet are of cypress boards, supported by a framework of yellow pine, resting directly upon the foundation. The chimney is of sufficient height to prevent loss of water by spray, and to draw a strong natural draft and a vigorous flow of air through the cooling-stacks. The timbers forming the frame of the tower and chimney are especially treated to prevent deterioration. The frame is constructed with mortised and tenoned joints where necessary, bolted together with steel bolts with large iron washers on each side, thus making a rigid and substantial frame to withstand a fifty-mile wind pressure. The shell of the chimney and the tower consists of surfaced tongued and grooved 1-in. cypress boards as free as possible from large loose and dead knots, shakes, and other imperfections, treated after erection with a special wood preservative to prevent decay. Special attention is drawn to the water-distributing system. The main trough into which the water is discharged from the water inlet is of cypress planks 1½ in. thick; from which the water flows into lateral gutters, which in turn distribute the water over the entire area of the tower by iron pipes arranged at equal intervals in the length of the gutters. The water falling from these pipes impinges upon galvanized-steel splash plates, which break the water into a fine spray, presenting to the rising current of air a cooling surface of maximum area. The water then drops upon the triangular cooling-laths below, which are arranged in zigzag tiers, as shown. The water is continually broken up, turned over, spread out in a thin film and retarded in its downward progress, so that the greatest possible amount of surface is exposed to the rising current of air. The zigzag arrangement of cooling-laths insures thorough breaking up and turning over of the water.



THE WHEELER-BALCKE COOLING TOWER.

The cooling material or cooling laths are supported by a framework independent of the tower and chimney, and consist of well selected cypress. Cypress being practically indestructible in water, the life of the tower is almost unlimited. Data regarding the life of cypress wood may readily be obtained from Government publications, which cite, for instance, a case where a well selected grade of swamp cypress lasted in first-class condition for over 80 years. The air enters the tower near its base, louvre boards being used to prevent loss of water by splashing, diverting it instead into the cold-water well. The cold well also forms the foundation for the tower and may be made of concrete or masonry, as desired by the purchaser. A working platform with hand rail is built on one side of the tower. The platform is reached from the ground by means of a strong ladder also provided with hand rail. Entrance is effected into the tower by means of a door which is made part of the shell. The distributer may be cleaned out by a broom while the tower is in service.

Scarcity of Aluminum

There is proof of the scarcity of aluminum in the large number of inquiries being made in various quarters by consumers as to where they can procure prompt deliveries. They do a large amount of shopping, particularly for sheet aluminum, and find great difficulty in satisfying their wants. Apparently production is not keeping pace with consumption. Culinary utensils are taking a large amount of the metal, as well as automobiles. Manufacturers of 'fireless cookers,' lamps, and match plates for molding have been among those seeking the metal, while the foundry business is increasing steadily. A large foundry is being built by the Werra Aluminum Foundry Co. at Waukesha, Wisconsin. News dispatches from Pittsburg, Pennsylvania, state that pressure for deliveries of aluminum sheets on contracts placed a year ago is so severe that the Aluminum Company of America is months behind in orders, and consumers are looking abroad for material. When books are opened for new business it will be for 1915 delivery. Even improvements which will result in increased production have been discounted. Other reports state that contracts incidental to the construction of the big plant of the Southern Aluminum Co. at Whitney, North Carolina, are about to be, or have been, placed, and it may be that some relief will be afforded by the operation of this plant.

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H. FOSTER BAIN - - - - - - - EDITOR
THOMAS T. READ - - - - ASSOCIATE EDITOR
T. A. RICKARD - - - EDITORIAL CONTRIBUTOR

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

REPORTS of the Nevada Consolidated, Ray, and Chino companies were made public this week. As usual, each presents much of public and technical interest. They will be reviewed next week.

SPRING has come and the mines in the Coeur d'Alene are short handed. The men say they leave for the farms—but there are many fine streams in the mountains, and fishing rods weigh less than hoes.

COMPOSITE prices of iron and steel are figured monthly by *The Steel and Metal Digest*. The pig iron price for March was 16.775, a shade under prices for January and February, but materially higher than the March price at any time in five years. The steel price was 1.7646, substantially equal to that of any month since July 1910, and higher than any March price, except that for 1910, in recent years.

ONE of America's best loved minor poets once wrote:

> "*De gustibus*, 'tis stated, *non disputandum est*,
> Which meaneth when translated, that all is for the best."

We commend these lines to those of our readers who may think that the discussion in our pages, started by 'A Miner' and continued first by 'Mine Superintendent' and now by 'A Commissary,' is likely to become acrimonious. If the use of butter-knives makes for peace and contentment, or the reverse, around a mine, the matter is, like Lincoln's rat hole, "worth looking into."

SINTERING fine ore preparatory to smelting is by no means easy, but the difficulties are being gradually overcome, and it is hoped that the necessity for briquetting in all but exceptional cases will ultimately disappear. One of the most successful devices is the Dwight-Lloyd, which operates on the principle of drawing a flame down through a thin layer of fine material carried in movable pallets. This machine quickly made a place for itself in lead smelting and is now finding a field in treating ores of copper as well. With the latter it works excellently when the percentage of sulphur is about 15. A smaller amount results in too little bond, while a larger causes the formation of a crust over the top of the layer of ore. The machine has been adopted by the Tennessee Copper Company, and has just been placed in the plant of the Cerro de Pasco company. Its use at the latter is especially noteworthy because of peculiar problems due to the great alti-

tude at which smelting is conducted and the large amount of study that the engineers of the company have devoted to the problem of handling fine material. We will print later a special article covering these new developments in sintering.

FURTHER details regarding the flotation of Inspiration ores are now available. The new plant of 600 tons capacity is to be rushed to completion, and if it proves the success that is anticipated, a 7500-ton plant will be built. The experimental work, which was under direction of Mr. E. H. Nutter, representing Minerals Separation, Limited, and which was conducted in a 50-ton unit, built by the way in 16 hours, was on ore representing 98 per cent of the ore reserves. The tests indicate a saving of 93 to 94 per cent, the concentrate assaying close to 40 per cent copper. While the extraction cost has not been made public, it was evidently low enough to warrant expectation of material profit even allowing for the royalty that will be paid. Aside from that, it is estimated that the simpler plant will permit a saving of $1,000,000 in first cost of the projected first unit. Adoption of flotation at the Inspiration without waiting for decision of the litigation at Butte, is a great triumph for Minerals Separation. How rapidly methods are developing, despite the fact that the art is still on an empirical basis, is indicated by the circumstance that the Inspiration ore is secondary in origin, and so recently as when Mr. Theodore Hoover published his excellent book on flotation, treatment of secondary copper ores was held to be impossible.

CHILEAN copper mines are attracting serious attention in New York, the Guggenheims leading in the work of development. The Chile Copper Company, with a capital of $95,000,000, was incorporated under the laws of Delaware, April 15. The company was organized in Delaware because the present stringent corporation law in New Jersey does not offer attractions to large corporations. It will take the place of the $20,000,000 Chile Copper Company organized in Maine last December, and will also take over the $1,000,000 Chile Exploration Company. The next step, after incorporation is completed, will be to issue $15,000,000 in 7 per cent convertible bonds, increasing the capital to $110,000,000. The stock will not be offered for public subscription. Mr. Daniel Guggenheim will be president of the new company, and Mr. A. C. Burrage vice-president. Development is already under way, as noted in a recent issue. The Braden company continues to do good work, having milled 53,700 tons of ore, averaging 2.4 per cent copper, in March, yielding 1,472,000 pounds of copper. The recovery in the wet concentration mill was 65 per cent, and in the Minerals Separation plant 71½ per cent. The copper production of the Braden for the first three months of this year amounted to 4,134,000 pounds. Incidentally, converters are being erected at the Backus & Johnston smelter, at Casapalca, and the company will ship blister instead of matte, as it is now doing. The present output is about 700,000 pounds per month.

DECANTATION is a process that attracts much attention just now in view of the situation as regards vacuum-filter patents. In a recent editorial we questioned its general applicability to treatment of slime, and our comment has been widely quoted. In the *South African Mining Journal*, Mr. Huxley St. John Brooks recently discussed the limitations of the process in an informing article, of which we present an abstract on another page. Mr. Brooks considers continuous decantation to be inapplicable to ores when the greater part of the gold or silver is locked up in the sulphides, or to high-grade ores that require extra strong solutions. He would apply the process to low-grade silicious ores requiring solutions of only moderate strength, and even in this case evidently prefers to combine the process with filtration. We have printed several articles, and have others in hand, in which the application of continuous decantation is described. The process has a field, and we hope to do our part in pointing out the conditions under which it attains maximum usefulness; our original protest was against a disposition to hail continuous decantation as a panacea, and the scramble to get away entirely from filtration. In the meantime, the metallurgist who reads Mr. Brooks' article will find in it a number of practical points of great helpfulness.

MEXICAN conditions show no signs of immediate improvement. Advices from the City of Mexico indicate general discouragement, though, as one correspondent writes, no one should expect any government to pacify the country in three months. Local sentiment, among Americans at least, is evidently strongly favorable to the present Government and the American Ambassador, Mr. Henry Lane Wilson. Members of the American colony feel that Mr. Wilson's activity and good judgment preserved the lives of many who would otherwise have been sacrificed at the time of the recent fighting in the city. In the United States the killing of Madero produced a profoundly unfavorable impression, and as one result the Huerta government has, rightly or wrongly, fallen heir to profound distrust. In the meantime the rebellion in Sonora and adjacent states is gaining headway. Point after point has been won by state troops, and the federals are now being besieged at Guaymas. At Cananea the mills and roasting-furnaces are idle, and a mob of 2000 men last Monday compelled the new manager, Mr. James S. Douglas, to leave the district, when he refused to give them work. Conditions are more serious there than at any previous time. Mr. L. D. Ricketts has gone to the scene of trouble, and it is hoped that means of meeting the situation will be found. The officials of the Cananea Consolidated Copper Company can hardly be expected to keep the plant in full operation, in view of the disturbed conditions and the fact that adequate police protection is not available. At the same time, stoppage of work operates to increase largely the number of trouble-makers. Many companies operating in Mexico have, in the past two years, been exhausting ore reserves with no adequate return; but there is nothing Mexico needs more than steady workers.

The Airblast at the Miami

The accident at the Miami mine, of which an account is given in our news pages, calls attention to a source of danger little appreciated by metal miners. Falls of rock are in themselves prolific causes of accidents to men, and great pains are taken and expense incurred to protect workers in this particular. The Miami mine was no exception. Readers who recall the description of the mining method employed, written by Mr. C. F. Tolman and revised by Mr. N. O. Lawton, that we printed November 13, 1909, will remember that elaborate plans had been laid to enable the men to work always under cover. How successful Mr. Lawton's plans were in this particular is evidenced by the fact that despite the fall, over an area roughly 450 by 500 feet, of rock estimated to have weighed 3,000,000 tons, not a man was injured by the rock itself. Even when the cave extended through from the level first affected to the one below, every workman was able to step into a fully protected drift. The men who were killed and injured lost their lives as the incidental results of the great airblast caused. This, in Western mines, is not a frequent source of danger, but it will not do to jump to the conclusion that it is a result of the caving methods of mining now being introduced. Airblasts occurred on the Comstock and have been noted elsewhere. They take place also in narrow workings and are the result of moving ground whether in broad stopes, as at Miami, or extensive narrow ones, as at the Champion Reef mine in the Kolar field of India. It is worth noting that at the latter mine airblasts are becoming more frequent, and a seismological observatory has been erected in the field for their study. Of 88 men who lost their lives in the Mysore gold mines last year, 41 deaths were due to airblasts, and 21 men were killed in one of the 406 noted. Compared with this record, the Miami accident, unfortunate as it was, becomes minor. It may none the less prove extremely significant, and the whole matter demands careful study.

Airblasts are not unknown in the mines of the United States. In the Lake Superior region they are common, but, so far as our recollection goes, have not resulted in loss of life. Their cause is the sudden compressing of air in a confined space, as a result of the infall of a large mass of rock. The wave of compressed air rages through the mine, exactly as does any similar wave caused by a dust or gas explosion in a coal mine. Men, timbers, cars, are picked up and thrown varying distances, according to the force of the blast. At Miami a train of 15 cars and a 7-ton motor was blown 200 feet along the track despite the best efforts of the motorman. Some of the men injured were blown forty feet or more. Such a blast has terrific force, and, if possible, means must be found to avoid their creation.

Recalling Mr. Lawton's method of mining already cited, it will be remembered that the system is one of large rooms and pillars. The rooms are kept filled with broken ore and the men work under cover, retreating into the pillars. It was planned to remove the latter by top slicing. Owing to irregularities in the top of the deposit, it was necessary to square-set a large area in starting the system. The plan is based upon Lake Superior methods, with which region both Mr. Lawton, the superintendent, and Mr. J. Parke Channing, the ruling spirit in the company, are thoroughly familiar. Carrying into a district methods developed in another necessarily involves nice judgment as to modifications. In introducing Lake Superior mining methods into the copper mines of the West, the principal new features are the greater vertical thickness of the orebodies, and greater strength of the walls, the capping, and the ore itself. It is worth noting that on the Mesabi range, where both ore and capping are soft and can easily be induced to cave, room and pillar methods have been almost entirely abandoned in favor of uniform top-slicing. While the ore won in room mining is cheap, there is increased danger, and the loss in pillars has been found to offset the economy. Experience of the same sort, though in reverse, may be cited from coal mining. In the latter long-wall work corresponds closely to the top-slicing by the iron miners, though rarely is it possible in a coal mine to take more than one slice. Long-wall mining has been proved time and again only to be successful when the roof is weak. Where it is strong it holds up until a great area is mined and then, giving way all at once, causes disaster. Any room and pillar method of caving is dependent for success upon bringing the capping down regularly and evenly. The cap must not be allowed to hang up and arch over any wide area. Entirely aside from the difficulties of judgment that this involves, there are certain human problems. The economical success of the method depends upon caving the greatest possible percentage of ore, and with the long time that must elapse between discovery and production, in the case of any of the great porphyry copper mines, there is every inducement to work quickly. It is even difficult to insure that subordinates will follow instructions and draw ore evenly from the stopes, and yet a big empty stope is a constant potential source of danger. Even locking and sealing the chutes, as has been done by one enterprising manager in the Southwest, does not altogether protect the mine.

Speed is the American mania, and we cordially sympathize with the managers who feel they must rush production. But speed involves drawbacks and, at times, penalties. Winning the last ton of ore is none too easy at best, and winning the heart of the deposit cheaply may well involve prohibitive expense later. We are glad to be able to add that the Miami engineers have shown every disposition to provide for the future even at added present expense. The mining expense per ton has heretofore been, if anything, a little higher than was anticipated. The figures for the past two years are given elsewhere. This has been explained, correctly enough, as the result of the careful square-setting over the main workings, undertaken preparatory to regular work. The accident of last week merely indicates that, since despite the care and competence of the engineers of the Miami, an airblast did occur, a grave danger must be faced in all the large mines, and even more care must be taken.

Rand Practice in Deep Shaft-Sinking

By Charles B. Brodigan

*Although the speeial subject upon whieh I propose to address you is shaft-sinking, I think it would add to the value of my paper if I prefaeed it by a short introduetion giving some idea of the nature of the problem that must be solved by the engineer before the work of shaft-sinking can be started. In order that you may be brought into touch with aetualities, I will consider the problem of the Brakpan Mines area as it came up for consideration before work aetually started upon it. The area is shown in Fig. 1. From evidenee afforded by bore-holes sunk upon the Brakpan and adjoining areas, a close approximation to the depth, dip, and general eontour of the reef eould be obtained. Speaking generally, the 3000-ft. contour was as shown in Fig. 1. The dip was estimated to vary

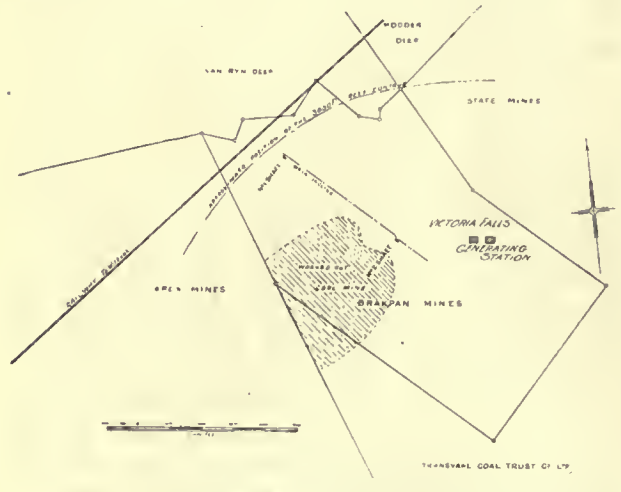


Fig. 1. Plan showing position of shafts.

from a maximum of 20° in the northwest corner to almost nothing about the centre of the area.

With this knowledge it then became a question as to the relative advantages of rise and dip shafts (otherwise described as shafts situated on a dip line) or strike shafts (shafts sunk on a contour line) for opening the area. The issue was at the time complicated by the faet that no long incline connection, in dead ground, had ever been made from lines derived from plumb-bobs swinging at a depth of from 3000 to 4000 ft. It was obvious that in a flat area it would be a great advantage to sink two rise and dip shafts separated by about 4000 ft., and which would eventually be connected by a haulageway for the transport of ore and material to the lower shaft about which the reduction works would be ereeted.

The strike shafts were, however, the easier scheme, for here there was no surveying diffieulty. All that had to be done was to sink the shafts, measure their depth, and then when the reef in both shafts was opened at the same level, simply drive the connection on reef. The strike shaft scheme had, however, the great disadvantage that wherever the shafts were plaeed there would be diffieulties with regard to ventilation and haulage, and also the probability of having to work a great amount of ground above the shafts, that is, to the rise; problems that were mueh simplified by the adoption of the rise and dip scheme. The strike shaft scheme, in faet, imposed such conditions on the ventilation and economieal extraction of the ground that it was eventually decided to brave the diffieulties connected with the aeeurate laying out of the incline connection and proeeed with the rise and dip shaft scheme.

Having once decided upon the general scheme, it was an easy matter to fix upon the positions the shafts should occupy. As the whole of the area would have to be opened up from two shafts, it follows that they should be central as regards the whole area. The existence of a worked-out coal mine, shown as a shaded area on Fig. 1, had to be considered. The coal in this mine was met at a depth of about 80 ft. from the surface. It was a very thick seam and had been worked on the pillar and stall system. It was necessary to keep the shafts well away from this area. Eventually the shafts were placed in the position shown on the map.

Circular v. Rectangular Shafts

Then eame the consideration of the size of the shafts. This problem had to be looked at from many points: (1) shape; (2) what ore would have to be hoisted; (3) capital cost; (4) ventilation. With regard to the shape, it was decided that they should be reetangular and not circular. The reasons whieh prompted this deeision were as follows: The proposed shafts, between 3000 and 4000 ft. deep, were to be sunk in a practically unknown area and through unknown strata, in whieh many weak places might be encountered. Poor ground can be easily held at any depth in a rectangular shaft, simply by bringing the sets eloser together. It is, of course, easy to make a circular shaft seeure when the sinking is performed in manufacturing countries like England and Germany. Tubbing necessary for the work is simply ordered for the job. In Africa this could not be done, and relianee would have to be placed on brieking the shaft. This did not commend itself. Again, speed in sinking is of primary importance in opening a new mine, and in Africa the men were already trained to sink and timber rectangular shafts and would have to start afresh if put to circular shaft-sinking and bricking. The speed factor was indeed two to one in favor of rectangular shafts. Owing to the depth of the shafts, it would be necessary to fix rigid guides in the circular shaft, so that even in good ground hitches would have to be cut in order that supports might be provided for these guides. This delays sinking to a serious degree. These drawbacks were considered to outweigh the many points of superiority that circular shafts possess.

*The Sir Clement Le Neve Foster Memorial Lecture, delivered at the Royal School of Mines, London, on Monday, January 27, 1913.

Of the other three factors, that regarding ventilation was decisive. It was rightly felt that mining on the Rand would in the future have to be carried out under much better conditions as regards ventilation than in the past, and upon investigation it was seen that the increase in capital cost for a 7-compartment shaft compared with a 5-compartment one was not serious. In fact, taking everything into consideration, it was better to be safe as regards ease of ventilation, by the adoption of the big shaft. Looked at from the point of hoisting capacity, it was felt that while a 5-compartment shaft would, with electric hoists, be large enough to cope with all the ore that was likely to be mined, yet the area was an unknown one and estimates of probable output might be far short of the actual requirements. Therefore, on this ground also, it was felt that it was a safe step to decide upon a 7-compartment shaft. The dimensions of the shaft are practically peculiar to the Rand. It consisted of six hauling-ways, 5 ft. by 6 ft. 6 in. The seventh compartment was a pump and cable-way and was 6 ft. by 6 ft. 6 in. The 6 ft. 6 in. dimension is the width across the shaft.

Equipment for Sinking

The equipment necessary to carry out the sinking of such a shaft with speed and economy must now be considered. The first point to be borne in mind is the fact that this sinking was being done in an unknown area far away from other mines; there was, therefore, always the possibility that the reef when reached would not be a profitable one, and that therefore anything in the nature of expensive permanent plant was not to be considered. Further, it was necessary to hurry the work; consequently, steel head-gears could not be ordered from Europe. Draughtsmen were consequently started at work, and the whole equipment was designed and ordered within a few weeks. It was first of all decided to have a 65-ft. wooden head-gear with surface ore-bins and flap-doors over the hauling ways to enable the bucket sinking to be carried on. For the shallower shaft, in which the reef was struck at a depth of 3100 ft., the principal items of the equipment were as follows.

Hoists.—Two 15 by 30-in. Ruston Proctor, double-drum, geared hoists were erected to serve, respectively, compartments 2 and 3, and 5 and 6. In this way the engines served the entire bottom of the shaft, leaving the end compartments and the middle one free. Geared hoists were selected for the sole reason that they were cheap in first cost and very efficient as sinking hoists that would have to be abandoned and scrapped as soon as the development period closed.

Boilers.—Care had to be taken to obtain a boiler which was fairly economical and yet possessed good water capacity and steam space, these features being of paramount importance in hoisting equipment. The fact that the available water was dirty had also to be considered, inasmuch as the boiler selected would have to be cleaned frequently and should therefore be very accessible. Bearing all these points in view, a boiler of the type known as an externally fired 16-ft. by 66-in. multi-tubular boiler of 125-hp. capacity was selected for each shaft. Three boilers were provided for each shaft. When increase in boiler capacity was made, a 250-hp. water-tube boiler was added, it being felt that the existing three boilers supplied sufficient steam space to justify the installation of the more economical water-tube boiler as a supplement.

As regards the other shaft where the reef was found at a depth of 3700 ft., the only difference in the equipment was in the provision of two 16½ by 33-in. Robey, geared, double-drum hoists instead of 15 by 30 in. The hoisting ropes used throughout the sinking were ¾-in. plow steel, ordinary lay, which gave a factor of safety of over 8 even at the bottom of the sinking.

Buckets v. Skips

It was decided that the sinking should be performed by the aid of buckets. Opinion on the Rand is acutely divided on the relative merits of buckets or skips as aids to sinking. The skip advocates point ont the safety of their method, while the bucket advocates enlarge upon the general handiness and quickness of their system. The decision between the two methods depends in a large measure on the temperament of the person to whom the matter is referred. I had no hesitation in deciding in favor of the bucket, though if the matter were referred to me now, with the added experience and judgment that comes with years, I think I would not be so certain. The sinking bucket used was of 20-cu. ft. capacity. It was attached to the rope capping (Fig. 2) by means of the falling pin connection (Fig. 3) which is safe and allows of quick detachment.

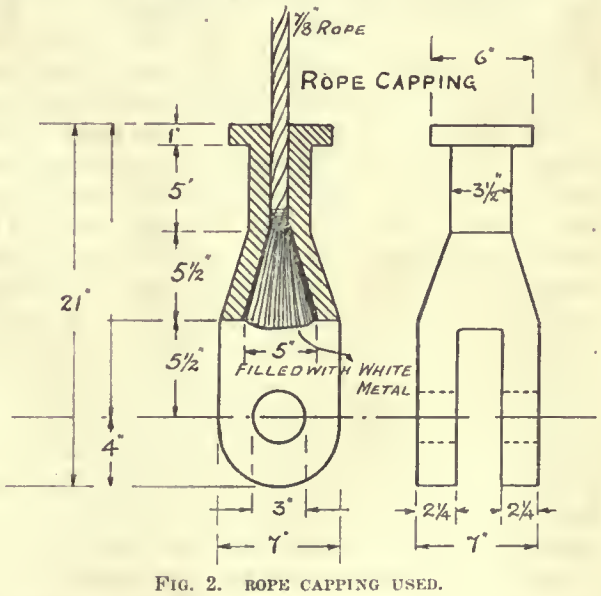


FIG. 2. ROPE CAPPING USED.

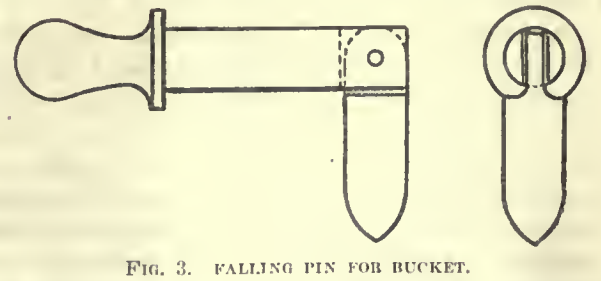


FIG. 3. FALLING PIN FOR BUCKET.

The rope capping (Fig. 2) was devised during the sinking in order to shorten the distance between

the cross-head and the bridle of the bucket; the ordinary splice that had previously been in use was about 12 in. longer, and in consequence allowed a dangerous swinging of the bucket while it was traveling through the shaft. The construction of the new capping is evident from the sketch. The manner in which the rope is attached to the sheath is as follows: The rope is pulled through the hole and then the end is untwisted and the individual wires separated and formed into a brush. This brush end is then cleaned by washing with caustic soda and rubbing with emery until the individual wires are perfectly clean. These are then tinned by first dipping them into a solution of zinc chloride and then into molten tin. The tinned brush is then pulled back into the cone sheath and molten white metal of good quality is poured in and fills up the space. This completes the work, and the resulting capping has never in my experience given the slightest trouble.

Cross-Heads

When sinking with buckets a cross-head must be provided, and it must be of such construction that while rigidly attached to the bucket during its passage through the timbered portion of the shaft, it can be released from this connection to allow the bucket to descend alone to the working bottom, the cross-head meanwhile hanging up and remaining fixed at the last timbered set. The cross-head resting on the stops is seen in Fig. 5. The cross-head used at Brakpan was a form known locally as Berry's. During the time the hoisting equipment was being erected the shafts were actually being sunk by means of hand windlasses. This work was necessary in order to get the collar set fixed in position.

Collar Set.—Unless hard rock comes right to the surface, it is necessary to secure a good foundation for the collar set. Thus, as is often the case, there may be 60 to 100 ft. of clay that will have to be secured before either the shaft may be permanently completed to that depth, or the collar set securely supported. To enter into a discussion of the many methods of doing this work is much beyond the scope of this paper. It must therefore suffice to describe the method which was used at Brakpan, where a hard rock known as 'Oude Klip' was found within 6 ft. from the surface. This 'Oude Klip' was of sufficient thickness to support the collar set, and under it the clay was hard and in it sinking could be carried on without the necessity of 'poling.' The only care necessary was to see that the excavation was not carried down for any considerable depth without first securing the walls with 4-in. lagging at the back of the timber sets.

The method of supporting the collar set can be seen in Fig. 4. Shortly described, the first stage consisted in cutting five trenches, two at either end of the shaft and three more at intermediate positions (under the first, third, and fifth dividers, respectively). These trenches were sunk in connection with the excavation for the concrete shaft wall enclosing the shaft. The bottoms of the trenches were leveled and, concurrently with the filling of the shaft wall with concrete, they were filled to the level given and worked up to a dead level in every direction. Upon these walls were then laid five 12 by 6-in. steel joists, 30 ft. long. These were then filled all around with concrete and the whole allowed time to set hard. Upon this bed the 12 by 12-in. pitch-pine collar set was placed. This set was constructed with great care and was carefully leveled and lined into position by the aid of survey instruments, and was then fixed with bolts to the girders. So fixed, this constituted the reference set, from which all the others were plumbed.

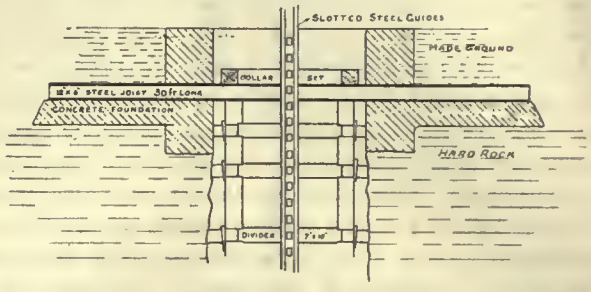


FIG. 4. SECTION THROUGH SHAFT WALL AND COLLAR SET.

It was necessary to provide a firm and adequate support for the collar set, inasmuch as if bad ground, against which it was found impossible to block the timbers so that they would be self-supporting, were met, the collar set would have had to bear the whole weight of this timber and maintain it in position until good ground was met.

By the time the sinking and hoisting equipment was ready for work the shafts were sunk and timbered for distances of 66 and 98 ft., respectively, in shafts No. 1 and 2. In passing, I may mention that hand sinking with windlasses is not economical beyond a depth of 30 to 40 ft., but in this case we were impelled to continue the system in order to accustom the natives to shaft work. When starting a new mine, the greater proportion of the labor available is green, and the training of the first units must be taken in hand as soon as possible. If the training of the first drafts is thorough, it will facilitate the training of those subsequent, for owing to language difficulties natives explain things much better to each other than can the white overseer.

The labor force, both white and native, for each shaft, consisted of 1 shaft overseer, 3 sinkers and 3 helpers, 3 timbermen, 6 engine-drivers, 2 banksmen, and about 300 natives. In addition, the general staff of the mine and set-maker and drill-sharpeners were available for both shafts.

Routine of Sinking

In order to make the actual system of work clear to you, I will assume that a round of holes in the shaft has just been blasted, and then follow the routine right through the working shift. The morning shift, which commences at 7 o'clock, is the best to describe, for during that shift the timbering of the shaft is also done. It will, therefore, be assumed that the sinkers in charge of the previous shift have just come to the surface and are counting the explosions resulting from their work. Having done this, they report to the leader of the oncoming shift the number of misfires. Without waiting, the sinkers and timbermen descend to the bottom sets of timber, where they carefully examine and clean

down any débris that may be lying there. The stops upon which the cross-head rests are then examined and fixed securely.

It is of the utmost importance that the sinkers should be able to get to the bottom as soon as possible after the blast. To do this, the smoke and gas resulting from the explosion must first be completely removed. This removal is effected in a cheap and efficient manner by the simple method of carrying down a brattice partition made of 1¼-in. tongued and grooved Oregon pine. This partition is carried on the dividers of No. 4 compartment, and is carefully fitted into the rough sides of the shaft. In a short time the shaft on one side of this partition constitutes itself an upcast and removes the smoke from the bottom. No mechanical aid is necessary after a depth of about 300 ft. is attained.

As soon as the timber has been cleaned down the sinkers go to the bottom, and the lowering of the natives constituting the shoveling gang commences. While they are being lowered, the sinker, his helper, and some of the experienced natives are dressing down the sides of the shaft, removing loose lumps that might fall, and otherwise making things secure.

Loading the Buckets

Bell boys are stationed at each signal rope and the removal of the débris from the last blast is started. To do this with the greatest speed it has been found necessary to use three buckets to each engine, but this is only necessary after a depth of 1500 ft. has been attained. It is at this point that the advantage of thorough training and organization of native labor pays best. Every boy engaged in this work has his allotted task and position in the shaft. Thus around one bucket are six boys with picks to loosen the rock and up to 18 shovel boys.

When only two buckets are in use, as soon as the bucket reaches the bottom the boys are standing ready with big stones—that could not be lifted on their shovels—in their hands; these they throw in, and then taking up their shovels they load for all they are worth. As soon as it is full the bell boy gives the signal to hoist, the bucket is lifted six feet in order to steady it and that the bottom may be cleared of loose material before starting on its journey. Another signal is then given and it is raised to pick up the cross-head resting on stops at the bottom set of timbers about 50 ft. up. It is essential, for reasons of safety, that the cross-head should be picked up very quietly, in fact we found it necessary to make it a positive rule that a pause should be made at that point. Directly the bucket has left the bottom the shovel boys step back to the sides and end of the shaft, and the pick boys come in to loosen the rock ready for the down-coming bucket. This bucket is stopped about 15 or 20 ft. from the bottom, and is only let down to the bottom on definite signal.

Necessity for Order

I have detailed this procedure in order to indicate the paramount importance of order and arrangement in everything concerning shaft-sinking. When it is understood that over 200 buckets of rock result from a blast, and that practically all this must be removed before the actual work of drilling can commence, and, further, that all the work of the shift, comprising clearing, drilling, charging, and fixing *must* be completed *within* eight hours, it will be realized that the organization of the work of clearing is essential to speed in sinking.

While the broken rock is being cleared the timbermen lower four weighted strings from the last blocked set of timbers to the sinker, who then stretches longitudinal strings, touching the plumb lines, along the sides of the shaft. He is thereby enabled to ascertain where, if at any place, the shaft is 'tight,' and thus be able to place holes that will remedy this. From Fig. 5, which shows the appearance of the bottom of the shaft during sinking, it will be observed that the ends are slightly higher than the middle.

In order to maintain good speed in sinking, the endeavor should always be made to keep the bottom as flat as possible: it facilitates getting about and gives level ground for the bucket or skip to rest upon. In practice the ends are just a little higher than the rest, and in consequence the sinker is able to start boys drilling at these high places, and also at the important corner holes, without delaying the work of clearing out.

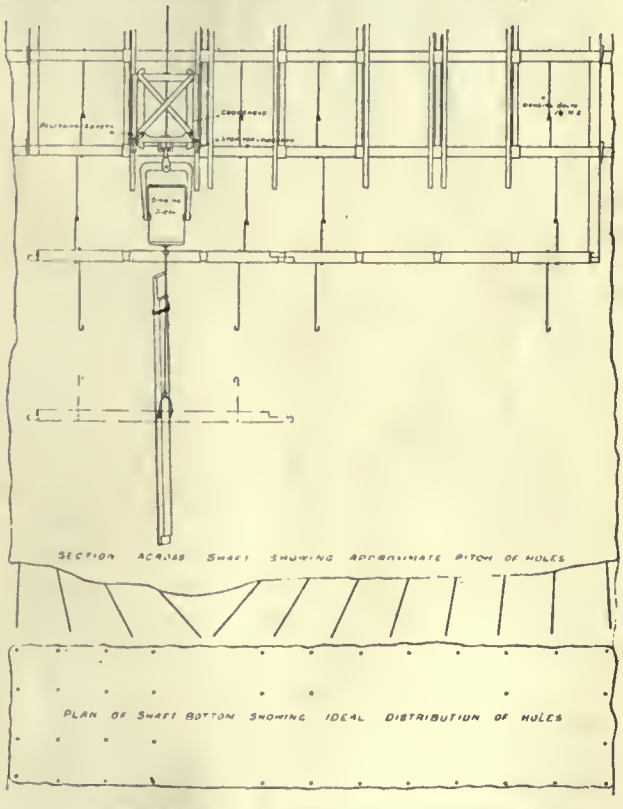


FIG. 5. PLAN AND SECTION AT BOTTOM.

The work of clearing is carried out in what would seem to be an unnecessarily complete manner; but when it is realized that owing to the close spacing of the holes in the shaft it is inevitable that some of them will be cut off before exploding, it will be seen that there is the chance of finding unexploded gelatine among the débris or an unexploded hole. Consequently, it is absolutely necessary to exercise the greatest care in clearing up thoroughly in order that all miss-fired holes and loose cartridges may be discovered before the boys are set to drill. At least 60% of the fatal accidents incidental to shaft-sink-

ing are the result of blasting accidents caused by drilling into miss-fired holes.

Drilling

While this thorough clearing out is being done, the sinker is starting boys in successive rows from the ends of the shaft. It takes four holes in average ground to break to the width of the shaft. It is impossible to indicate the actual position in which the sinker would place the holes, so much depends on the way in which the bottom has been left from the previous blast. The diagram (Fig. 5) indicates the general appearance of the shaft bottom when sinking is proceeding in good ground. In hard ground, the holes would not be so deep; they would in consequence be closer together and there would be more of them.

The last holes to be started, and the most important, are the sump holes. These are the leading holes in the shaft, so it is of the utmost importance that not alone must they be carried deeper than the others, but that they must be so set out and drilled that the ground between them must 'come.' Any failure of these holes would result in the whole blast being partly ineffective. The sump is carried about 10 to 12 ft. from the end of the shaft, and for ease of filling and bailing water is in the position where the end shaft-bucket rests. This is shown clearly in Fig. 5. Everything drains to the sump, and it is in consequence the last part of the shaft that is cleaned. For this reason the best boys in the shaft are kept apart as sump boys. Generally two, but sometimes three, are put on each hole, and every encouragement is given to them to drill deep holes.

While the sump is being drilled, the sinker and his helper are charging the finished holes in the other parts of the bottom. From 6 to 12 sticks of gelatine and two No. 6 detonators with two lengths of fuse each 12½ ft. long are inserted in each hole. As gangs of six boys finish their holes they are sent up to the surface, and so ease the anxiety as the shift approaches its climax. When all the holes are charged and the sinker has everything ready for firing, the timbermen are warned to leave everything safe and get out. The blasting signal is then given on the bell to notify the engine-drivers that they are to be ready as soon as a signal is given.

Firing the Holes

The firing is done by the aid of what is termed a 'cheesa' stick, which is made by cutting a gelatine cartridge into strips and wrapping these round a thin wooden rod prepared for the purpose. There are grave objections to the use of such material for this purpose, the principle one being that flaming gelatine gives off poisonous gases during the burning. But in a wet shaft no reliable substitute has so far been provided, and I would continue to use it on the grounds of safety and efficiency. With it you are certain of a flame that will not go out and which will light fuse under the worst possible conditions. In firing with the 'cheesa' stick one white man, with a native to cut the fuses, takes each end of the shaft. The sump holes are naturally lighted first, and then the men work toward the ends, lighting the holes in the order in which they wish them to explode. The length of fuse provided, 12½ ft. of 90-sec. speed, allows six minutes before the first hole explodes; but considering that the men are working in a space of only 42 by 9 ft., and that there is probably 100 lb. of blasting gelatine in the holes, there is every inducement to them to get through the work quickly. There is also every necessity on the part of the management to provide the men with the best and most efficient implements to enable them to carry out their duties quickly.

As soon as the shots are lighted the men and boys run for the bucket, ring the bell, and get up to the surface. This signal to the driver is also the signal to the banksman to lift the bell ropes from the bottom where they would be damaged by the shots, and also to lift the cluster of six electric lamps, by the light of which the sinking has been carried on. This cluster is carried on a wire rope from the surface and can be raised and lowered by means of a winch. This then completes the shift's work so far as the sinker is concerned.

(To be Continued)

Costs at the Perseverance Mine, Kalgoorlie

During 1912 the mill treated 234,636 tons of ore by roasting and cyaniding, and mine and treatment costs were as follows:

	Per ton.
Mining:	
Wages and contracts	$0.88
Explosives	0.14
Timber	0.01
Rock drills and air pipes	0.04
Candles	0.02
Steel	0.01
Tool sharpening	0.02
Assaying and surveying	0.04
Stores	0.02
General maintenance	0.11
Air for drills	0.10
Hoisting	0.26
Salaries	0.02
Development and broken ore debit	0.15
Total cost	$1.82
Less broken ore reserve credit	0.12
Net total cost	$1.70
Treatment:	
Rock-crusher	0.11
Ball-mills	0.53
Roasting	0.68
Grinding and agitation	0.52
Filter-pressing	0.42
Precipitation and clean-up	0.08
Disposal of residue	0.12
Total treatment	$2.46

Nevada Consolidated has completed its absorption of the Cumberland-Ely, and the latter company has been dissolved by the Supreme Court of Maine. The full capital ($10,000,000) of the Nevada Con. has now been issued, 543 shares having recently been listed. The outstanding shares of Cumberland-Ely, 1762 in number, can no longer be converted into Nevada Con. shares, but may be redeemed at $6.16 each. March production of the Nevada Con. was 5,555,320 lb. of copper, making the total for the quarter 14,525,560 pounds.

Hydraulic Elevator Work on Anvil Creek, Nome, Alaska

By C. W. Purington

The operation herein deseribed is being carried on by the Pioneer Mining Co. on the elaims known as No. 1 and No. 2 Below Specimen, on the gravel benches following the left limit of Anvil ereek, Nome, Alaska. It presents unusual interest as an illustration of the handling of unfrozen gravel by the hydraulie nozzle with the aecompaniment of the hydraulie lift and tailing nozzle.

Duty of a Miner's Inch

Aeeurate surveys were made during the past season at Nome to determine the points which are illustrated in the accompanying table. Calculations as to the amount of gravel handled in the hydraulie operations at Nome have generally been of a casual nature. Yardage in the bank is difficult to measure, the duty of the ineh was not definitely known, and conditions from one year to another have varied to such an extent that conjeetures as to the amount handled have generally been substituted for faets. From the data eollected from 29 days operation of this plant, from September 11 to October 9, 1912, I have determined the duty of the miner's inch[1] working on unfrozen gravel, namely, 2.63 eu. yd. per 24-hour inch, working with elevator and tailing giant in addition to the piping giant. Knowing this important figure, and knowing the eost per day of the operation, I have been able to ealeulate the eost per eubic yard from the data at hand.

The work is supplied with water from a penstock situated just below where the small stream of Specimen gulch crosses the Miocene diteh, on the left side of Anvil ereek.

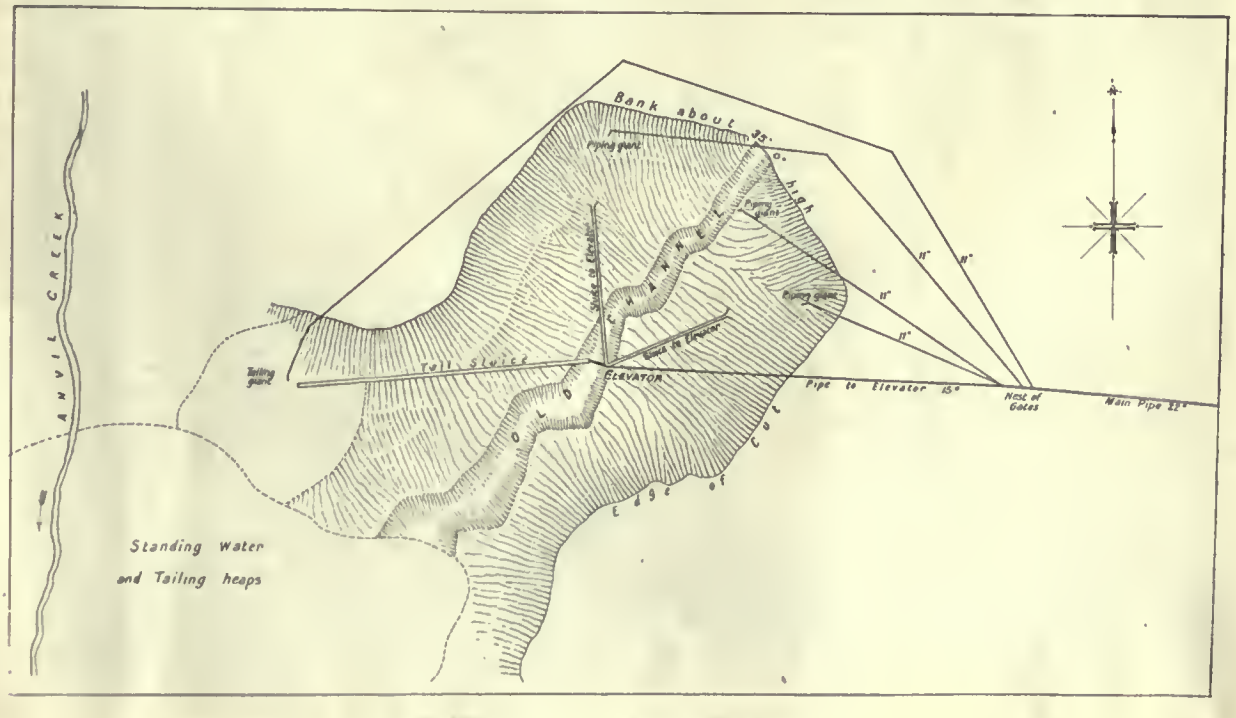
The gravel, which is eoarse and sub-angular with many medium sized boulders, oeeurs in the lowest and most westerly of the several beneh channels which parallel the main present ehannel of Anvil ereek. The ehannel worked lies at a distanee of about 1000 ft. to the east of the present Anvil ereek, all the ground between having been previously worked. The ehannel now worked in faet was for-

PENSTOCK AT MIOCENE DITCH SUPPLYING ELEVATOR.

merly mined by drift, but the record of previous produetion is not available. The drift or underground mining did not, however, produee more than the gold eontained in the lower 5 ft. of a narrow portion, the 25 to 35 ft. remaining above being left for extraction by eheaper forms of mining. Although no overburden tops the gravel, there is little or no gold in the upper 10 ft. of the 30-ft. average section.

The bedroek of this portion of Anvil ereek eonsists of hard laminated sehist striking northwest,

[1]The inch of 1.5 eu. ft. per minute.


Bank about 25° high
Piping giant
Piping giant
Piping giant

BEDROCK ON No. 2 BELOW SPECIMEN AT ELEVATOR PLANT.

penetrated by a multitude of narrow quartz veins showing mineralization, and evidently the source of the placer gold. Eighteen men and one team of horses are employed on each shift of 10 hours. More than one-half of the men are employed in cleaning bedrock. So rich is the bedrock dirt that it has to be cleaned with coarse brushes after the piping is finished, and a certain amount shoveled into wheelbarrows. The bedrock sluice referred to in the table opposite, is used for only a few days at the end of each set-up. On account of the uneven bedrock it is necessary to pick the rich concentrate out of the crevices, and wheel and dump it into this sluice, which leads to the elevator throat.

Handling Boulders

The team of horses is constantly employed in hauling out of the cut, as ordinarily it is impossible to drive with the giant a stone over 8 in. diameter from the bank into the bedrock sluice which leads to the elevator throat. Nearly twice as many men are used in this place as are necessary in the hydraulic lift operations at Little creek, where frozen gravel is dealt with, but where bedrock is softer and more nearly level. The difficulties of hard bedrock are more than offset so far as the capacity of the plant is concerned by the unfrozen condition of the gravel. This place affords indeed a good illustration of the fact that where gravel in the Nome district has good drainage it is generally unfrozen.

The duty of the miner's inch in the specimen operation is 2.63 cu. yd., as against slightly over 1 cu. yd. in frozen ground. The operation in question was the portion of the ground which occupies the east central portion of the claim No. 1 Below Specimen gulch, and consisted of 1.0079 acres, of an average depth of 8.5 yd., from which were extracted 41,415.7 cu. yd. of gravel. The table opposite gives the essential details of the operation. The head in feet for each nozzle was determined by applying pressure gauges to the pipes, and the amount of water used by each of the three elements, namely, the piping giant, elevator, and tailing giant, was determined by computation, and the total checked by measure at the penstock with current meter.

Consumption of Water

The unwelcome fact is clearly borne out in the last column to the right that the elevator, which only serves to lift the gravel 26.5 ft. in order to get grade or incline for the disposal of the tailing, consumes more than two-thirds of the total water used in the operation, which water has been obtained at great expense and many miles of ditch construction.

The piping water, which actually does the work and fulfils its legitimate purpose of breaking down and moving the gravel to the sluice, is only 20.4% of the total used. Looking at the matter from one standpoint, it is proper to say that nearly 80% of the water is wasted, or does not perform its proper function. At the same time it is doubtful if any other means could be devised for working this particular ground on a profitable scale.

But the most interesting fact appearing from the test, in fact the crux of the whole matter, is the duty of the miner's inch. This is a factor which varies in different regions with different kinds of gravel and is subject to many conditions. For the elevator operation in question, the important duty is the so-called 'combined,' namely, 2.6324 cu. yd. of gravel for each 24-hour miner's inch of 1.5 cu. ft. per minute. In other words, this means that if 1000 in. of water were in use constantly at this plant under 1912 conditions, 2632 cu. yd. of gravel per day would be moved, washed, and stacked. Actu-

DETAIL REPORT OF HYDRAULIC ELEVATOR PLANT*

On Placer Bench Claim No. 1 Below Specimen gulch, opposite No. 5 Above on Anvil creek, Nome, Alaska, operated by Pioneer Mining Co., of Nome, Alaska.

	Duration of work. Commenced.	Finished.	Total time. Days.	Hr.	Number of cubic yards handled. Actual operation.	Cleaning bedrock.	Total.
Bedrock sluice	Sept. 11, 2 p.m.	Oct. 9, 3 p.m.	28	1	39,789	1626	41,415
Tailing giant	Sept. 11, 2 p.m.	Oct. 3, 7 a.m.	21	17	39,789	....	39,789
Piping giant	Sept. 21, 9 p.m.	Oct. 8, 2 p.m.	16	17	21,047†	1626	22,673
Hydraulic elevator	Oct. 3, 7 a.m.	Oct. 9, 3 p.m.	6	8	.....	1626	1,626
Combined totals and means			28	1	.....	....	41,415

	Time consumed handling. 39,789 cu. yd. Days.	Hr.	21,047 cu. yd.† Days.	Hr.	1626 cu. yd. Days.	Hr.	Total. Days.	Hr.	Time lost by shut downs. Days.	Hr.	No. of 24-hr. miner's inches consumed handling. 39,789 cu. yd.	21,047 cu. yd.	1626 cu. yd.	Total. 41,415 cu. yd.
Hydraulic elevator	21	14	..	..	6	8	27	22	0	3	8324.55	.....	2225.53	10,550.08
Piping giant	21	15½	..	..	..	..	21	15½	0	1½	3213.73	.....	.....	3,213.73
Tailing giant	..	..	11	10	0	16	12	2	4	15‡	.....	1230.81	70.62	1,301.43
Bedrock sluice	..	..	..	..	6	8	6	8	..	..	.....	.....	667.85	667.85
Combined totals and means	..	..	..	..	..	..	27	22	..	..	.....	.....	.....	15,733.09

	Mean head or pressure. True (full) head, ft.	Effective head, ft.	Friction or lost head, ft.	Per cent of true head.	Duty per 24-hr. miner's inch handling. 39,789 cu. yd.	21,047 cu. yd.	1626 cu. yd.	41,415 cu. yd.	Per cent of total water used.
Hydraulic elevator	179.26	159.94	19.32	10.78	4.7798	...	0.7306	3.9256	6.7
Piping giant	148.66	134.09	14.57	9.80	12.3812	...	.....	.....	20.4
Tailing giant	163.41	137.10	26.31	16.10	.....	17.1	23.0250	.....	8.3
Bedrock sluice	170.00	wasted	170.00	100.00	.....	...	2.4347	.....	4.2
Combined totals and means	171.30	145.98	25.32	14.80	.....	...	.....	2.6324	100.0

Hydraulic Elevator—Nozzle, 4⅝ in. diam.; throat, 10½ in. diam.; lift, 26.5 ft. from top of nozzle to bottom of sluice-boxes.

Sluice-Boxes—Dimensions: width, 30 inches in clear; sides, from 2 to 4 ft. high; length, 136 ft. Grade: 3 in. first or upper 12 ft.; 4 in. second 12 ft.; 5 in. third 12 ft.; and 5 in. each 10 ft. thereafter.

Riffles—Oregon pine blocks.

Piping Giant—Nozzle, 3 and 3 1/16 in. diam. (only one nozzle used at a time under various heads.

Tailing Giant—Nozzle, 2 9/16 in. diameter.

Pipe-Lines—Main, supplying all water, 22 in. diam. by 1429 ft. long; branch for hydraulic elevator, 15 in. diam. by 307.5 ft. long; branch, for piping giant No. 1, 11 in. diam. by 284 ft. long; branch, for piping giant No. 2, 11 in. diam. by 236 ft. long; branch, for piping giant No. 3, 11 in. diam. by 139 ft. long; and branch for tailing giant, 11 in. diam. by 889 ft. long.

Bedrock Sluice-Boxes—Plan, 24 in. wide, iron, without riffles.

Miner's Inch—Equal to a flow of water 1.5 cu. ft. per minute.

*Prepared by Arthur Gibson for C. W. Purington. †Estimated.
‡Intermittent work while cleaning bedrock.

ally a daily yardage was maintained of 1428.1 using an average of 542.5 miner's inches for all purposes.

Now assuming that only this amount of water is available for future operations, it is evident that were the use of the elevator not necessary, and could all the water be used for piping the tailing now entirely disposed of by gravity, a duty of 12.3812 cu. yd. per inch, or a daily yardage of 6716 cu. yd. could apparently be maintained. This surprising duty is possible on account of the unexpectedly high duty of the miner's inch when the water is used for piping only.

The bulk of the remainder of the gravel in this portion of the Anvil benches can be directly hydraulicked without the use of the elevator owing to its physical situation. I therefore consider it an amply conservative estimate to allow a duty of 6 cu. yd. per miner's inch and assuming that 600 miner's inches will be available, to say that the remainder of the Specimen Gulch gravel can be piped off at the rate of about 300,000 cu. yd. annually. This increased duty of the miner's inch will have a remarkable effect in lowering the cost per cubic yard, as given in the table on the following page and based on the cost of handling over 1400 cubic yards.

PREPARING TO MOVE THE ELEVATOR.

Estimate of Cost per Cubic Yard

The following table is compiled from the cost sheet covering a period of 29 days, directly preceding the period already considered, when all conditions were essentially the same. These figures are the closest approximation possible under the circumstances.

The amount charged for water is based on the actual cost of ditch opening and maintenance for 1912.

COST OF WORK FOR HANDLING 1431.31 CU. YD. PER DAY*

	29 days.	Per day.	Per cu. yd.
Foremen	$ 435.00	$ 15.00	$0.010
Common labor	5,303.33	179.77	0.126
One team (boulders)	527.22	18.18	0.013
Boarding house	1,650.10	56.90	0.039
Supplies—freight, tools, carbide, quicksilver, sacking, grease, lumber, miscellaneous	1,210.17	41.73	0.029
Total labor and supplies	$9,125.82	$311.58	$0.217
Total Miocene maintenance, normal annual	$15,278.85		
Divided by 4 for proportion to No. 1 and 2 Specimen for season	$3,819.71		
Total for period	1,110.70	38.30	0.026
Depreciation of plant, namely, pipe, giants, elevators, steel sluice-boxes, riffles, etc, exclusive of ditch.			
Arbitrary figure on basis of 10-year life at cost, $10,000, or $1000 for season	263.61	9.09	0.006
Total working cost	$10,500.13	$358.97	$0.249

Administration Charges

The above costs do not include general administration charges and it will be noted that they do not include the original cost of the ditch. I regret that it is not practical in the present instance to give these items. The additional cost which must be added depends in each case on the number of separate plants against which the total of overhead costs may be charged. The amount charged for original construction of ditch was nominal as its cost had been mainly written off, and amount charged for management, being distributed over four operations was only moderate. But in certain cases this amount might be very high.

The working cost is what concerns us here. Allowing 24.9c. as the cost when the duty is only 2.63 per miner's inch, it is apparent that as the duty per miner's inch increases, the cost per cubic yard decreases. The cost of the operations per season, say $43,000 for 120 days, remains constant.

The operations of next season or the year after will be on higher benches, and it is likely that elevator and the tailing giant will be dispensed with. Under these circumstances, the duty of the inch may be taken conservatively as 6 cu. yd. If all the water be used for piping, namely, 542.3 in., as in the operations of 1912, the annual yardage in a season of only 100 days, actual piping will be 325,380, and the cost instead of 24.9c. will be 13.2c., a decrease of 47%. Every inch of water used for piping in addition to the amount used in the example above will increase the yardage and decrease the cost per yard.

There are generally two piping nozzles set, fed from the main pipe-line, and only one is operated at a time. In practice it is found that with a bedrock steel sluice laid on the grade, the face can be carried to a distance of 150 to 250 ft. away from the throat of the elevator in any direction. The elevator used is of the Campbell type, having 10½-in. throat and upcast pipe 15 in. diameter. As all details concerning the amount of water used for each element, size of nozzles, head, and length of pipe-line are given in the table, I will not repeat them here.

*Including all labor, foremen, tools, supplies, teams, hauling, boulders, boarding-house costs, and freighting.

Progress at the Inspiration Mine

By C. E. MILLS

*The operations described in the following report of work done at the Inspiration Consolidated Copper Co.'s mines during 1912 fall into two divisions—the underground work preparatory to the extraction of the developed ore, and the construction of the surface equipment necessary for the handling and reduction.

At the close of the year the total underground work in the Inspiration and Live Oak divisions of the mine may be summarized as follows:

	Prior to Dec. 31, 1911 (ft.).	During 1912 (ft.).	Total, Dec. 31, 1912 (ft.).
Drifts	32,655	25,355	58,010
Raises	2,902	4,676	7,578
Shafts	3,366	2,348	5,714
Miscellaneous	90	454	544
Total	39,013	32,833	71,846

Ore Reserves

Except for 1795 ft. of drilling done on the boundaries of the Live Oak property, and which did not add to the ore reserve, the churn-drill record for the property stood at the end of the year as at the beginning—229 holes, with a total footage of 124,886. The drilling record shows the following:

	Inspiration orebody, ft.	Live Oak orebody, ft.
Average thickness of capping	354	435
Average thickness of ore	142	114

The underground work of 1912, which was practically done during the last half of the year, was preparatory to ore extraction within the ore areas developed by the churn-drills, and was not designed to be exploratory in character; therefore the work has not resulted in any additions to the estimate based on the churn-drilling at the time of the consolidation, which was 45,000,000 tons of 2% ore.

No mining method except one of relatively high cost could be used that would deliver this ore to the surface practically free from admixture with barren capping, and it has been calculated that better net returns will follow the use of a cheaper mining method, though this method will inevitably reduce the grade of the mill ore. An attempt has been made to check the original estimates of ore tonnage and grade in that part of the mine where

*From the annual report of the Inspiration Consolidated Copper Company.

sufficient underground work has been done to render such a procedure reasonable. The regular mine samples have been checked by a second careful and independent sampling of such underground work, and these confirm the figures of Henry Krumb, the engineer under whose direction the churn-drill sampling and estimates were made.

The ore block sampled consisted of 600 ft. of the Joe Bush orebody lying immediately west of the eastern end-line of the Joe Bush claim. The comparative figures are as follows: Original estimate based on five churn-drill holes and 4325 ft. of underground work; tons of ore, 2,475,000; per cent copper, 1.95. Recent estimate by V. A. Hart, based on sampling of 15,165 ft. of underground work in same block; tons of ore, 2,525,000; per cent copper, 1.93. Estimate made by substituting regular mine samples for Mr. Hart's samples of same underground working; tons of ore, 2,525,000; per cent copper, 2.

This estimate very properly covered sulphide ores only. The drill-holes, however, show in addition, above the total area of sulphides, approximately 8,000,000 tons of oxidized and semi-oxidized ore averaging 1.4% copper, and there is unquestionably more in other adjacent areas. This semi-oxidized material has been classified, through conservatism, with the barren capping. It immediately overlies the ore. In any caving system of mining it will replace in part the otherwise barren capping that unavoidably in some degree will be mixed with the ore. In grinding this material the oxide copper is largely concentrated in the slime. If this oxide copper were treated by leaching as auxiliary to the regular sulphide concentration, it is probable that such of this semi-oxidized ore as is unavoidably drawn with the sulphide ore in caving might be made to yield net returns above the reduction costs.

The ore from the mine will be hoisted through two main shafts, 104 ft. apart, on the Gift claim in Webster gulch, and outside the known orebody. These two shafts have each been sunk to a depth of 585 ft., such being a suitable distance below the second and lowest level of the Inspiration mine.

Construction Work

The surface construction has been various, the main items being:

Erection of steel head-frames at the two Live Oak shafts. Enlargement of the temporary power-plant and shops at the mouth of the Inspiration adit. Erection of a supply-house at the same place, and another at the junction of the Inspiration railroad with the Arizona Eastern railroad. Building of a dam and excavation for pumping plant at Wheatfields, on lower Pinal creek, the source of water-supply for the mill. Joint construction with the Miami Copper Co. of an emergency hospital for employees. Construction of quarters for housing employees. Building of roads and the grading of the mill-site. Work on the Inspiration railroad. This line will be about 4½ miles long, of standard gauge, and will connect the mine with the mill, and this in turn with the Arizona Eastern railroad. The grading for this line was not completed last year, but is substantially finished at this date, except for one cut, which should be out in forty days. This line, together with an extension of the Arizona Eastern railroad from Miami to Live Oak, likewise now nearing completion, will furnish railroad connections to the main working points of the property.

Building the Mill

The contract for the steel construction of main head-frames, coarse-crushing plant, ore-storage bins, and concentrator building was let last November, and at this date the first of the material is under shipment. The work on the concentrator building proper has been held up pending possible changes in detail. A ten-year contract has been made with the United States Reclamation Service for hydro-electric power from power-plants in the Salt River project, and the power-line is now under construction.

No suitable millsite was available near the main shafts, but a very satisfactory one has been acquired about 1½ miles from the main shafts, together with ample and convenient ground for tailing storage. Plans have been made by H. K. Burch, as chief engineer, for a concentrator of 7500 tons daily capacity. The coarse-crushing plant will be at the main shafts, and the ore, after being crushed to a 1-in. cube, will be transported by rail to the fine-crushing plant at the mill. The ore-storage bins at the mine and mill will have a total capacity of 40,000 tons. The railroad line of 1½ miles from mine to mill, over which the heavy tonnage will move, will have a down grade to the mill of 0.3 per cent.

Previous to the consolidation, the Inspiration Copper Co. had made on a working scale, in a plant erected for the purpose, a long and careful series of tests on the concentration of its ores, under the direction of J. M. Callow. The result of these tests and of a flow-sheet worked out by Mr. Callow promised very good results for water concentration. In December last the company arranged with the Minerals Separation, Ltd., to make a trial of its flotation process. A plant of 50 tons daily capacity has been erected, and tests are now being made, from the results of which will be determined whether or not this process will be adapted to the treatment of the Inspiration ore.

The idiosyncrasies of the labor situation in Butte have brought new problems to the attention of the Eastern representatives of the General Electric Co. who have charge of the electrification of the Butte, Anaconda & Pacific railway. Paying $5 per day to electricians on one side of a county line and $4.50 per day on the other, did not seem reasonable at first. But after they had finished the work on the $4.50 side of the line they at last saw a great light and came to understand how wondrous were the workings of the Silver Bow Trades and Labor Assembly. So that now the work is to go merrily on and should be completed about the first of the year. Incidentally, the honest day laborer on the job demanded and is to get $3.50 for the 8 hours from the time he steps wearily on to the work train which carries him to the scene of operations in the morning until he steps lightly off said train in the afternoon.

Miners Versus Technical Men

By A Commissary

In the *Mining and Scientific Press* of Mareh 1, under the title of 'Mine Administration and Mine Bosses,' appeared an interesting article by some one signing himself 'A Miner.' Having knocked about the West from Nome to Panama, and having heard the same line of argument advaneed in bunkhouses all over the territory, it seems worth while at this time to take up the eudgels for the other side, in order that 'A Miner' and other intelligent miners may glimpse themselves for onee as others see them. I have been what might be termed a hanger-on of the mining business since my early teens. Raised in the West near the mines, not being able to seeure a eollege education, being of slight physique and hardly fitted for manual labor, it was natural for me to drift into timekeeping and commissary work and to remain there. And while following these lines of work, I have seen a great procession of miners, bosses, sehool of mines men, and farmers drift by me.

Are Technical Men Inefficient?

'A Miner' said in his artiele that "usually 95%" of mining inefficieney is found in the superintendent's office, and his artiele, as a whole, is a 'roast' of technical men, or as he terms them 'School of Mines men.' To the general publie, of eourse, no apology is neeessary for the great technical schools and eolleges seattered all over our eountry; but that 'A Miner' may know that there is an answer to the diatribes that he and his sort are so fond of spouting, his attention is called to the following argument.

To begin with, his article is illogical in that it condemns eollege men as a elass. All college men (classed) are no more ineffieient than all miners (elassed) are 'boneheads.' It takes an oecasional exception even to prove a rule. Generalizations are unsafe. His first argument against sehool of mines superintendents is that they change the old methods and then have to change back again. Possibly so. So might a praetical miner, who had never seen a school of mines, be inclined to try some method he had formerly used on taking eharge of a new property. If it didn't work and he saw that it didn't —good for him. if he is wise enough to change baek. The next argument made is that sehool of mines superintendents have a liking for importing men from their (the superintendent's) old stamping-grounds. This is quite natural, and especially so if he finds that any ideas he may have that he wants tried out are opposed tooth and toenail by the old-timers on the ground. It is a mistake made quite frequently by practical miners as well as school of mines men. I heard of an old 'Cousin Jaek' who got to be mine-boss who had one invariable question to put to applicants for jobs. His question was, "Has 'oo ever worked in Boote?" If the answer was yes, the man got the job if there was a vaeaney. If it was no, he didn't. And when there were no applicants and men were needed, he sent to 'Boote' for them. Now though this boss had a peeuliar manner of hiring men, it was said of him that he operated the mines with considerable suecess, as might be supposed, sinee there are many good miners who have worked in Butte. The point is merely that he was clannish and wanted men around him with whose type he was familiar.

Educated Superintendents and Profits

'A Miner' further says that he does not believe a superintendent (from a school of mines) ever took personal eharge of a mine and made it pay. Indeed! Now because a youngster has had the benefit of a eollege edueation, no sensible man will contend that he is therefore capable of handling to advantage a erew of men; but neither will any sensible man argue that because of his college years it has become impossible for him to aequire the knack of managing men. He may or may not beeome a good manager, but it is illogieal to damn him in advance. Western sehool of mines boys have a habit of working during their summer vaeations in the mines, and I have known many to be able to do a good day's work for their money, but I have yet to meet a hard-roek miner who would admit their ability. Of course, among the students are exeeptions who do not do a shift's work and do not expect to, but that is hardly to be eharged against all college men. Apropos of this matter of a superintendent's ability, or lack of it, personally to manage a mine, does 'A Miner' know of any praetieal miner of his aequaintanee eapable of managing a mine—ineluding the financing, aeeounting, surveying, assaying—without ealling to his aid technieal men?

The Gentle Art of Eating

'A Miner' next takes a shot at the superintendent for eating in a private dining-room, instead of eating with the men. It never seems to occur to men of his type that the principal reason why the office foree often group themselves at a private table, where they usually get the same fare as the miners, is to avoid hearing, day in and day out, the 'practieal miners' kicking at the grub. The fare is usually as good as can be provided for the money, and the erowd from the office are, as a rule, men who have been well raised. While the bill-of-fare may not be sueh as they would deliberately ehoose, they realize the limitations, make the best of them, and seldom eritieize. To sueh men it is sometimes disagreeable to sit down among a bunch of 'rough-necks' and hear the string of ill-natured eomment from soup to dessert. Now, Mr. Miner, I know that in allowing myself the use of the word 'rough-neck' I am guilty of generalizing also—as I make haste to add—poor table manners are not universal among miners.

Just a word about mine boarding-house fare. Ten years ago, when eommodities were almost 50% cheaper, miners throughout the West paid $1 per day for board. Now they are still paying $1 per day.

The increase in the cost of living has 'never touched them.' 'A Miner' says that dissatisfaction over the boarding-house is less common where the bosses eat at the same table with the men. Right you are—the principal reason being that, with the bosses present, three-fourths of the kicks are unuttered owing to the restraint of their presence; the remaining one-fourth being possibly deserved. 'A Miner' further inquires why it is that all 'school of mines' superintendents believe Chinamen to be the only people capable of running mine boarding-houses, and asks why they don't get "clean white women." From the query, I take it that 'A Miner' has gleaned most of his experience at mining in the Pacific Coast states, as the Coast is the only locality I know where Chinese kitchen crews are regularly employed. The answer as to why "clean white women" are not employed in isolated mines and camps is one I will leave to 'A Miner' to cipher out, merely advising him to think it over, and not to blame miners (classed), but just human nature for certain natural tendencies. I don't believe, though, that the superintendent has any special love for the Chinese.

Geology and Much Talking

'A Miner's' next complaint is that superintendents talk geology to the 'muckers.' Perhaps some of them do. 'Loud-mouthed' men exist in all classes, with or without a college education, and the tongue is an unruly member. Still, I would rather hear an educated man talk than one who is uneducated. Wouldn't you? 'A Miner' then says that school of mines superintendents are always harping on the inefficiency of labor. Now I will admit that I have heard some of that sort of talk when I thought it undeserved, and from superintendents whom I thought to be incompetent; but I have heard so little of it as compared to the amount of talk I have heard from men about the incapability of their bosses, that it hardly weighs in the scale. One benefit of a college course is the broadening of the mental horizon, and from this benefit comes, in most cases, a broad tolerance and understanding of the environment of the mine employee, so that but little attention is paid to the general grumbling about a mine. Coupled with his complaint that the superintendent grumbles about the inefficiency of the men, 'A Miner' asserts that they insist on hiring all the help themselves and are not capable judges of efficiency. This might be a reasonable complaint if it were true. I have worked under several mine superintendents myself—not as many, to be sure, as 'A Miner', who claims to have had experience with 40 or 50—but I have never yet seen a superintendent who insisted on hiring the mine-workers. Usually, the foreman has a 'hang-out' at some 'joint' in town where all his men are hired—and a bottle of 'booze' from the aforesaid 'joint' is a great lubricant of the process of securing employment; not mentioning at this time cases where even greater graft is involved.

By Way of Summary

Now the gist of the whole matter seems to be that no one man is perfect, to say nothing of an entire class of men, and men of any class are liable to make mistakes; but for 'A Miner' to assert, as he does, that all 'school of mines' superintendents are fools is the height of absurdity. I knew one such man, a foreman and an efficient one, who went to Panama to work on the canal. He did not 'make good' there, and soon returned to his old 'stamping-grounds.' When asked what he thought about the canal work, he had not words to express his scorn of the methods employed there, and loudly asserted that 'school of mines' boys were running everything into the ground down there.

The mining business, as is true of most other occupations in this country, despite temporary setbacks and in spite of more or less inefficiency of superintendents, school of mines men, miners, and foremen, is progressing. One foreman I know objected to college-boy samplers, and insisted that the only one who could practically sample a mine was a miner. He was allowed his way, and his samples all ran higher than the mill average; but since he insisted that his samples were right, the technical men may have been wrong. Another foreman, without being conscious of a prejudice, hires every farm-boy who comes along, to the exclusion of old-time miners. His farmer shift-boss breaks them in and they do good work, so the foreman is efficient.

Why Not Be a Superintendent

From his article 'A Miner' would seem to be a man of intelligence and ability, and with ambition. To such a man there should be a future in the mining business. Why doesn't he fit himself (if he is a young man) to become a superintendent? Mining companies are on the lookout for good men. If, however, his youth is gone and it seems impossible for him to overcome his early handicaps, I hope that some day he may 'hook up' with a wise superintendent, one who will understand him and whom he can understand. One to whom he will freely give of the best that is in him, of his practical knowledge of mining, and one who will know how to profit by this practical knowledge, adding thereto the benefit of his own theoretical and technical abilities in such manner that the result will be honor and profit to both, without jealousy or recrimination. If, on the other hand, 'A Miner' is at present 'hooked up' with such a superintendent as he describes, why on earth doesn't he quit his job? In no place more than in the operation of a mine is loyalty, enthusiasm, thorough confidence, and understanding more valuable, and in no other place is it more necessary that one 'get out or get in line.'

Australian trade in 1912 aggregated $753,278,500 for a population of approximately 5,000,000 people. Exports and imports were practically the same total, and the former included gold worth $59,728,500, and minerals worth $41,469,200, while the latter included gold valued at $8,092,800.

German iron and steel exports during 1912 totaled 6,000,000 tons, worth $280,000,000 (preliminary figures), against 5,400,000 tons in 1911, and 4,800,000 tons in 1910.

Organization of Smelting Enterprises—II

By Herbert Lang

The pay of the various classes of workers at a smelter varies greatly, being influenced by the custom of the country, the degree of proficiency shown, and by other contingencies. The manager of a large metallurgical works in America oftentimes receives as much as $10,000 per year, with instances where considerably more is paid. His pay is sometimes contingent upon the financial success of the enterprise, to which his services may contribute greatly. Considering the heavy responsibilities of the position, and the large amount of detailed knowledge demanded, such a salary cannot be considered unduly large, and is not greater than such a man would naturally earn in any other occupation demanding equal business skill. Superintendents subordinate to managers receive from $250 to $500 per month, according to circumstances. Those whose duties include business as well as technical management naturally get the most. It is difficult to estimate the pay of metallurgists, but it is probably about equal to that of superintendents, with the exception that there is a class of self-styled metallurgists who perform only the commoner functions of the office and receive hardly more than the pay of assayers. From this comparatively low plane we rise to that of the foremost men of the craft, who combine the duties and abilities of superintendents, or even of managers, with their own higher technical powers and are paid accordingly. Such persons, being supposedly capable of conducting the affairs of the concern in all respects, are expected in case of need to furnish the designs of new buildings and parts of the works and receive high pay therefor. Metallurgists who have attained proficiency in the practice of their art are sought in consultation by parties who have need of advice or assistance in the preparation of plans or the conduct of metallurgical work. They are then called metallurgical engineers, or more restrictedly, consulting metallurgists. This branch of effort, when it concerns the planning and construction of new or the rehabilitation of old plants, does not differ in character from that carried on by ordinary constructing engineers. Men of this sort, if well known, frequently receive very high compensation for such services, as high or higher than those engaged either in civil or mechanical engineering.

Metallurgists and Inventions

If of a reflective or inventive turn of mind, the metallurgist will find a great field of usefulness open to him in improving the apparatus and operations of his chosen branch. It is thought by those familiar with the growth and recent history of metallurgical engineering that there are few other pursuits that offer such strong incentive to the young and ambitious, and few professional means of livelihood that surpass it in the certainty and magnitude of its returns. The assayer, as a rule, expects to receive about $100 to $125 per month, if fairly proficient in his calling. Some are hired at much less, some at much more, depending mainly on the locality. In some regions, as at Butte, Montana, the custom has been to pay the assayer a daily wage of from $4 to $4.50 per day instead of the monthly allowance. Chemists are paid rather better, owing, no doubt, to the comparatively greater complexity of their work and the greater experience necessary to get reliable results. Probably $150 to $200 per month will cover the extreme range of their compensation.

Foremen and Wages

In addition to the above groups of employees, who invariably receive their wage on a monthly or yearly basis, there are others who in the practical running of the plant are hardly less important, but, as they are paid wages and not salaries, are less regarded. They are the foremen, who take personal charge of the routine work, subject to orders of the superintendent, to whom they report. They are commonly two in number, the day and the night foremen, and are persons who have risen from the rank and file of the operatives, having been distinguished by their skill, intelligence, and devotion to their company's interests. As they stand between the ordinary workmen and their officials, they occupy positions of no mean importance in relation to the welfare and success of the company. It will be found that the wages paid to these men, while on the daily and not on the monthly basis, are often higher than those obtained by the assayers, who are commonly regarded as superior in standing. The reason undoubtedly is that the position of foreman requires a man of tact and good understanding and experience, while the assayers are much younger men, of better education but less experience, who are, as it were, undergoing a probation in the practical affairs of life, and who are prone to look upon their billet as a sort of stepping-stone to something better. The average wage of a good foreman is $5 per day, or $6 in the more important establishments. In a properly regulated concern, all orders to the men, instead of being given direct to them by the superintendent, manager, or other person in chief authority, are transmitted through the foreman, for he it is who is directly responsible for their proper execution. In this way misunderstandings are avoided and proper discipline is maintained. In order to maintain the foreman's authority over the men, he is intrusted with hiring and discharging them, all applicants for such positions being referred to him from headquarters.

Below the foreman come several individuals who in large works perform services somewhat aside from the usual run of laborers and receive rather higher pay. They are the samplers, weighers, timekeepers, etc. Their duties are variously performed according to the size of the works, it being found that the larger the establishment the more special-

ized the duties, until in very large concerns there is an almost complete division of labor, the result of which is that no individual is expected to perform any work at all outside of his narrow specialty. This peculiarity of large concerns is the opposite of that in small establishments where every man is expected to make himself generally useful, and where, in consequence, the inquiring student, bent upon perfecting himself in the whole body of the art of ore reduction, has an ampler opportunity of doing so.*

Office Force and Workmen

The subordinates are the office force, especially clerks, who are under the immediate control of the superintendent, and the workmen, skilled and unskilled, who carry on the labor of the plant. The latter are divided into classes according as they perform routine or occasional work about the place. The former class consists of the men who attend the furnace, including the tappers, the slag-wheelers (in case the barbarous and wasteful method of discarding the slag by manual power is followed), the feeders, the charge-wheelers (giving way to the drivers of horses and better methods of bringing up the charges), the day and night foremen, and generally a weigher on each shift. With these are two or three yardmen and an ore sampler, whose work goes on more or less steadily. The class of intermittent laborers contains principally roustabouts, an uninteresting and not too intelligent class, composed usually of foreigners whose business is to fetch and carry. They have the stowing away of the ore, the guiding of the useful but antiquated wheelbarrow, and other jobs for which machinery is inadequate. This is the class that gives the most trouble, works the cheapest but costs the most, and of which managers are always anxious to be rid. These individuals receive salaries and wages in the West about as follows:

Manager, on term contract, per year	$6,000—	10,000
Superintendent, unlimited time, per month	250—	350
Metallurgist, usual contract, per month	250—	500
Assayer (per day $4 to $5), per month	100—	150
Chemist (per day $4 to $5), per month	150—	200
Sampler, per day		4
Foreman (day), per day	5—	6
Foreman (night), per day	4—	5
Tappers and feeders, 12-hour shift		3.50
Slagmen and charge wheelers, 12 hours	2.50—	3.00
Roustabouts, per day of 10 hours		2.00

The total number of men connected with the running of one furnace and performing their duties at the works is usually not less than 20, and if the carpenters and others whose exertions are frequently but not constantly employed be included, it may rise to 40. On the other hand, there are many small plants which need but a dozen or so of men, but these of the best class. The number employed will depend mainly on the arrangement of the machinery of the plant, its adaptation to the purposes intended, and the inventiveness and originality of the designer. In these respects there is a vast difference between plants and a corresponding difference in the cost and perfection of the work they do

The consulting engineer, in name, at least, if not in principle, is the outgrowth of recent conditions. It has become quite the fashion with mining and metallurgical organizations that may desire to carry on their work in a more than ordinarily thorough style to employ consulting experts, much the same as one would employ an attorney or a physician. The consulting expert is a professional person who prescribes and gives advice. He has no authority, and is not supposed to participate in the management or conduct of any part of the business of his employers for the time being, but merely to observe conditions and plan and advise. The same qualifications which make the physician or the lawyer valuable to his clients must be possessed by the consulting engineer—namely, varied accomplishments, deep insight, and extended experience. It is not every new company that is circumstanced so as to avail itself fully of such qualifications.

Where Engineers Are Not Wanted

In the first place, the tendency of beginners is to postpone the employment of the higher sort of professional assistance until a late date, under the erroneous impression that a small enterprise, and especially one in its earlier stages, has no need of particular skill or knowledge. This is a great mistake. If to this be added the natural feeling of dislike that many men have to association with persons of talent or attainment beyond their own, sufficient reason is found for the omission of many companies to employ skilled engineers in their work. There is something also in the desire of ambitious members of companies—stockholders, it may be—to distinguish themselves by conducting the work in person. No doubt the same is to be expected in any other pursuit; for human nature is much the same everywhere and under every condition. Should the new company contain no member experienced in mining or metallurgy, it will ordinarily dispense with high-class professional assistance, at least until mistakes have been made and recognized, and some loss of time and money incurred. Experience frequently induces them to place their affairs finally in some measure in the hands of qualified persons, among whom the consulting engineer may be one. Should he possess the requisite skill, integrity, and experience, together with enough force of character to impress his views upon his associates so that they feel impelled to carry them out, his engagement will likely be of great advantage.

According to the circumstances of the case, the engineer may have been hired either to give advice,

*This feature should be borne well in mind by students and others wishing to familiarize themselves with the operation of general metallurgy. It is better for such to connect themselves with small establishments, where their opportunities for obtaining practical knowledge of many branches are much better than in large concerns, where the tendency is to confine employees to particular occupations. Entering the service of a small company which is about to begin operations in ore reduction, it is not difficult for the young assayer, chemist, surveyor, or clerk to obtain practice in nearly or quite every line of occupation about the works. With much profit to himself he may be in turn millman, tankman, weighmaster, slag rustler, furnace tender, or roaster-man, and acquire within a short space information and practice which will be of immense value in later life. Without this practical knowledge in the handiwork of metallurgy it is impossible to achieve the highest degree of usefulness in the various branches of the calling. There is no doubt that the most successful metallurgists are those who, in addition to a wide theoretical knowledge of their craft, have also a practical knowledge of how to do it; that is at least as valuable.

to plan works and supervise their construction, or to do both. Or he may even have been asked to direct the running of the plant after it has been built. If his duties are solely to give advice, his designation properly is consulting engineer or consulting metallurgist; if to plan the works, he may be termed the designer; if to supervise the building of the plant, he is called the constructing or superintending engineer; and if to conduct it subsequently, he is rightfully called either the manager or superintendent, according to the nature and extent of his services. In the former case he resembles the attorney who confines himself to chamber practice. He has clients, perhaps several at one time, to whom he gives advice, but his time is not, unless by special arrangement, wholly at the disposal of any one of them, and he bases his charges upon the character and extent of the services rendered, or even, as do other professional men, perhaps upon the supposed wealth of his clients.

No one, not even the manager, has so many and favorable opportunities to benefit his company as the consulting engineer. Viewing the entire field of their activities in the light of his wider experience, he sees many possible improvements in their practice and methods. Doubtless the career of every such engineer contains instances where in the compass of a single letter of advice he was able to save his company the amount of his salary for the year. A hint to a careful foreman about the conduct of the work, or a suggestion as to the saving of some hitherto unregarded by-product may often produce an almost invaluable effect upon the fortunes of the company. If mining and metallurgical companies knew how faulty even the best practice is, and how easy it is for the experienced engineer to suggest improvements, the employment of expert assistance would be the rule and not the exception. Consulting engineers might reasonably be paid according to the savings they are enabled to effect. Thus, if by some suggestion an economy of so many thousand dollars per year results, he might receive one-half or one-fourth of the sum for a stipulated number of years, or as long as his engagement lasts.

Visitors and Publicity

Metallurgical works should always be open to the visits and criticism of qualified persons, instead of being, as so often the case, shut against the outer world. The free exchange of ideas by the staffs of various works has done more for the prosperity of companies and for the advance of metallurgical science than any other cause which can be named. Those concerns which shut themselves up jealously, refusing the common courtesy of a visit of curiosity, are almost invariably behind the age in some department, perhaps in all, and manifest a disposition which is, to say the least, inharmonious with the spirit of the times. This narrow and illiberal spirit, which manifests itself oftenest in the behavior of those foreigners who have been received on our shores, reacts most injuriously upon the fortunes of those who practice such exclusiveness, and also on the progress of the arts which they make, as a rule, so much pretense of understanding.

Continuous Decantation Versus Filtration

By H. St. J. Brooks

*Of late there has been a good deal of discussion on this subject, and between the various views it may be possible to steer a middle course. While frankly admitting the fact that filtration is a necessity for certain ores, it nevertheless seems to me that for many others continuous decantation, supplemented when necessary by a final dewatering on a rotary type of filter, has a distinct future. In metallurgy, as in every other field of endeavor, there is a general tendency to follow the prevailing fashion. A new process, a new machine is introduced; at first it is eyed askance, then some well known mine takes it up, it is proved successful, and it immediately becomes the panacea for all imaginable metallurgical ills. This, in itself, tends to bring about a reaction, and just as even the Pachuca tank has reached its zenith and is now slowly giving way to other forms of agitators, so there is beginning to be observed in the United States, the home of vacuum-filtration, a reaction against the idea that filtration is essential in all cases to the modern slime plant. It may be granted that for those ores where the greater part of the gold or silver is locked up in the sulphides, for high-grade ores and those requiring treatment with extra strong solution, filtration is necessary. But where the bulk of the precious content is present in the silicious part of the ore, and especially for low-grade ores requiring only moderately strong solutions for beneficiation, I think there is a wide field for continuous decantation.

Reaction Against All-Sliming

The writer of an editorial in the *Mining and Scientific Press* deals with the question from the standpoint of the all-sliming mill alone; but it must not be forgotten that not every mill, even nowadays, is an all-sliming one. Indeed, there are already signs of a reaction against the too prevalent employment of all-sliming as opposed to fine grinding. I am one of those who agree with E. M. Hamilton, Stuart Browne, and others, that many ores now being all-slimed in deference to the prevailing fashion would give a better commercial extraction by crushing to about 100 mesh, separating the sand from the slime, and treating both products independently. As a case in point, the management of a gold mine in the Orient which all-slimed its ore was considering the installation of an additional 20 stamps and two tube-mills in order to increase the mill tonnage. A little laboratory investigation revealed the fact that the sand at 100 mesh gave good extraction by leaching, and the bulk of the metal contents were in what may be termed the natural or colloidal slime, as opposed to granular slime produced by finer comminution of the 100-mesh product. It was therefore decided to crush with much coarser screens, separate out the sand at 100 mesh, and leach this in a sand plant erected at a trifling cost compared to that of 20 additional stamps and two tube-mills. To my mind,

*Abstracted from the *South African Mining Journal.*

the ideal treatment of a low-grade, oxidized, non-complex ore is that of coarse stamping, tube-milling to about 100 mesh, amalgamation after the tube-mills if necessary, classification, leaching of the sand, and continuous decantation of the slime through Dorr thickeners, finishing with some simple continuous dewaterer of the rotary type. Undoubtedly it would be far simpler to dispense entirely with the final filter treatment, particularly as there seems every reason to suppose that even operators of the continuous rotary type of filter will have to pay the Moore Filter Co. royalty for some years to come. But, save where it is possible to mill with weak solutions, the mechanical loss of cyanide where no filter is employed, is bound to be high, amounting to over 24c. per ton in the most favorable cases. By using weak solution running 0.04% KCN, or less, as a diluent in the final thickener, and returning the effluent after precipitation to the battery storage-tank, mechanical loss of cyanide would be kept as low as possible, while by stamping in a weak cyanide solution through a coarse screen, and only bringing the solution up to full strength in the tube-mill circuit after return of the excess solution to storage, not only would the amount of solution requiring precipitation be considerably diminished, but the bulk of the metals could still be brought into solution ahead of the agitators. Yet neither the gold content of the battery solution nor the cyanide titration of the same solution when precipitated for use as a final diluent would show any tendency to climb. Such a scheme, requiring two classification circuits, would necessitate the employment of double the usual number of classifiers and also of an extra thickener.

The Field for Decantation

To sum up: in my opinion, the slime of many gold ores may be successfully treated by a combination of continuous decantation, with some form of continuous rotary filtration. A smaller proportion of ores will give good results with the same process, even after dispensing with a final filtration. On the other hand, most silver ores, and high-grade and fairly refractory ores, which require prolonged agitation, are best treated by filtration with a discontinuous filter of the leaf-type. Even then, however, it is advisable to remove the greater part of the precious content by preliminary thickening and dilution with barren solution. Though used in a large percentage of the latest mills in America and Mexico, like the Nissen stamp, the Dorr thickener has been slow to find much favor on the Rand. Again, like the Nissen stamp, it has been left for Rhodesia to be the first South African field to adopt these machines. The working of the thickeners at the Globe & Phoenix, and at the Shamva, will be watched with interest, and should they fulfil expectations, perhaps in a little while they will become as common on the Rand as vacuum-filters or Pachuca tanks. The Dorr machine will discharge a thickened slime containing as low as 40% moisture, but in continuous decantation it is not advisable to pull a slime containing less than 50% moisture, owing to the difficulty that might be experienced in obtaining a perfectly homogeneous mixture of the thickened slime and the added diluent. I have found it advisable to fit a jet of compressed air to the outlet in such a manner that, if it clogs, as it sometimes does when discharging a thick slime, the valve may be cleared. Needless to say, the air must be used with discretion, as the slime in the thickener is disturbed and tends to make the clear overflow muddy. In any case, it is advisable to run the overflow through some sort of clarifier, as in a plant where there are several thickeners it is easy for one to receive a little more slime that is drawn off from it. In course of time the thickener gets overloaded, and if it starts to overflow muddy at three o'clock in the morning, when the shiftman is busy somewhere else, that shiftman is out of a job, and the smelter has more mud than gold slime to smelt at the next clean-up. For this reason, not only should a sand-filter or clarifying-press be always employed, but it is advisable to fit each thickener near the top with a 3-ft. gauge-glass similar to those provided on boilers. Then it is an easy matter for the shiftman every time he passes to observe if the glass is clear or not, and if slime appears in the gauge to take the necessary measures to lower the slime-level of the thickener in question.

One other point: harpooning on night shift for a sack or other foreign body which has stuck in the outlet of a thickener, demands skill, patience, and luck. Therefore, it is as well to have the machines covered with ordinary wire netting. Sometimes one is troubled with an excess of foam or scum, which is often due to excess of alkalinity, and which tends to be carried over into the discharge launder and render the overflow muddy. A simple remedy is to withdraw every alternate bolt among those holding the inner rim of the iron overflow launder in place. This lowers the level of the solution a few inches, and while the clear overflow escapes through the bolt holes, the foam is kept back by the edge of the launder till it finally sinks because of its own weight.

Starting Mill Motors

By W. B. Lewis

*A recent inquiry leads me to cite a case of mill operation in which the motors are started synchronously with the turbine generator. When the plant is shut down at night, the turbine throttle is closed, and the turbine stops together with all the motors. In the morning an engine-driven exciter is started, and full excitation is applied to the turbine-generator field. The throttle of the turbine is then opened and all the motors start up with the generator. This method of operation has been used for six years, with practically no switches operated on the switchboard, not even the generator-field switch. The line-current never exceeds normal running current, and all mechanical and electrical strains on the system seem to have been reduced to a minimum. The method is particularly favorable in the case cited, as there are a number of 100-hp. squirrel-cage motors, the starting of which in the usual manner by means of an auto-starter would be troublesome.

*Abstract from *The Electric Journal.*

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Miami Costs

The Editor:

Sir—Your special correspondent in New York was mistaken when he said that the copper costs of the Miami Copper Co. are not given in detail. They are down to the third decimal place in cents. However, as you do not have them, I herewith enclose you a sheet showing the relative costs for 1911 and

MIAMI COPPER COMPANY

Tons ore treated—1911, 445,036 of 2.48% Cu; 1912, 1,040,744 of 2.39 per cent.

Concentrator production—1911, 16,195,561 lb.; 1912, 34,560,665.

Net smelter production—1911, 15,385,783 lb.; 1912, 32,832,609.

Extraction (net)—1911, 34.57 lb. per ton; 1912, 31.55.

SUMMARY OF COSTS

	1911.		1912.	
	Per ton.	Per lb.	Per ton.	Per lb.
Mining	$1.2134	$0.03500	$1.2032	$0.03813
Milling	0.6274	0.01810	0.6586	0.02087
General expense	0.2514	0.00714	0.1802	0.00577
Freight on concentrate	0.2174	0.00629	0.2173	0.00689
Smelting, refining, etc.	0.8041	0.02326	0.7323	0.02321
Selling	0.0591	0.00171	0.0405	0.00128
New York office	0.0605	0.00175	0.0386	0.00122
Total	$3.2333	$0.09325	$3.0707	$0.09739
Ag, Au, etc	0.0767	0.00222	0.0477	0.00151
Net cost	$3.1566	$0.09103	$3.0230	$0.09588

1912, together with the respective tonnages, grade of ore, and extraction. You will see that in 1912, on account of the high price of copper, we thought it desirable to treat certain ore of lower grade, and although the net cost was about one-half a cent higher, we received 3½c. more per pound.

J. PARKE CHANNING.

Miami, Arizona, April 14.

The State Mineralogist

The Editor:

Sir—I am today in receipt of your issue of February 1, and have read with interest the reports of the State Board of Control, and of the Board of Trustees, upon the administration of the Mining Bureau. Holding as I did the position of curator of the museum during the early spring and summer of 1912, I am in a position to know a little of the facts in the case, and when I read that "P. K. Swain and C. C. Selbie were successively employed as curators of the museum, but it is extremely difficult to ascertain what they accomplished in this position," and that "Neither one made any attempt to catalogue the exhibit," it occurs to me that further restraint on my part is neither necessary nor desirable.

In regard to the character of service rendered the bureau by Mr. Swain, I have no knowledge; he was not incumbent in that position when I took up the work, nor do I know during what period his services occurred. As to my own work, I was well prepared to undertake it at the start, and because I understood it and enjoyed it, I did it well. If the distinguished gentlemen of the Board of Control who found it so difficult to ascertain what had been accomplished, had shown me the courtesy of asking a personal statement in that regard, it would have given me the greatest pleasure to have furnished it, fully, and beyond a doubt to their entire satisfaction. There already existed, as stated in your published report of the Board of Trustees, a five-volume catalogue of the exhibit, and of this edition there were then on hand a large number of copies in the quarters of the Bureau, which it is difficult to believe could have escaped the attention of the Board of Control. This catalogue was, nevertheless, in great part antiquated, and inadequate to the present demands of the Bureau, and it was one of Mr. Storms' first suggestions, upon my taking up the work, that an immediate effort be made looking toward the re-cataloguing of the exhibit.

With this in view, and only after a careful and exhaustive examination of the entire collection by both Mr. Storms and myself, we were forced to the conclusion that any such attempt at re-cataloguing must be preceded by an entire rearrangement, not of the cases alone, but of the specimens themselves, this latter involving the redetermination of a great number and the relabeling of all, there being in the neighborhood of 25,000 all told. It will be at once apparent to those conversant with mineralogy that here was no slight task, and however congenial, it would call none the less for time and serious effort. In the short time that elapsed between my beginning work and July 29, when I left for Chosen, I had redetermined and labeled several thousand specimens in addition to meeting the regular routine demands upon my time, preparing mineral collections for the schools, determining and labeling new additions to exhibits, and disposing of the usually numerous inquiries, etc., to be expected by a curator in such a museum. As I said before, I liked the work, and so far from having had time upon my hands, it was seldom I found the time to complete what I had laid out; the hours were all too short.

Regarding other departments of the Bureau, I have little knowledge, with the exceptions of the chemical laboratory and the library. In the course of my work in the museum I had frequent occasion to visit both these departments, the former being in the charge of Mr. Preston, a Freiberg graduate; the latter in the charge of Mr. Bradley, a Berkeley man; both of them experienced mining men, and competent, efficient, and uniformly courteous in the discharge of their duties, which were numerous. As to Mr. Storms himself, I think there will be little doubt among the mining men of the Coast, to most of whom Mr. Storms is well known, as to the reasons contributing to his removal from office—no doubt that these reasons were purely political, and accurately described in statements given by him to this journal and to the San Francisco press.

CHAS. C. SELBIE.

KoSung, Korea, March 5.

Special Correspondence

NEW YORK

DULL MARKETS.—AMERICAN METAL BUILDING NEW ZINC SMELTER.—A. S. & R. AND GUGGENHEIM AFFAIRS.—POPE YEATMAN EXAMINING BRADEN.—BATOPILAS.

The week that ended April 19 was for the most part a cheerless one. In the matter of new enterprises there is little or nothing doing in the financial markets. The American Metal Co., Ltd., has completed plans for a new plant just west of Pittsburgh at Burgettstown, Pennsylvania. The plant, upon which construction is to be begun in the near future, is to have an initial capacity of 40,000 tons of sulphuric acid and 20,000 tons of spelter. The purchases of the company include 2500 acres of coal land, and 350 acres of land bought for the plant and for the homes of the people who will be employed. As fast as operations can be carried forward, the plant is to be increased to two or three times its first unit capacity. Present outlay amounts to about $2,000,000. The operations will be carried on by the American Zinc & Chemical Co., which is being organized as a subsidiary of the American Metal Co. H. L. Heinz, who was formerly connected with the Matthiessen & Hegeler Zinc Co. of Lasalle, Illinois, will be general manager for the new company and a member of the board of directors. The present plans of the company have been worked out by Mr. Heinz and Otto Sussmann, who has been chief engineer and metallurgist of the American Metal Co. for many years.

The A. S. & R. Co. and the American Smeltera Securities Co. have been under something of a sharp cross-fire during the week. Sidney Norman has been waging a vigorous campaign in behalf of minority stockholders in the Federal M. & S. Co., charging that the Federal was not receiving fair treatment. Mr. Norman's activities have caused the rumors of a federal investigation of the A. S. & R. Co. to be revamped and put into circulation. It is stated, though not officially affirmed, that agents of the federal Department of Justice are now engaged in gathering data, but that the work in this regard will not be completed for some months. In the meantime the affairs of the Guggenheim combination go merrily forward. Pope Yeatman and his staff of engineers are now in South America making a thorough examination of the Braden property, and a tremendously bullish report as to Braden's possibilities as a cheap producer is confidently anticipated. The production of Braden for the first quarter of the current year totaled 4,134,000 lb. of copper. The March output was 1,472,000 lb., produced from 53,700 tons of ore, which averaged 2.40% in copper. It is not the results that are now being attained that are of particular interest at this time, but rather Braden's possibilities as a large producer at a very low price. Mr. Yeatman's report will undoubtedly have something of interest as regards ore reserves, while some of the Braden people are being unofficially quoted as saying that even now Braden's output could be laid down in New York for 7c. per pound or less. As a matter of fact, up to the present time the copper has been shipped in blister form to Liverpool.

Convertible bonds of copper mining companies are evidently not in quite so high favor as formerly. Granby is listed on the New York Stock Exchange; a recent offering of the right to subscribe to the new bond issue brought out the fact that there was absolutely no bid whatever for the 'rights.' Granby has declared a dividend of 1½%, payable on June 2, and the Amalgamated a regular quarterly dividend of $1.50, payable on May 26. At the annual meeting of the New Baltic Copper Co., John C. Shields and John Merton were elected directors. The treasurer's statement shows a balance on hand of $23,576, the income during the year having been $1150. The anaual report of the Butte-Ballaklava Copper Co. shows a balance on hand of $118,787, receipts during the year of $151,560, and expenditures of $86,030. The suit of the Anaconda against the Butte-Ballaklava company is expected to come to trial in June. D. E. Woodbridge has made a report upon the vein system in controversy which is said to favor the Butte-Ballaklava, as it is said that exploratory drifts which have been driven within Anaconda ground have shown that the Mountain Chief vein continues down into the lower workings and is not faulted over into the Ballaklava ground, as claimed. The group of Butte people who have been behind Tuolumne and the Pilot Butte, are asking the public to come into another flotation known as the Butte Main Range Copper M. Co. As a sort of encouragement to possible investors, Pilot Butte has been given a little market impetus and the stock quoted as high as $15, giving holders a very handsome paper profit, most of the stock having been put out at $10. A receiver has just been appointed for the Tuscarora-Nevada Mines Co, a $12,000,000 corporation, a promotion in copper mines which 'died a bornin'.'

The Batopilas Mining Co. is to be reorganized. The company's capitalization of $9,000,000 is to be cut in half, probably by a reduction of the par value from $20 to $10. The English company of the same name is to be wound up as soon as possible. The annual meeting was held this week in New York. The preliminary report of operations showed net profits of $81,202, as against a deficit of $17,409 in 1911. During the first quarter of the current year, the company produced 161,000 oz. of silver. During the past 18 months the company has been shipping its product to Liverpool.

LONDON

SAN FRANCISCO DEL ORO.—KNOX & ALLEN REPOAT FAVORABLY.—NEW ARRANGEMENTS MADE FOR WORKING THE PROPERTY.

For ten years the San Francisco del Oro mine at Parral, Chihuahua, Mexico, has provided many texts for disquisitions on direction and management. The mine was worked by local owners for some years at a handsome profit, for the oxidized lead ores were rich in silver, and were acceptable to the smelters. When the sulphide zone was reached, and blende made its appearance in large quantities, the property was sold to Englishmen, who presumably had not sufficient knowledge of concentration and smelting to enable them to determine correctly the value of their purchase. Anyway, the original prospectus contained an analysis of the ore, with the lead, zinc, copper, silver, and gold contents separately valued and added together so as to obtain the total value of the ore. This method of fixing the value of the ore was adopted through "sheer ignorance," as Dr. Samuel Johnson once said in explanation of an error in his dictionary. It was not done of malice prepense, as was the case in connection with one of the 'patent' smelting nostrums for the treatment of similar ore at Broken Hill at about the same time. For many years the San Francisco del Oro company perpetuated its existence by picking the best leady ores and selling them to the smelter, but no profit was ever made. Reconstruction was necessary three years ago, and at the meeting of shareholders then held, a director repeated the heresy of ore valuation. But last year it was recognized that this could not go on forever, and expert advice was obtained, Knox & Allen of New York being retained. Their report on the mine was favorable, and they also indicated that with modifications the present dressing plant could be utilized. A large amount of additional capital has been subscribed, by a combination of groups, A. Goerz & Co., the South African firm, which has also an office in Mexico, being the leaders. Knox & Allen report that the San Francisco vein is a persistent fissure lode in limestone. Below the third level the ore consists of sulphides. The ore reserve above the fourth level is estimated at 140,000 metric tons, and the expected ore between the fourth and fifth levels is given as 250,000 tons. The geological formation and the indications are such as to warrant the hope of a further 500,000 tons. The ore at present known averages 12½% lead, 17.4% zinc, 21 oz. silver, and 1.4 dwt. gold. The concentrating plant, consisting of jigs and tables, has a capacity of 200 tons per day. Eventually it is to be extended so as to have a capacity of 300 tons per day. When the alterations have been made, it is expected to produce a lead con-

centrate averaging 55% lead, 8% zinc, 60 oz. silver, and 4½ dwt. gold, which is salable to lead smelters; and also a zinc concentrate averaging 37% zinc, 8% lead, 22 oz. silver, and 1½ dwt. gold, which is to be roasted and shipped to the works of the Hydraulic Power & Smelting Co. in Norway, where it will be treated in an electric furnace. This smelting company owns the plant at the Trollhättan falls in Sweden and is building others in Norway. The smelting is done electrically, and details of the venture were contained in several issues of *The Mining Magazine* a year or so ago. The adoption of this method of disposing of the zinc concentrate proves the continued influence of some of the old controllers. The concentration problem at the mine is complicated by the presence of calcite and fluorite, two minerals that make flotation methods impossible. Calcite is wasteful of acid, and fluorite has an inconvenient habit of floating with the blende.

BUTTE, MONTANA

BUTTE CENTRAL.—CORBIN COPPER AND NATURE LOVERS.—BARNES-KING.—TUOLUMNE.—FORGED PAY-CHECKS.—REVIVING PLACERS.

If the Butte Central Copper Co. is as abused and misunderstood as its sponsors keep asseverating, it is time that some effort be made to put the rascals down. Why wouldn't it be wise for Butte Central to employ a competent mine-valuer from distant parts to find out about that one and one-half million tons? Loud plaints and innuendos seem to be convincing no one, as the stock is still in the dumps. The only definite evidence so far is that from Mr. Treloar's report, to the effect that the one and one-half million tons of commercial ore is conspicuous by its absence. Those who know seem to be all agreed that the mill is well put up, and of good design, but the country is already strewn with serviceable mills with nothing to treat. Everyone hopes that Butte Central will come out of this with flying colors, but up to the present Mr. Treloar's 400 or more samples are more convincing than the occasional sample of a stockholder or a chance visitor underground, or even than the sampling of the mine management. The general declaration that so and so, the well known, etc., spent the day inspecting the mine and was very much pleased with conditions, means absolutely nothing, as you can't value Butte silver ore by walking through the mine drifts.

The Corbin Copper Co. is having trouble getting started on the Gambrinus property in Butte. The ground is situated in a residence section of the city, and property-owners are protesting against having a mine in their back yards. But why be so sensitive! W. A. Clark has one in his back yard, operating, too, and Butte never can get up much of a reputation for looks anyway. Of course, we can't all be like Mr. Clark and go to our New York, Los Angeles, or Paris homes if we don't like the turmoil at Butte. But, after all, if it wasn't for her mines, the site of Butte would be a nice little bit of mountain scenery, which would be conspicuously free of humanity. Harry B. Byrne, of Paine, Webber & Co., has been elected a director of the Corbin company.

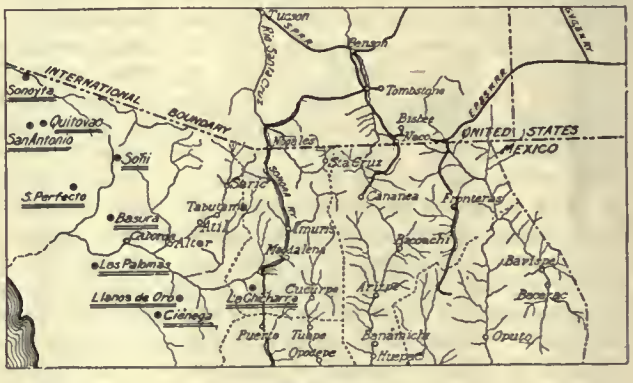
The outlook for the Barnes-King Development Co. continues promising. The March output from the North Moccasin property was 3870 tons, yielding $8.40 per ton. Although work has been temporarily suspended in the Piegan-Gloster mine at Marysville, prospects there are fairly good and will justify a continuation of development, now that an extension of six months has been granted on the final $70,000 of the purchase price. The shaft of the Tuolumne Copper Co. has reached the 2200-ft. level, a station has been cut and drifts started. Good copper glance and bornite ore has already been opened on this level.

What might have caused a serious loss to Butte business men was nipped in the bud last week when it was discovered that the pay-checks of the Anaconda Copper Mining Co. had been forged. The criminals were so eager for returns that they began cashing the checks with merchants on Friday, and a bank teller recognized the fraud. Had they waited until after banking hours Saturday, a big haul could have been made, as Butte merchants have always cashed the mining company checks without question. That the much-vaunted pioneer placer miner occasionally overlooked a good thing has recently been proved in the Highland diggings south of Butte. A stampede for Highland gulch occurred in the '60s, and it was thought that the cream had been skimmed long since, but recently some rich finds have been made there, and the old camp of Highland is beginning to show signs of renewed activity.

CANANEA, MEXICO

MINES CLOSING AND TRANSPORTATION DISORGANIZED.—CONDITIONS AT CANANEA.—EXPORTS THROUGH AGUA PRIETA.—STATE REVOLUTION SUCCEEDING.

With the present revolution throughout Sonora against the Diaz-Huerta government, mining has been given a setback which will probably prove to be more serious than any experienced heretofore. There is no train service to speak of, except on the line between Douglas, Arizona, and Nacozari; labor is scarce in many quarters, especially in the smaller camps, while in many districts the mining business is at a standstill. The latter condition is to be noted principally in the central and southern portions of the state. During the past ten months a number of mining companies have resumed operations after a period of idleness extending through several years in some instances, and just before the present revolution a number had begun work after spending large sums in cleaning up their properties and installing machinery, only to be forced to close in a short time. It appears that it may be some time



NORTHERN SONORA.

before conditions are normal, and many of the properties will remain idle until that time. The Southern Pacific Railroad of Mexico, which traverses the entire state, has been practically idle for almost two months, the only trains operated being those run by the state, which has appropriated a portion of the company's rolling stock and is using it to transport troops. For this reason no supplies can be secured by companies in the interior dependent upon this line.

In Cananea conditions were not so bad up to this week, although only two properties are operating to any extent—the Cananea Consolidated Copper Co. (Greene-Cananea) and the Moctezuma-Arizpe Development Co. (Mexican Metals). The Democrata Mining Co. is doing a small amount of necessary work, while the Calumet & Sonora is operating on about the same scale. Only 42 carloads of fuel oil have been received in Cananea since the trains stopped running, on March 9, and these were brought in through courtesy of both federal and state armies prior to the battle at Naco and after the fight in Cananea. Whether the Southern Pacific will operate trains soon is problematical, as the officials first demand the return of their rolling stock now held and used by the state. Notwithstanding the battles and accompanying disorders, the Cananea company has been operating steadily throughout the period of unrest, and, although not on a normal scale by any means, is now making between 60 and 70 tons of blister copper per day. During March the smelter output (gross) was 7,200,000 lb. Only a few of the company's mines are being operated, those which ship direct to the smelter, while those shipping to the concentrator have been

idle for several weeks. The concentrator is closed, but repair work is being done in order to give some of the unemployed men employment. The reverberatory furnaces and McDougall roasters are also down, and it will probably be some time before they are in operation. The smelter is operating at present with four of the eight furnaces and two converters. It will be at least two months before everything is running normally again.

A good barometer of conditions in the northeastern portion of the state is the exportation of mineral through the custom house at Agua Prieta. March exports showed considerable loss compared with February. The total value of mineral shipped to the United States during February was $1,086,550, while that for March was $881,150, a difference of $205,400. In that portion of the state several properties have closed, but there are a few larger concerns continuing, such as the Moctezuma company at Nacozari, and El Tigre. The Transvaal Copper Co., near Cumpas, has closed completely, and the Minneapolis Copper Co. has done likewise. Both of these had resumed operation but a short time previously. The Gueriguito silver property (W. L. Humphrey, manager), about 35 miles south of Nacozari, has closed its mill, while a number of smaller properties in that neighborhood are also idle. The Ormus mine, near Cumpas, has continued in operation continuously. The Colorado mine (Frank Lintner, manager), near Huepac, will soon resume operation, Mr. Lintner leaving Cananea for the property this week. The Washington mine, close by, will also resume, F. O. Bostwick now being at the property. A hoist will be installed at once. La Cobriza company, whose property is 17 miles northwest of Noria (F. C. Emery, president), has closed some time ago, early in the revolution. It only recently blew in its smelter, which was installed two years ago but never used on account of the unsettled conditions accompanying the Madero revolution. San Geronimo (El Tajo) mine, near Carbo, has also closed. At present it appears as if the state revolution against the central government will be successful, and when this is ended it is expected that mining will again resume its normal condition, and that all properties which have been forced to close during the past two months will soon resume.

MIAMI, ARIZONA

FALLING CAPPING CAUSES AIR-BLAST.—THREE MEN KILLED AND SEVEN INJURED.—TOO MUCH ROOF FALLS AT ONE TIME.

At the Miami Copper Co.'s mine, on the morning of April 17, a disastrous cave-in occurred on the 245-ft. level. Three men were killed, seven seriously injured, and a large number suffered minor injuries. The cave-in was in what is known as the northwest portion of the mine, lying about 300 ft. northwest of the main shaft. The shrinkage-stope method of mining which is being carried on in this portion of the property necessitates that the overlying capping be undermined and allowed to gradually settle, coming to rest on the broken ore beneath. In accordance with this method, three chambers on the 245-ft. level had been broken up to the capping. The first of these chambers lay to the south, 90 ft. wide and 150 ft. long, and was partly filled with ore. Adjacent and running north lay the second, 75 ft. wide and 160 ft. long, while the third lay to the west and had a width of 50 ft. and a length of 300 ft. Like the first, it was partly filled with broken ore. Below these, at a depth of 125 ft. on the 370-ft. level, commences the three shrinkage stopes, No. 500, 600, and 700, these also being partly filled with ore. In the past the capping has always settled without any accompanying bad results, but for some unforeseen reason, the nature of which is at present unascertainable, the entire capping overlying these chambers and stopes suddenly gave way, breaking through to the surface. The capping at this point varies from 250 to 300 ft. in thickness; corresponding to a weight approximating 3,000,000 tons. This enormous descending mass of earth carried away the intervening block of ore lying between the 245-ft. level and the underlying shrinkage stopes, completely filling these rooms and expelling the air at a terrific velocity. The blast of air traveled through the many drifts of the lower levels at a rapid rate of speed and was the direct cause of all the casualties. Men were hurled 40 and 50 ft. The caved portion gave sufficient warning of its approach, and all men in this vicinity were removed from the danger zone. This accident will in no way interfere with the effectiveness of the shrinkage stopes as the result obtained was the one the company intended to eventually secure. The capping in all parts of the mine is now down to the broken ore, and there is absolutely no chance of a repetition of the disaster. Mine operations in other parts of the mine were not interfered with, but it is probable that the mill tonnage will be slightly cut down during the following week.

Operations at the Miami have not been affected by the temporary disturbance at Cananea, as an ample supply of cars for the storage of the concentrate is available. If the difficulties at Cananea continue, it is said that the ore will be shipped to the I. S. & R. plant in Utah. It is reported from New York that holders of the 6% Miami bonds, of which $1,500,000 were issued, have exchanged them all for stock, with the exception of $26,000. The bonds are convertible into stock at $17. Of the 800,000 shares authorized, 745,541 have now been issued.

BRITISH COLUMBIA

DIVIDENDS AND DEVELOPMENT THROUGHOUT THE PROVINCE.—BRITANNIA UNHURT BY STRIKE.

Dividend payments in 1913 to the middle of April by metalliferous mining companies have reached a total of approximately $573,756, in the following proportions: British Columbia Copper Co., one distribution of 15c. per share (April dividend has been passed), $88,756; Granby Consolidated, one of 1½%, $225,000; Hedley Gold Mining Co., one of 3% and 2% bonus, together $60,000; and Standard Silver-Lead Mining Co., four of 2½% each, $200,000. In the East Kootenay district shipments of lead ore from the Sullivan mine to Trail for three months have been about 10,000 tons; output of St. Eugene mine for the same period has been only 363 tons. Both mines are operated by the Consolidated M. & S. Co. Recently published figures show production of Monarch concentrator near Field, Northeast Kootenay, in 1912 to have been 1855 tons of lead concentrate, net recovery from which was 1125 tons of lead and 7405 oz. of silver; also 185 tons of zinc concentrate, containing approximately 72 tons of spelter. At Ainsworth, No. 1 and Silver Hoard mines have been worked during the winter; both have shipped silver ore to Trail, but conditions have been unfavorable to production, so the output has been comparatively small. The Bluebell, situated across Kootenay lake from the town of Ainsworth, which concentrates its lead ore about 6 into 1, shipped to Trail in three months approximately 2500 tons of concentrate. At Slocan, Retallack and Co. (Whitewater group), Lucky Jim, Rambler-Cariboo, Slocan Star, Richmond-Eureka, Ruth-Hope, and several others have been worked during winter, but deep snow has interfered with the output of ore. Near Silverton, the Standard has been the largest producer, with an output for the quarter of nearly 4000 tons of sorted silver-lead ore and concentrate, besides zinc concentrate. Both the Van-Roi and Hewitt, in the same camp, were also continuously operated. At Nelson, near Kootenay river, the Molly Gibson, Queen Victoria, Eureka, and Granite-Poorman were the chief operating mines. At Ymir, the Wilcox and Dundee continued development, while the Yankee Girl to the end of March shipped about 1300 tons of ore to Trail. The H. B. and Emerald lead mines near Salmo, the Motherlode and Queen gold mines and stamp-mills in Sheep Creek camp, and the Arlington and Second Relief, in Erie camp, were all worked, and shipped more or less ore or concentrate. At Rossland, the Consolidated company's Centre Star-War Eagle group and Le Roi mine, and the Le Roi No. 2 Ltd.'s Josie mine were producers. The total output of the first-mentioned company's Rossland mines during three months was about 52,000 tons; the latter company shipped to

Trail nearly 6000 tons, chiefly crude gold-copper ore, and milled between 4000 and 5000 tons of second-class ore. In the Boundary district the Granby company's output for the quarter was about 306,000 tons of ore, from which was recovered nearly 5,590,000 lb. of copper and small value in gold and silver. British Columbia Copper Co. smelted 82,000 tons of ore from its Mother Lode mine, 63,000 tons from the New Dominion Copper Co.'s Rawhide mine, 7000 tons from its Queen Victoria mine (Nelson), and 10,500 tons from several smaller mines. Other mining operations in the district were unimportant. In the Similkameen, the only noteworthy mining was that of the Hedley Gold Mining Co., which mines and mills about 6000 tons of gold ore per month and recovers on an average $11 per ton.

The Britannia Mining & Smelting Co., operating a copper mine on Britannia mountain, Howe sound, within 30 miles by water of Vancouver, does not appear to have any serious difficulty in continuing its work, for about Easter time it had approximately 600 men at work, all told, and operations were in progress in all departments. Miners' union officials have caused to be published in provincial newspapers statements to the effect that 700 men had struck work; as a matter of fact, less than half that number went out. When the property was visited at Easter time it was found that mining and extraction of ore was being carried on up at the mine, although the mine crew was 30 or 40 men short of the full number; the long aerial tramway from the mine down to the concentrating mill at Britannia Beach was being used for the conveyance of ore, some 500 tons of which was being sent over it daily; the work of driving the long low-level adit—then in more than 3600 ft. and with 1400 ft. more to be driven before the 1200-ft. raise to the 1050-ft. level of the mine workings above will be commenced—was being continued with two shifts of men; three-room houses for the accommodation of married men were being built near the portal of the adit, with a dozen houses already erected and ground cleared for more; large new bunk and boarding houses were occupied, and power-house and machine-shop were being equipped with much machinery and plant; grading for the railway from the adit to the top of a long incline to be made for transportation between adit and mill was well advanced; construction of new power-house at Britannia Beach was nearly completed, and the erection of the building for the Minerals Separation plant was well forward; erection at the Beach of more houses for married employees was being vigorously proceeded with; a large new store was about finished; dock, bunker, and other shipping facilities were being added to; railway connections from mill to shipping docks were being improved; the concentrating mill was treating 500 tons of ore per day, and provision was being made for increase to 600 tons; and generally, operations were being carried on with comparatively little inconvenience, and with good prospects of shortly having full working forces in all departments. The company has stated most positively it will not recognize the union, but will in the future, as it has done in the past, pay good workmen the best wages obtainable at similar work elsewhere on the coast; will give them good food and accommodation, with all reasonable provision for their health, comfort, and recreation, and will provide permanent employment for all its employees so long as they shall do a fair day's work for their pay and otherwise conform to the reasonable rules under which they accept employment here.

COBALT, ONTARIO

La Rose, Little Nipissing, and Other Mines.—The Eight-Hour Day Legislation Likely to Pass.

The market for the silver issues has lately been dull and declining. The annual report of La Rose is of discouraging character, showing a marked falling off in ore reserves, which at the end of 1912 were estimated at 2,796,650 oz., as compared with 4,250,861 oz. in 1911. Production was decreased, the output being 2,816,597 oz., of the value of $1,603,969, as compared with 3,691,797 oz., valued at $1,810,470. The surplus, after paying $936,641 in dividends, was $1,578,592. The Little Nipissing, which has been unfortunate from the start, will in all probability be wound up, as the holders of a mortgage against the property for $21,000 have taken foreclosure proceedings. The Gould Consolidated will also have to go into liquidation unless the funds to settle obligations amounting to $8000 are shortly forthcoming, of which there seems to be no likelihood. Persons who want to secure a controlling interest in Peterson Lake are offering the stockholders 43c. per share for their holdings. The strike at the Beaver has been amicably settled, and the mine and mill are working after being closed down for eight days. The Belmont, which had been shut down for two years, has been reopened. Work has also been resumed at the Twentieth Century, the plant which was burned some months ago having been replaced. The Drummond is reported to have been sold for about $500,000 to men whose names have not been made public. The Cobalt Lake has declared another 2½% dividend, with an additional ½% bonus. The Mann of Gowganda Lake has shipped 20 tons of high-grade ore running about 3000 oz. per ton. The Keeley mine, South Lorrain, has been sold by the receiver of the Farmer's Bank under a working option for a year to an English syndicate. The bill providing for an eight-hour day for the miners on April 9 received its second reading in the legislature by a unanimous vote, which is regarded as practically insuring its adoption. It was strongly opposed by the mine-owners. Some modifications in the measure were made; iron mines, which were expected in the draft, will be included in its provisions, with a clause to the effect that the Government might exempt an iron mine from the operation of the bill if it were shown to be sanitary and healthful.

BOSTON

Reorganization of Dow Companies.—Cheerful Reports from Chino, Old Dominion, and Ray.—Annual Meetings.

The annual meetings of the Edwards, formerly the Dow, copper companies have all been held in Boston, and it appears that these companies, the Corbin, Algomah, Franklin, North Lake, and Indiana are to be re-established in public confidence without delay. It was decided to exonerate all Dow's associates except Alvin R. Bailey and to leave the matter of prosecuting Dow and Bailey to the new directors. These properties now have important Stock Exchange and copper interests identified with them and their restoration to public confidence should be complete. The United States S. M. & R. Co. has also become associated with the active direction of the Lake companies mentioned and it is assumed that this connection will be extended to the Corbin company, which is making valiant efforts to recoup itself by taking over a promising prospect in the heart of Butte, where a deep shaft is to be sunk. According to W. F. Bartholomew, who with E. N. Skinner has been visiting the Chino, that mine may be worked by steam-shovels for 20 years, and that two out of seven shovels in commission can supply the necessary tonnage for a production of 5,000,000 lb. of copper per month. Ore reserves are now placed at 94,000,000 tons and no disappointments in tonnage extraction or costs have been recorded. At Globe, Mr. Bartholomew found the Old Dominion making a most excellent showing with underground developments never better. The sixteenth, the lowest level, shows a wider orebody both east and west than was found on the fourteenth, and the ore reserves are larger than ever before. He figures that Old Dominion will show earnings this year of at least $2,000,000 net. He wired from Phoenix that Ray Consolidated looks good, is opening fast, has 54 miles of underground openings, and is taking out 6700 tons of ore per day. The second week in April was characterized by the annual meetings of 16 mining companies in Boston and other points, these being Algomah, Batopilas, Corbin, Chino, Ray, Nevada Consolidated, Nevada-Douglas, Miami, New Baltic, Houghton, Franklin, Bingham, Bohemia, Indiana, North Lake, and Utah Consolidated. Calumet & Arizona's meeting was postponed.

General Mining News

ALASKA

Fairbanks

Eighteen tons of ore from the Homestake mine, on Wolf creek, yielded $70 per ton during the last week of March. The adit is now in 250 ft., opening an 11-in. vein. To enable sinking to be done on the Newsboy claim, $6600 out of $15,000 required has been collected by shareholders. The 'camp' at Ruby is quiet at present, but sluicing will be begun as soon as water is available.

Juneau

During March the Alaska Treadwell company's 240 and 300-stamp mills worked 10.45 and 20.24 days, with water and steam-power, and 9.90 and 15.22 days with water and electric power, respectively, crushing a total of 69,944 tons. The yield from amalgamation was $90,375, and from cyanidation of 1385 tons of concentrate $76,481, the total realizable value being $165,187. Operating expenses were $85,806, and construction $6216, leaving a profit of $73,165. Development covered 621 ft., and the stock of broken ore increased 2172 tons.

ARIZONA

Gila County

(Special Correspondence.)—The number of underground employees of the Inspiration Consolidated mines is being increased, a noticeable feature being the preference given to Americans over foreigners.

Miami, April 12.

Greenlee County

The Arizona Copper Co., Clifton, will add 30 motors, ranging from 3 to 125-hp., to the electrical equipment in its mines. The motors have been ordered from the General Electric Company.

Mohave County

(Special Correspondence.)—The Gold Road Mining Co. shipped during the past week $28,000 of gold bullion, the result of a week's clean-up. The stopes in the old workings have been cleaned of low-grade ore, and with the new orebody and the better grade found on the 500-ft. level, it is expected that the mill will produce $200,000 per month. The shaft at the Sonoma mine, at Chloride, is down to a depth of 115 ft., and the drift has opened 4 ft. of shipping ore, a carload sent to the smelter at El Paso giving satisfactory results. As soon as stopes can be opened on the 115-ft. level, regular shipments will be made. This is one of a number of old mines and prospects on Silver hill, at Chloride, that have been idle for years. Ed. Williams and wife have sold their ranch on the Lower Sandy and invested the money in tungsten claims at Williams Springs in the Aquaisus range. A treatment plant is to be erected on the property, and concentrate will be sent to Eastern ore-buyers.

Kingman, April 17.

Santa Cruz County

(Special Correspondence.)—Gold and copper ore has been found in the 200-ft. adit of the Copper Queen Co.'s property in the Harshaw district, near here. The rich orebody was found in the upper adit, which has over 800 ft. of backs, and it is expected that the vein will be reached within 100 ft. more of work in the lower adit.

Patagonia, April 17.

CALIFORNIA

California oil companies paid $1,580,344 in dividends during March, the largest amount ever paid in any month. Of the total, the Standard Oil of California paid $1,123,349; Union Oil Co., $184,743; Amalgamated Oil Co., $50,000; United Petroleum Oil Co., $48,450; and American Petroleum Co., $52,040.

Amador County

Some time ago a vein was opened on the 1800-ft. level of the Oneida mine, Sutter Creek, and during the past week rich ore was opened in the South Eureka mine, which is believed to be a continuation of the Oneida shoot.

Eldorado County

The Beebe mine at Georgetown is being unwatered, after being shut down for three months. The shaft is down 200 ft., and 100 ft. of cross-cutting has been done.

Mono County

The annual meeting of the New Bodie Mining Co. and the Field of Gold Mining Co., known as the Loose companies, whose properties are at Bodie, was held at Provo, Utah, on April 8. Little work is being done, except some leasing.

Nevada County

The mining claims at You Bet, owned by the late J. S. Goodwin and Nicholls Bros., are to be bonded to Los Angeles people, if permission is granted by the Court.

Shasta County

After being shut down for over a year, the Mammoth Copper Co. has eight men pumping out and repairing the Original quartz mine near Whitehouse. This mine is under lease to the company, which contracts to mine 15,000 tons of low-grade flux per annum, containing a little gold, for the Kennett smelter.

Sierra County

The adit at the Kirkpatrick placer property, near the Mountain House, is in 800 ft. in hard rock, and 100 ft. per month can be driven with seven men. Rich specimens of gold-bearing arsenical pyrite and other ore from the Ironsides mine has been on show at Downieville. The Gold Bluff North Fork ditch has been repaired, and the Middle Fork ditch will also be done as weather permits.

Trinity County

The Trinity Gold Mining & Reduction Co. has mines and works in Trinity county, California, and the report

MAP OF TRINITY COUNTY.

for the year that ended on November 30, 1912, has just been issued. The report of the president, H. W. Miller, states that during the year the company's indebtedness was reduced from $154,392 to $75,042, and the current assets at the end of 1912 were $50,976. It is proposed to dispose of the 40,780 shares of treasury stock and apply the proceeds to the debt. The amount of cash on hand is $14,402. Net earnings for the period amounted to $38,533, which, added to the previous surplus of $66,264, made a total of $104,797. The orebody in the mine may be described as a fairly flat shoot 40 ft. thick, as disclosed by outcrops and mountain slides. Previous development work consisted of clearing away overburden from an area of three to four acres, extending the upper adits under the vein, and raising and sinking at various points. Several examinations were made by engineers, tests made on the ore, and it was thought that the vein was a continuous shoot of profitable value, but mining operations during

the first half of 1912 proved otherwise, and the plant was closed. Adits had disclosed ore 72, 90, and 55 ft. thick, the distances between raises being 80 to 100 ft., and it was concluded that it was all payable ore, but gold only lasted for a few feet in depth. In another part of the property a mountain slide had exposed 40 ft. of ore, and overburden was removed by hydraulicking. Assays taken at frequent intervals proved good ore, but further mining revealed that the ore was barely 10 ft. thick. Later work, several hundred feet from the ore referred to, has opened 100,000 tons of sulphide ore containing $4.50 per ton in gold, 30c. in silver, and 0.5 to 2% copper, more continuous than any opened in the property. Owing to the winter, work was stopped in January 1913, and in the spring it is proposed that the mine be thoroughly examined. The mill is not adapted to treating the sulphide ore and must be altered.

The general manager, D. W. Shanks, reported that large dikes of disintegrated porphyry, not showing on the surface or cut by raises, caused the loss of ore reserves mentioned in the president's report. A system of drill-holes was laid out around the uncovered ore, about 100 ft. from the stripped ground, and the sulphide ore referred to was cut. Up to August 1, 1912, the mill treated 47,600 tons of ore worth $4.36 per ton, with a recovery of 81.88%. Mining costs were $1.43 and milling $1.01 per ton. A report dated March 27, 1913, states that the cross-cut from the lower adit has been driven 200 ft., and a raise has opened sulphide ore 40 ft. long, 20 ft. high, and 8 ft. wide. Samples returned from $8 to $34 per ton in gold and silver, and 1 to 3% copper, a drill-hole having passed through 6 ft. of $33.97 ore. On either side of the sulphide ore is a zone of mineralized schist worth $1 to $5 in gold and silver, with a little copper. At present, prospects are encouraging and extensive development is justified.

Tuolumne County

(Special Correspondence.)—Five men are employed in development work at the mine on the Barendregt ranch, north of Jamestown, recently bonded to a Japanese company, and grading is in progress for a steam-hoist. The 10-stamp mill on the Karnac mine has been purchased for the property, but will not be put up for some time. The shaft has been sunk to a depth of 100 ft., and until the hoist is placed driving only will be done. Clint Manley, of Jamestown, is in charge of operations. The Mountain Lily mine and a group of surrounding claims, situated above Columbia, have been taken under bond by John Lieber, and it is reported that development on an extensive scale is to begin soon. It is understood the group of properties is to be developed as one claim. A shaft 100 ft. deep and a drift 50 ft. long at the Morning Glory mine, near Confidence, has exposed a 3-ft. vein of good milling ore, with a streak of ribboned quartz several inches wide that is remarkably rich. The owners, C. F. and A. J. Layman, E. W. Burley, and W. S. Bingham, encouraged by the outlook, propose to push development with an increased force in the spring. The old Carlin mine, situated near the Harvard, a mile out from Jamestown, has been bonded to the Jamestown Exploration Co., and the property is being reopened for further development. Work will be directed by J. P. Mangante. The price to be paid for the property is $25,000, of which $5000 is to be paid in six months from date of option and balance in one year. The mine has produced upward of $50,000 and is considered a promising property. Sinking has been resumed at the Longfellow mine, at Big Oak Flat, and ore is being extracted from the 600-ft. level. Three machine-drills, an electric motor, and 1300 ft. of steel cable have lately been purchased by the new company. A. H. Prentice, now in charge of operations at the If I Can mine, has 30 men employed in the development of the property. The Philbert Gold Mining Co., of which George H. Walker is president, is steadily prosecuting development work at the Sunnyside mine, south of Tuolumne. The Sonnet mine, on Grant ridge, above Columbia, has been bonded to John Greenhalt, and development work is soon to begin.

Sonora, April 19.

COLORADO

Clear Creek County

Shareholders in the Waldorf Consolidated Mining Co. are being asked to pay an assessment of 3c. per share to save the property, which some time ago was bought in by bondholders under foreclosure. The treasurer, Mr. Wilcox, at considerable sacrifice, has advanced the company about $70,000 and endorsed about $40,000 of the company's scrip, so it is up to shareholders to help him out.

Lake County (Leadville)

At this time of the year there is always trouble in hauling ore to the railroads and smelter from mines not connected by rail, on account of bad roads. The Stars Consolidated Mines Co. is not shipping zinc ore at present, but iron ore totals about 4000 tons per month. The new mill in California gulch will receive all classes of ore for treatment when completed. The Sutton-Steele concentration process will be installed. The county has been presented with a bill for $1224 for capturing and bringing back from New York the alleged 'high-graders,' who were supposed to have stolen $100,000 worth of ore early in January.

Teller County (Cripple Creek)

During March the El Paso mine yielded 141 cars of ore, while the current month is expected to produce 156 cars. A 4-drill air-compressor has been installed on the Ocean Wave claim, Battle mountain. The Yellow Bird Leasing Co. has leased the Yellow Bird mine, south of the town, for three years. At the Independence mine the company is operating 9 and lessees 20 to 25 machine drills. The lessees ship about 750 tons per month. Water now stands at 1180 ft. below the collar of the shaft and recedes nearly 4 in. per day.

The Roxana Gold Mining Co. is suing the Doctor-Jack Pot Mining Co. for alleged wrongful extraction of ore from the former's mine. It is believed that the trial will be heard in the United States District Court. The Rapp lease at the C. K. & N. mine, on Beacon hill, employs four machines in development and one on ore. A shipment from the new ore-shoot proved it to be of good grade.

IDAHO

Shoshone County

About 6000 ft. of development, costing $52,000, has been done in the Silver Cable mine, and in the drift from the main adit a well defined vein containing talc and galena is being followed. It is expected that the vein will be reached within 50 to 75 ft. The new 200-ton mill of the Interstate-Callahan company, in the Sunset Peak district, has been started.

The Tamarack & Custer Consolidated Mining Co., operating the Tamarack, Chesapeake, and Custer mines, shipped 700 tons of ore and concentrate in March, and the current month's output is expected to be larger. The Black Bear mine, in Canyon creek, has a large amount of ore developed by its 6500 ft. of work done. A 100-ton mill is under consideration.

Leasing in the Coeur d'Alene has never prevailed to the extent it has in some of the high-grade Nevada, Cripple Creek, and Clear Creek districts and in many other of the old and new silver and gold 'camps' of the West. Such leasing as is done here usually is of old workings, where individual miners take a chance of making money and the peculiar conditions prohibit company profit and often involve the opening of new ground. At the present time there are extensive operations under the leasing system. Some of the lessees are making money, according to accepted report, notably those in the old Tyler workings above the Bunker Hill at Wardner, the 'McBride lease,' and that the lease on the old Sierra Nevada, farther over the hill from Wardner, known as the D. W. Peeples lease. Besides these, there are lessees at the Stewart, Bunker Hill, Crown Point, Yankee Boy, and Monarch.

MICHIGAN

Dickinson County

The Oliver Iron Mining Co., of Duluth, Minnesota, has arranged to add to the electrical equipment in its power-

plant, at Iron Mountain, two 2205-kva. alternating-current generators with 50-kw. exciter, and two 2000-kva. and three 875-kva. transformers. The order for this apparatus has been placed with the General Electric Company.

MISSOURI

St. Francois County

The fight begun at St. Louis by Robert Holmes and associates against the St. Joseph Lead Co., and Dwight A. Jones, the president, has been transferred to New York.

MONTANA

Granite County

The Makeever interests are spending more money in the Royal Basin mine, and the manager, J. D. Fields, has recently ordered machinery costing $65,000 from a Butte firm. This mine has been profitably worked for three years, and 100 men are employed. A shaft has been sunk 1000 ft. on the copper vein, and levels opened at regular intervals. The leaching plant is to be increased from 520 to 750 tons capacity, and a transmission line to carry 750 hp. from Philipsburg is being constructed.

Madison County

The placer ground in Alder gulch is being examined by Chas. Helman of Oroville and W. B. McCubbin of San Francisco, who have 700 acres in this district. A drilling machine is being shipped, and the ground will be thoroughly tested. Arrangements have been made to treat 500 tons of ore per month from the Arbor Day mine at the Easton-Pacific mill.

Silverbow County

The wages agreement at Butte is that, when copper is 17c., or over, per pound, the rate shall be $4 per day; below 17c., $3.75; and below 15c., $3.50. The price of copper having fallen below 15c. in March, the miners have been paid $3.50 per shift. Until smaller companies reduced the wages, the Anaconda company was not disposed to take action. It is stated that at the Washoe smelter a new method of leaching copper from the concentrator tailing has been devised, in which the sulphuric acid consumed in dissolving the copper is to be regenerated.

A station has been cut on the 2000-ft. level of the Pilot Butte mine and cross-cutting will be started in a few days to cut the six veins which have been proved, by development in the North Butte and Elm Orlu mines, to pass through Pilot ground. The Butte & Great Falls Mining Co. is sinking its shaft 3 ft. per day, the present depth being 90 ft., while a cross-cut will be driven at 300 ft. Plans are under way to raise $100,000 for electric equipment. The Raven mine is shipping 50 tons of ore per week. A heavy flow of water in the mine makes costs heavy. Machinery has been ordered for sinking the Butte Main Range company's shaft to 1500 ft., which will be about 600 ft. from the East Butte.

Five miners were killed and nine injured at the Leonard shaft of the Anaconda company, on April 23, when the hoisting engineer lost control of his engine when lowering two cages of men. Both cages dropped into the sump, one falling 2200 ft. and the other 800 ft. from the 1400-ft. level. The engine and the engine-house were wrecked.

All argument in the suit of Minerals Separation, Ltd., against the Butte & Superior company, which uses the Hyde process, is in, but the decision has not been announced.

NEVADA

Esmeralda County

A rush has set in to a new district 22 miles northwest of Millers and about 11 miles south of Republic. J. P. Sparks has opened two veins, one of which returns up to 286 oz. of silver, $26 in gold, and 7% lead, and the other, 200 ft. distant, assays 150 oz. silver, $6 in gold, and 4% copper. About 75 claims have already been staked. Water is hauled eight miles from King Solomon. An arrangement has been made by the Florence Goldfield Mining Co. and the Jumbo Extension company, by which the former can use 10 stamps, the tube-mill and cyanide plant of the Bonnie Clare mill. The plant will be shut down for about a month to install two Dorr thickeners, piping, and a division in the ore-bin to keep the two ores separate. By this arrangement the Florence will be able to treat about 1500 tons per month. In October 1912 several companies at Tonopah and Goldfield filed a complaint against excessive freight rates on cyanide on the railroads. The companies wanted a reduction from $2.37 and $2.08 to $1.15 per ton. News from Washington, D. C., states that the Interstate Commerce Commission declared that the rates for carload lots from San Diego, California, to Goldfield, Tonopah, and Millers were reasonable.

Mineral County

The Silver Comet mine, near Pioche, has been shipping gold, silver, and lead ores to Salt Lake smelters, and in developing this ore tungsten ore was opened. On the 50-ft. level the vein is 3½ ft. wide, and 2 ft. on the hanging wall will average 30% WO_3. It is between the two streaks of tungsten that the first mentioned ore is mined. Another shaft is down 180 ft. in similar ore. A small concentrating plant may be erected, while a 5-ton motor truck has been purchased to carry ore 14 miles from the mine to the railroad, to be shipped to Pittsburg.

Nye County

The Tonopah-Munhall Consolidated Mining Co. is being formed with a capital of 2,000,000 shares, with 1,500,000 in the treasury. Of the latter stock, 560,000 will be exchanged for outstanding stock of the Northern Tonopah Mining Co. and 500,000 to holders of stock in the old Munhall-Tonopah Mining Co. The properties have been examined by A. S. Haskell. The Northern Tonopah claims are six miles north of Tonopah, and surface rocks are granite, diorite, and rhyolite. Work has been done in rhyolite and samples have shown galena, blende, and copper minerals. A shaft was sunk in rhyolite 20 ft. north of the surface contact of rhyolite and diorite. The 100 and 150-ft. levels were not driven far enough, and an extension of the latter is advised. The Munhall claims are 5000 ft. east from the Tonopah Merger mine.

During the week that ended on April 19, the Tonopah mines produced 11,508 tons of ore worth $248,847. The Tonopah Mining Co. treated 14,712 tons in March yielding $198,900 at the mill, and $33,850 from 118 tons of concentrate shipped. The net profit was $133,395. A winze on No. 5 level of the West End has opened 4 ft. of ore assaying from $100 to $200 per ton. The winze has averaged from $16 to $35 per ton for 90 ft. of sinking, and this depth corresponds with the No. 6 level.

Electric power is of great benefit to Manhattan, and the consumption at 30 mines and mills is about 8000 kw. per day. At present the cost of power, 4c. per kilowatt-hour for hoists and 2c. for constant-speed motors, is about two-thirds that of gasoline engines, and less than half that of steam power.

Washoe County

The property of T. Warner and C. W. Nelson, in the Granite district at Peavine, 14 miles north of Reno, has produced 80 tons of high-grade copper, gold, and silver ore, while 60 tons was shipped from the Red Metals mine.

White Pine County

Freight rates between the Ely district and the Utah smelters have been under discussion of late, and the Nevada State Railroad Commission has suggested the following charges per ton of ore to the railroad companies concerned:

Value of ore.	Present rate.	Proposed rate.	Value of ore.	Present rate.	Proposed rate.
$ 7.50.....	$ 3.00	$ 1.75	$ 70.00.....	9.25	5.80
10.00.....	3.00	2.25	80.00.....	9.90	6.00
15.00.....	3.00	2.60	90.00.....	11.00	6.20
20.00.....	3.00	3.00	100.00.....	11.00	6.40
30.00.....	5.00	3.90	150.00.....	12.50	7.70
40.00.....	6.40	4.50	200.00.....	14.00	8.60
50.00.....	7.85	5.10	250.00.....	15.50	9.40
60.00.....	9.52	5.60	300.00.....	17.00	10.30

During March the Nevada Consolidated mine produced 5,555,320 lb. of copper, as against 4,798,537 lb. in February.

A rush has set in for Johnson's Springs, about eight miles west of Cherry Creek, and several automobiles from Ely have gone out. This new 'camp' is said to contain gold-bearing ore, in contrast to the many silver districts of Nevada.

OKLAHOMA

Pushmataha County

According to the United States Geological Survey, there have been persistent reports of the discovery of gold and other valuable ores near Albion, metal contents ranging between $60 and $600 per ton, and several 'mining companies' were organized and stock sold. H. G. Ferguson, assistant geologist of the Survey, made an examination of the locality in March, and reported the entire absence of gold or other metals in commercial quantities. The rocks are chert, shale, and sandstone, carrying a little pyrite, and there is no indication of any vein or metalliferous deposit.

MAP OF OKLAHOMA.

OREGON

Josephine County

(Special Correspondence.)—The placer season is drawing to a close in southern Oregon, and many of the smaller mines have already closed on account of shortness of water. The larger properties will keep their giants at work for a month or so yet; and some of them will have a full pipe-head till late in June, but the greater part of the gold from the surface mines will be cleaned up by the end of April. Shipments of gold are already being made through the banks to the Mint at San Francisco.

For the especial benefit of the miners of Galice district, lower Rogue river, the county is building a new steel bridge across the Rogue at Massie's Ferry. In addition to building the bridge, several thousand dollars will be expended on the road, thus giving much better transportation facilities for the district.

New Yorkers will operate 10 or 15 of the Greenback's 30 stamps this summer, and work will probably be continued through the fall and winter. Development will be done on the Cowboy, Lyttle, Queen of Bronze, and other copper properties of the Waldo district, southern Josephine county. Ray Bros. are making good progress in overhauling the Braden mine, near Gold Hill. They will have the mine operating to full capacity by the middle of May. The Oriole Mining Co. will have its new mill and concentrating plant finished by the end of June. In the meantime, a large quantity of ore is being opened. Equipment and supplies are going over the road from Medford and Jacksonville for the mines of the Blue Ledge district. The old Jewett mine, near Grants Pass, has been completely overhauled. The Michigan Mining & Milling Co. has resumed work on its property, the Michigan mine, near Murphy, on Applegate river. This mine has been idle for the past five years. The old Mountain Lion mine, on Missouri flat, Applegate river, is also being overhauled.

Grants Pass, April 11.

UTAH

Juab County

The Grand Central shaft has been repaired, and work resumed. The south drift on the 2380-ft. level is now in low-grade ore. The 1300-ft. level of the Eagle and Blue Bell is yielding good gold and silver ore. The weekly ore shipments from the mine are from 800 to 1000 tons. The Gold Chain and Opohongo companies will prospect ground above the main adit-level from which the Gold Chain shaft was sunk.

Summit County

The Court of Appeals at St. Louis has affirmed the decision of Judge Marshall giving the King Consolidated Mining Co. judgment for $734,243 for ore alleged to have been taken from its property by the Silver King Coalition Mines Co. In addition to this sum, the court added $24,000 to be paid. An appeal will be taken to the United States Supreme Court. The suit started in December 1909.

At the Ontario mill two additional roasting-furnaces are being built, making a total of eight. A 100-hp. motor has been installed to drive the large blower. The Silver King Coalition Mines Co. has paid a dividend of 15c. per share, amounting to $187,500.

Whitman County

The Pullman Mining & Milling Co., which owns 10 claims, known as the Salmon river junction quartz claims, 50 miles south of Lewiston, plans considerable development, and later on will erect a concentrator costing $20,000. There are four veins in the property carrying copper, silver, and gold, which assay from $7 to $80 per ton at the outcrops. C. Heller is superintendent.

CANADA

British Columbia

During the first fortnight of April the Granby smelter treated 47,708 tons of ore and shipped 762,000 lb. of copper. The Rambler-Cariboo mill is to be enlarged to handle the zinc content of the ores. A snowslide did some damage to a bridge across a canyon at the mine. Snowslides have caused almost a cessation of work at Bandon. The aerial tramway of the Richmond-Eureka and the pipeline of the Slocan Star were partly carried away last week. The flotation plant of the Britannia mine is expected to be in operation in May.

Ontario

(Special Correspondence.)—Owing to insufficient support and the concrete anchors moving in the mud during the recent wet weather, the double penstock of the Wawalatin Falls hydro-electric power-plant, which supplies Porcupine with power, buckled in several places, putting the machinery out of commission for about two or three months. The Pearl Lake company has been compelled to suspend operations owing to lack of power, while the Hollinger and Dome are working with a temporary supply. The 10-stamp mill of the Dome Lake Mining Co. has started work, this being the sixth mill in the district.

Timmins, April 11.

During 1912 the Beaver Consolidated Mines, Ltd., produced 689,921 oz. of silver, valued at $409,212. Dividends paid amounted to $180,000, and $172,511 was carried forward. Ore reserves are 20,000 tons on the dump, and 3000 to 9500 in the mine, containing 775,000 oz. The mill is now treating 100 tons per day, and from March 15, 1912, to February 28, 1913, treated 17,842 tons, yielding 278,512 oz., with a profit of $123,655. On the 700-ft. level of the Beaver mine, on April 11, a shoot 3 in. wide, averaging 8000 oz. per ton, was cut. The McKinley-Darragh-Savage mine produced 430,923 oz. of silver during the first quarter of 1913. The draining of Cobalt Lake will be beneficial to this mine. The old Nipissing reduction mill of 70-ton capacity has been leased by the Cobalt Aladdin Mining Co. and is used as a customs plant. During March, La Rose Consolidated produced 239,934 oz., with a profit of $74,104. Development on No. 3 level of the St. Anthony, in the Sturgeon Lake district, has opened 230 ft. of ore from 12 to 32 ft. wide, and the 10-stamp mill is yielding $20 per ton. No. 2 level has opened $13 ore for some distance.

The second annual report of the Hollinger Gold Mines, Ltd., has just been issued.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

H. E. SYMMONS is in Irkutsk.

E. B. KIRBY is in New York City.

VICTOR M. BRASCHI is in New York.

WEBB SMITH was in the city Tuesday.

H. C. HOOVER has returned from Europe.

THOMAS B. STEARNS is visiting New York.

A. CHESTER BEATTY sailed for Europe Tuesday.

C. B. NAREMORE was in San Francisco this week.

GEORGE F. BECKER has gone to the Isthmus of Panama.

H. C. BELLINGER has returned to New York from London.

W. E. THOANE has arrived at Bodaibo in the Lena region.

C. W. MERRILL has gone to Santa Barbara for a vacation trip.

C. R. CORNING will leave New York for South America today.

J. A. BURGESS was in San Francisco Wednesday and Thursday.

WILLIAM H. LANDERS has returned to San Francisco from New Almaden.

AUGUST HOFFMANN has returned to Stockholm from the Ural mountains.

R. E. SMITH has finished investigating the Oodeei region and has returned to Nikolaievsk.

The San Francisco Engineers' Club has changed the date of its weekly luncheon to Friday.

A. WARNER HOOKE, of London, is now with the Forum River Tin Co., Ltd., Naraguta, N. Nigeria.

J. F. A. STRONG, of Juneau, has been appointed Governor of Alaska to succeed WALTER E. CLARK, resigned.

JAMES DOUGLAS is visiting Phelps-Dodge properties in the Southwest, expecting to return to New York about May 1.

ALTON L. DICKERMAN, who has been visiting the copper mines of the Southwest, was in San Francisco this week.

EDWIN J. COLLINS, who has been engaged in examination work in Arizona and New Mexico for the past month, has returned to Duluth.

E. M. RABN, engineer for the Gold Road Mines Co., of Arizona, has been appointed mine superintendent of the Gold Road mine, S. A. HOLMAN having resigned.

ROBERT E. CRANSTON has severed all connection with the Brazil company, and will continue the practice of his profession with headquarters in the Mills building, San Francisco.

Schools and Societies

THE MICHIGAN COLLEGE OF MINES graduates of 1913 were given a Class Day address by J. A. Holmes, Director of the United States Bureau of Mines, on April 24, at the college gymnasium.

PRINCETON UNIVERSITY has received gifts of $255,000, including an endowment of $100,000 for the professorship of chemistry, $125,000 for another professorship, and $30,000 for the professional salary fund.

THE IOWA ACADEMY OF SCIENCE met at the Iowa State College at Ames, April 25. Among other papers read were a number by C. R. Keyes, J. L. Tilton, J. E. Gow, and others dealing with local geological features.

R. E. EARLE, of the Department of Geology of the University of the City of New York, read a paper on April 7 before the New York Academy of Sciences on 'The Origin of the Great Deposits of Interbedded Iron Ores of the Appalachians.' The lecture was illustrated by a number of rock specimens and also by lantern slides.

HARVARD UNIVERSITY and the Massachusetts Institute of Technology have practically decided to coöperate in the teaching of advanced students, when the latter gives up its present site at Boston and moves to its recently purchased land at Cambridge, in 1915. There is no intention to carry the plan further than the advanced courses. The University has received bequests of $150,000 from Mrs. S. A. Matchett and $25,755 from George Haven. The Agassiz house, occupied by the late Alexander Agassiz, has been turned over to the Speakers' Club, which is now five years old.

THE AUSTRALASIAN INSTITUTE OF MINING ENGINEERS will hold its annual meeting at Broken Hill, New South Wales, from May 26 to June 4. Besides the usual receptions, business meetings, Institute dinner, and discussion of papers, there will be excursions to the North, South, Central, and Block 10 mines; the concentrating plants of the North, South, Central, Block 10, Proprietary; and the flotation plants of the Amalgamated Zinc, Zinc Corporation, and Sulphide Corporation companies. The new Government water scheme will be inspected; while in South Australia, the Iron Knob deposit, which at present supplies the Port Pirie smelters of the Proprietary company, and will supply the new iron works being erected at Newcastle, is to be visited, along with the Port Pirie lead smelter and refinery, and the zinc distillation plant.

THE MICHIGAN COLLEGE OF MINES is considering the advisability of starting a course in Spanish. W. L. Cumings, of the Bethlehem Steel Co., who graduated in 1900, and has spent a considerable time in Mexico, has collected data showing that 20% of the graduates from this college are employed in Spanish-speaking countries, another 20% has worked there, and 10% more may be employed there. Instruction in the language would thus benefit about 50% of the graduates. With the completion of the Panama canal, it is certain that the Central American republics will attract a great deal of attention. Many European graduates in engineering, who go to these countries, know Spanish, and the Americans should be so equipped. The course proposed is of two years, one hour daily for five days each week, and the method of teaching advocated is the conversational.

THE FARADAY SOCIETY held its sixty-seventh ordinary meeting at Burlington House, London, on March 12, when a general discussion on 'Colloids and their Viscosity' took place. Several scientists came from the Continent, and Wolfgang Ostwald, of Leipzig, made an introductory statement on 'The Importance of Viscosity for the Study of the Colloidal State'; Victor Henri, of Paris, read an article on 'The Measurement of the Size of Colloidal Particles'; and H. Freundlich and C. Ishizake, of Brunswick, discussed 'On the Rate of Coagulation of $Al(OH)_3$ Sols. as Measured by the Viscosity Change.' In the first-mentioned paper the author shows how extremely important is the study of viscosity, though apparently a special subject, for our knowledge of the colloidal state, as regards both theory and practice. The phenomena of viscosity in colloids, present in themselves extreme variety, both qualitatively and quantitatively. The viscosity of molecular solutions in a given solvent is defined by only two variables, concentration and temperature. With colloids, viscosity is affected qualitatively by the following factors, in addition to concentration and temperature: degree of dispersity, solvate formation, electric charge (ionization), previous thermal and mechanical treatment, innoculation with more viscous colloid, phenomena of 'ageing' of various kinds, the influence of various additions, and so forth. In regard to quantitative factors, it is to be noted that the viscosity of gelatinizing colloids can pass through all values from that of the dispersion medium to that of a solid, within limits of concentration from 0 to 1%. An equally large quantitative variation of viscosity occurs within certain small intervals of temperature, about the so-called melting or setting point of jellies.

Market Reports

LOCAL METAL PRICES

San Francisco, April 24.

Antimony	12—12¾c	Quicksilver (flask)	41
Electrolytic Copper	16¼—16¾c	Tin	52—53¾c
Pig Lead	4.75—5.70c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

METAL PRICES

(By wire from New York.)

NEW YORK, April 24.—Copper is quiet, hardly any being sold. Lead is firm and in large demand. Spelter is weak due to selling pressure and little demand. Average daily prices for the past week in cents per pound, based on wholesale transactions, standard brands, are given below.

Date.	Silver, per oz.	Electrolytic Copper.	Lead.	Spelter. St. Louis
April 17	59⅜	15.48	4.35	5.45
" 18	59⅜	15.48	4.35	5.45
" 19	59⅜	15.48	4.35	5.45
" 20	Sunday.	No market.		
" 21	59⅜	15.40	4.35	5.40
" 22	60	15.40	4.45	5.40
" 23	60⅛	15.40	4.50	5.40

Copper prices seem to be steadier all round. Calumet & Hecla withdrew from the New York market at 15½c. more than two weeks ago and has been holding out for 16c. abroad. Telegraphic advices report the London market steady and New York dull, evidently waiting. Phelps-Dodge and the A. S. & R. have been quoting 15¾ in London for May and June delivery, electrolytic. Amalgamated has been selling in France at 15.65, but later asked 15.70 for May, June, and July delivery. Henry R. Merton & Co. report European copper stocks February 28 as 44,673 tons of 2240 lb. each. This does not include Bremen and minor ports which December 31 held nearly 5000 tons.

MINING STOCK QUOTATIONS—NEW YORK

(By courtesy of J. C. Wilson, Mills Building.)

	Closing Prices. April 24.		Closing Prices. April 24.
Alaska Mexican	$12⅛	McKinley-Darragh	$ 2
Alaska Treadwell	42⅜	Miami Copper	24⅛
Alaska United	23	Mines Co. of America	2⅛
Amalgamated Copper	77	Nevada Con	17⅜
A. S. & R. Co	69½	Nipissing	9
Braden Copper	8⅜	Ohio Copper	1
B. C. Copper Co	2⅜	Ray Con	18⅛
Chino	41⅛	Tenn. Copper	35⅜
First National	2½	Tonopah Belmont	6⅜
Giroux	2⅛	Tonopah Ex	2½
Goldfield Con	2⅛	Tonopah Mining	5⅜
Greene-Cananea	7	Trinity	4
Hollinger	19	Tuolumne Copper	2⅜
Inspiration	18	Utah Copper	53½
Kerr Lake	3¼	West End	1⅜
La Rose	2½	Yukon Gold	2⅜
Mason Valley	8½		

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	Closing prices. April 24.		Closing Prices. April 24.
Adventure	$ 2	Mohawk	$ 51½
Allouez	34¾	North Butte	29½
Calumet & Arizona	65¾	Old Dominion	48½
Calumet & Hecla	475	Osceola	83
Centennial	14	Quincy	68½
Copper Range	43	Shannon	10¼
East Butte	11¾	Superior & Boston	3⅜
Franklin	6¾	Tamarack	29½
Granby	63	U. S. Smelting	40½
Greene Cananea	7	Utah Con	9
Hancock	20	Victoria	1
Isle-Royale	25	Winona	1⅛
Mass Copper	3½	Wolverine	50½

Eastern brokers report that market activity in mining stocks in New York last week was confined mainly to Tonopah stocks. The sharp advances followed by reactions were interpreted as part of a move to eliminate habitual 'short-sellers' who have been a disturbing factor. In the meantime the Tonopah stocks have attracted the attention of Boston curb brokers.

In view of the dull sessions held in that city, covetous eyes are being cast by members and traders at them, and representatives visited New York and Philadelphia recently to bring about the listing of the active Tonopah on the Boston Curb. As soon as the data required can be obtained it is likely that something will be done. Boston's preference for the copper stocks is well known, but new coppers are scarce and the principal old coppers have been transferred from the Curb to the Exchange. These conditions have brought about a great reduction in the Curb trading list and this is helping to bring the Tonopahs into favor. Two or three Cobalt stocks have been dealt in on the Curb, but never featured, and the same applies to the Goldfield stocks. A broader market and a more extended mining trading list would be greatly welcomed on the Curb in Boston, and it is likely that the effort will be kept up until the active trading list has been increased by desirable new additions from the gold-silvers.

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 24.

Atlanta	$ .16	Mizpah Extension	$ .75
Belmont	6.27	Montana-Tonopah	1.70
Big Four	.63	Nevada Hills	1.15
Buckhorn	1.00	North Star	.38
Con. Virginia	.19	Ophir	.20
Florence	.45	Pittsburg Silver Peak	.57
Goldfield Con	2.07	Round Mountain	.59
Halifax	1.20	Sierra Nevada	.25
Jim Butler	1.10	Tonopah Extension	2.10
Jumbo Extension	.25	Tonopah Merger	.95
MacNamara	.19	Tonopah of Nevada	5.60
Manhattan Consolidated	.09	Union	.09
Mexican	.75	West End	1.70
Midway	.53	Yellow Jacket	.25

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 24.

Associated Oil	$41.00	Orcutt	$ .55
Caribou	.90	Palmer Union	.18
Claremont	.60	Premier	.28
Coalinga Central	.20	Republic	.15
De Luxe	.50	Sterling	1.00
Maricopa 36	.33	United Oil	.34
Monte Cristo	.85	W K Oil	2.22
New Pa Pet	.45		

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, April 23.	Unlisted.	Closing prices, April 23.
Associated Oil 5s	100¾	Natomas Dev. 6s	100¼
E. I. du Pont 4½s	93½	Pac. Port. Cem. 6s	99
Natomas Con. 6s	94¾	Riverside Cem. 6s	77
Unlisted.		Standard Cem. 6s	91⅝
Associated Oil 1st ref.	85	Santa Cruz Cem. 6s	85⅜
General Petroleum 6s	59½	So. Cal. Cement	80

STOCKS.

Listed.	Closing prices, April 23.	Unlisted.	Closing prices, April 23.
Associated Oil	40¾	Mascot Copper	2
Amalgamated Oil	87½	Noble Electric Steel	15
E.I. du Pont Powder pfd.	90	Natomas Consolidated	12
Pac. Coast Borax, pfd.	100½	Pac. Coast Borax, old	206
do com.	80	Pac. Portland Cement	59
Pac. Crude Oil	35c.	Riverside Cement	50
Sterling O. & D.	1.00	Standard Cement	18¼
Union Oil of Cal.	91½	Standard Oil of Cal.	187½
West Coast Oil, pfd.	70	Santa Cruz Cement	30

MINOR LEAD AND ZINC PRODUCTION IN 1912.

Detailed figures of production recently issued by the United States Geological Survey credit Wisconsin mines with a total lead and zinc output in 1912 of $4,793,190. The total tonnage of crude ore was 1,363,636 containing 0.2% lead and 2.9% zinc. From this were produced 3373 tons of concentrate containing 76.5% lead and worth $180,661; 102,617 tons of blende concentrate containing 38.4% and worth $2,908,892; and 4360 tons of zinc carbonate averaging 16.66% and worth $72,800. Illinois is credited with lead production amounting to $86,497, zinc worth $367,537, and silver worth $2909. The silver came from the lead concentrate now in the southern part of the state as a by-product of fluorspar mining. The concentrate from this district averages 6.31 oz. silver per ton. The Arkansas production for the year amounted to: lead, $2180; zinc, $56,235. The Kentucky output of concentrate was valued at: lead, $9540; zinc, $41,391. Iowa produced lead concentrate worth $3900.

THE KENNECOTT MINES CO. has declared another dividend of $1,000,000.

Company Reports

SUPERIOR & PITTSBURG COPPER COMPANY

In the four main sections of this Arizona property, development work covered 29,547 ft. during the year ended December 31, 1912. In the Cole section, oxidized ore was mined on the 800, 900, and 1000-ft. levels. A cross-cut is being driven on the 100-ft. level to connect with the old 1100-ft. level workings of the Cole. Work done on the 1300-ft. level in the Briggs section may prove one of the largest bodies of sulphide ore found in Bisbee. Ore opened in No. 97 cross-cut, on this level, is irregular, bnt averages 7% copper. South of this, another shoot 420 ft. long and averaging 10 ft. wide has been developed. The Briggs shaft is handling 400 tons of ore per day. The Junction shaft is being lined with concrete. Work in this section has been encouraging. The most important development during the year in the Hoatson section was the work below the 1400-ft. level of the oxidized orebody, it being found to extend to the 1500-ft. level. Details of the year's work are as follows:

Ore smelted, tons	288,429
Copper recovered, per cent	6.36
Copper production, pounds	36,618,399
Silver production, ounces	361,227
Gold production, ounces	13,815
Value of total production	$6,186,964
Expenditure	2,813,047
Net income	3,393,619
Dividends paid	1,919,734
Cash, ore, and bullion	2,705,248

STEWART MINING COMPANY

This company operates in the Coeur d'Alene district, Shoshone county, Idaho, and the report under review is for the six months ended December 31, 1912, and would be best presented in the following form:

Ore milled, tons	97,290
Ore shipped, tons	2,753
Total	100,043
Revenue from concentrate sold	$485,164
Revenue from ore sold	105,960
Total	$591,125
Costs:	Per ton.
Mining and development	$2.15
Ore transport	0.15
Milling	0.35
Management and general	0.31
Taxes and depreciation	0.15
Litigation ($58,114)	0.57
Total	$3.68
Net profit	$222,623
New construction, from profits	12,235
Added to cash assets from profits	210,388
Net current assets (cash in banks, $328,582)	354,622
Plant and equipment account	86,575
Surplus	650,363

EAST BUTTE COPPER MINING COMPANY

This company's fiscal year now ends on December 31, 1912, instead of March 31 as heretofore. The company has continued operating the properties of the Pittsmont Copper Co. under an extension of the agreement of April 8, 1909. Notes amounting to $1,625,574 fell due on December 1, and were met by applying cash surplus of $1,125,574, and issuing company notes amounting to $500,000, payable in five equal instalments. With this settlement, the East Butte company secured 800,000 of the 1,000,000 shares in the Pittsmont company, and 200,000 preferred shares carrying 6% cumulative dividends. Mine development covered 7130 ft., mostly on the 1000-ft. level, to open veins already proved on No. 8 and 12 levels, while several other orebodies were opened. The main shaft is now being sunk from the 1200 to 1800-ft. level. Ore reserves are somewhat less than in previous years. A sample mill of 1200-ton daily capacity was constructed, and is giving good results. In the past, the concentrating plant has been supplied with mine water, but as this was becoming more acid, a new supply was obtained from the company's land at Elk Park. It is intended to enlarge the blast-furnaces when opportunity allows. The new dust-chamber has increased the recovery to the value of $100,000, and the Dwight-Lloyd sintering plant has helped to the extent of $50,000. Operations during the year resulted as follows:

Ore treated (company), tons	96,601
Ore treated (custom), tons	85,173
Copper produced, pounds	14,709,460
Silver, ounces	370,675
Gold, ounces	16,920
Gross value of metals shipped	$2,841,205
Other revenue	314,271
Total	3,155,475
Cost of mining, treatment, refining, custom ore, etc.	1,875,738
Profit	1,279,737
Interest and equipment	296,036
Net profit	983,701

BRITISH COLUMBIA COPPER COMPANY, LTD.

This company operates mines and a smelter at Greenwood, Boundary District, British Columbia, and has an issued capital of $2,958,545. The report of the president, Newman Erb, for the year ended December 31, 1912, states that 740,589 tons of ore, of which 443,022 tons was from the company's mines, was treated at the smelter, yielding 11,146,811 lb. copper, 142,025 oz. silver, and 25,863 oz. gold. The net results of operations were $425,985, and $177,513 was paid in dividends. During the year the company paid on account of four new properties optioned in British Columbia, and their development, the sum of $229,489. Nine of these were acquired, while interests were taken in the Copper mountain district. The company added to its holdings of New Dominion securities, bonds of the par value of $237,675, costing $122,249. The acting general manager, Frederic Keffer, stated that in the Mother Lode mine, which produced 410,686 tons of ore, the transverse-stope method of mining was continued, it being the best applicable to this mine. Drilling of new ground ahead of requirements was done by 5000 holes, totaling 65,000 lineal feet, in readiness to blast. Ore reserves have not materially increased. The Wellington mine has been temporarily shut down. There is 300,000 tons of ore in the Lone Star and Washington mines, but the ore is refractory, and experiments are being made for its treatment. From the Napoleon mine, 17,118 tons of sulphide flux, with good gold and sulphur contents, was mined. The Napoleon mill treated 6483 tons of ore. The ore in the Queen Victoria mine is an altered limestone carrying copper, and the mine was purchased in November and produced 1080 tons. The smelter consumed 103,154 tons of coke. Basic linings are to be used in the converters. Twenty-three groups of mining claims were examined by the company's engineers. The average price received for copper was 16.66c. per pound, and the cost of production was 12.85c., and the cost per ton, from ore in place to sale of contained metals, was $2.46.

Assets include metal and smelter products, $193,055; copper on hand and in transit, $214,769; cash in banks, $83,602; while liabilities include sundry creditors, $336,910; profit and loss account, $965,737.

GREAT BOULDER PERSEVERANCE GOLD MINING CO., LTD.

This important property is at Kalgoorlie, Western Australia, and is now producing low-grade ore which yields fair profits. During the year ended December 31, 1912, with the exception of driving the 2200-ft. level on the Lake View lode, development of this and the Perseverance lode was restricted in favor of opening the Furness and D lodes, while efforts to find an extension of payable ore on the

Perseverance lode on No. 11 level were not successful. The Furness lode has been proved continuous from the 200 to 1100-ft. level, and there is blocked out 52,300 tons averaging $5.27 per ton. The D lode has yielded ore on the 200, 300, 400, and 500-ft. levels, and contains 26,000 tons of $6.48 ore. Prospecting in parts of the mine opened in past years has revealed a good deal of ore, and on No. 2 and 7 levels the El Oro lode is yielding good ore; on No. 4 and 5 levels, on the west branch of the Lake View lode, results are encouraging, while the Lake View lode on No. 5, 7, 9, and 11 levels will add considerably to reserves. Driving, cross-cutting, winzes and raises, and chambers covered 8320 ft. at a cost of $11.82 per foot, while leading stopes and 'stulling' covered 4656 ft. During the year 240,912 tons of ore was stoped from an average width of 12.68 ft., worth $6.14 per ton, at a cost of $1.06 per ton. Stope filling used 15,667 tons of sand and waste rock. Ore reserves are estimated as follows:

	Tons.	Value.
Ore developed	320,800	$5.84
Broken ore	177,460	5.80
Total	498,260	$5.82

The mill treated 234,636 tons, with 89.76% extraction, yielding 62.932 oz. gold and 7839 oz. silver, worth $1,299,650, costs being as follows:

Mining, per ton	$1.72
Treatment	2.34
Stope filling	0.01
General expenses	0.17
Disposal of residue	0.12
Total cost per ton	$4.36
Net profit for year	$120,000
Brought forward from previous year	320,000
Dividend paid	160,000
Carried forward to 1913	270,000

YUKON GOLD COMPANY

The report of the president, S. R. Guggenheim, for the year 1912, states that the company acquired by purchase or lease, control of the principal properties in the Iditarod district, Alaska, and there is reason to expect that they will add considerably to the profits. The cash required for this business was $1,600,000, which accounts for the $725,000 increase in debt to the Guggenheim Exploration Co. The Iditarod property was equipped with a dredge moved from the Klondike, and after the other dredges in that district have finished their work, they will be transferred to other properties acquired. The company's assets total $21,223,414, made up of property and investments, $12,026,121; equipment, $6,935,801; supplies, $879,292; amounts collectable, $502,965; advanced royalties, $340,604; and cash, $97,351. The surplus on December 31, 1912, was $409,276; depreciation account, $586,893; and bills payable, $202,272. The capital is $17,500,000. The report of the general manager, O. B. Perry, states that the dredgable area acquired in Alaska contains 5,500,000 cu. yd., a large amount of which is thawed. At Dawson, Yukon, No. 7 dredge was dismantled and was reërected at Iditarod, Alaska. Its weight was 850 tons, and was delivered in gasoline boats after many delays. A 300-kw. steam-driven turbine and 4400-volt generator, and a 2-mile transmission line was installed to supply the dredge with power. In 75 days it dealt with 172,333 cu. yd. of gravel, yielding $404,040, equal to $2.34 per cubic yard, some of the gravel returning $8.90 per yard. The cost was 45.91c. per yard. The quantity treated was low, but will increase during the 1913 season. The 8 dredges at Dawson worked from the beginning of May to October 24, during which time they worked 86.15% of the possible time, and handled 5,157,280 cu. yd., yielding $3,346,026, or 64.88c. per yard, at a cost of 30.64c. per yard. This result was an increase of about 1,000,000 cu. yd. over the 1911 season, due to an extra dredge working, a higher capacity for all dredges, an increase of 4% of mining time, and better physical conditions. Steam thawing covered an area of 509,544 sq. yd., or 73.58% of the area mined. This method is gaining in efficiency, leading to better dredging. The two all-steel dredges did excellent work under severe conditions.

The hydraulic mines produced $629,043 from 2,967,750 cu. yd. of gravel, an increase 842,000 yd. over 1911, at an average cost of 9.37c., against 15.5c. per yard. Better water conditions helped this result. The Twelve Mile water system was in operation 168 days, and delivered 524,249,000,000 in. of water, at a cost of $76,760 for maintenance. The power plant on the Little Twelve Mile worked throughout the season. Other properties yielded a total of $484,337 at a cost of $204,672.

The year's operations may be shown as follows:

	Gravel, cu. yd.	Yield.	Profit.
Dawson dredges	5,157,280	$3,346,027	$1,765,737
Dawson hydraulicking	2,967,750	629,043	351,090
Iditarod dredge	172,333	404,040	324,926
Other operations	.....	484,337	279,666
Total		$4,863,448	$2,721,419
Royalties paid			692,995
Amortization and deferred charges			577,146
Interest, general, etc.			378,686
Net profit			$1,072,292

OLD DOMINION COPPER MINING & SMELTING COMPANY

This company's mines and works are at Globe, Gila county, Arizona, and the report for the year ended December 31, 1912, gives the following information. Mining and development covered 15,259 ft., and of the sinking done, 96 ft. was in the pump shaft from No. 10 to No. 11 level, also 107 ft. in the winze from No. 16 to No. 18 level. Water encountered in the winze interfered with work, and the winze was allowed to fill until development on No. 16 and No. 18 levels should be further advanced. During the year 854,340,000 gal. of water was discharged through the drainage adit, and 587,140,000 gal. was pumped to the surface. The Miami Copper Co. bought 732,000,000 gal. An Aldrich 18 by 18-in. electric quintuplex pump of 1000 gal. per minute capacity was installed to lift water from No. 16 to No. 12 level. No important changes have been made in mining methods. As in the past, the heavy wet ground on the west side has necessitated square-set and fill, while the stopes in more solid ground on the east side have been carried up, where possible, by cut and fill without timber. During 1913, sorting of ore in the stopes will be undertaken. Power costs were reduced by new contracts for fuel oil. Arrangements were made with the Copper Queen company to treat the flue dust in its reverberatory plant, and if the trial is satisfactory to the Old Dominion company's advantage, this procedure will be continued. In December the first Great Falls type of basic converter, 7.75 by 12 ft., started work. Slag re-treated amounted to 3500 tons. Construction work on the crusher, sampling, and concentrating plants is proceeding well, and the first two departments may be ready by September, and the concentrator about two months later. In June the working hours underground were reduced to 7½ hours, and wages were increased in September by 25c. per shift. The surface employees' hours were reduced from 9 to 8½ hours per shift. The year's results may be stated as follows:

Old Dominion ore production:	
Copper, pounds	16,533,999
Silver, ounces	42,750
Gold, ounces	583
Custom ore production:	
Copper, pounds	10,819,244
Silver, ounces	100,261
Gold, ounces	2,619
Total receipts	$2,888,203
Expenditure	1,884,017
Profit	1,004,186
Dividends	729,000
Surplus on December 31, 1912	962,229

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

DUST-CHAMBERS for the roasting and blast-furnace plants of the Calumet & Arizona smelter are 60 by 140 by 70 ft., and 60 by 180 by 70 ft. They are equipped with baffles and wires.

ACCEPTED VALUE for the weight of a dense crowd of people has been for nearly a century about 100 lb. per square foot, allowing for the kinetic effects of crowds on bridges, buildings, and other structures.

GOLD PRODUCTION of the world in 1912, as estimated by *The Mining Magazine*, was valued at $472,800,000, 10% of which is an estimate, as the exact output from certain countries is never obtainable.

ZINC-DISTILLATION at the Broken Hill Proprietary works, at Port Pirie, is accomplished in a plant having an annual capacity of 10,000 tons, and the production in 1912 was 2260 tons of spelter, and 284 tons of zinc-dust.

SILVER has been found in Missouri in quartz veins in the pre-Cambrian crystalline rocks. The lead found in the sedimentary rocks contains a small amount only of silver, and reported discoveries of silver deposits, using the term in its usual sense, warrant little attention.

MINING GEOLOGY is hereafter to receive special consideration from a committee of members of the American Institute of Mining Engineers. Of the new committee Waldemar Lindgren is chairman, J. W. Finch and R. A. F. Penrose, Jr., vice-chairmen, and L. C. Graton, secretary.

COSTS at the North Star mine during 1912 were: mining, $3.07; milling, 49c.; concentrating, 14c.; cyaniding, 50c.; bullion account, 3c.; miscellaneous, 27c.; general expenses, 15c.; and taxes, accident, and benefits, 7c.; making a total of $4.97 per ton. Development covering 4601 ft., cost 57c. per ton.

MINERAL LANDS withdrawn by the United States Geological Survey, under authority, during the fiscal year 1912, amounted to 1,400,000 acres for oil, and 1,200,000 acres for phosphate reserves; 350,000 acres for water-power, and 60,000 acres for irrigation-reservoir sites; and 86,000 acres for public water reserves, essential to the control of public grazing lands.

ELECTRIC FURNACES for treating ores and making steel have not yet been standardized in America. The Bailey furnace, made by the Electric Furance Co., of Alliance, Ohio, is used at a number of small plants. The larger furnaces in Shasta county, California, were built by the Noble Electric Steel Co., the operating concern, with the help of the Wellman-Seaver-Morgan Co. of Cleveland, Ohio.

ANTIMONY ORE is reduced in this country by the A. S. & R. Co., the U. S. S. R. & M. Co., and the Baibach S. & R. Co. at Eastern furnaces. No antimony metal is made on the Pacific Coast, though occasionally in periods of high prices ore is exported. Current United States production of the metal is about 2100 tons per year. Imports, including metal, regulus, and crude ore, amount to a trifle less than 8000 tons.

HIGH PRESSURE is essential to good results in the use of air drills. A recent visitor to a European quarry where the manager complained that air drills were not economical, found one outlet stopped with a wooden plug that was leaking badly. The *South African Mining Journal* has been investigating air pressures on the Rand, and while it is found that the pressures have been raised in recent years, the average, from Randfontein to Geduld, is placed at 60 lb. In the United States this would be considered absurdly low. All the record work on tunnel driving that has been done here has been based upon high-pressure air among other things. In driving the Newhouse tunnel, the pressure was held at 100 to 125 lb. At each increase in pressure the footage leaped and costs dropped, and the experience is typical. To maintain high pressures economically, large and well laid lines are necessary, but it is false economy to attempt working under other conditions.

LOCAL TERMS for the same operation or device differ the world over. On the Rand what is known in the United States as a 'hoist' or a 'hoisting engine' is called a 'winding engine,' a term that would be equally applicable, apparently, to an engine reeling a rope stretched horizontally as in cable haulage. The operator of a 'winding engine' is an 'engine driver.' In the United States, in general, he is a 'hoisting engineer' and jealous of his title. In the Missouri-Kansas zincfields, where, as in France, "they order things differently," he is a 'histerman' and the term engineer is reserved for the man who fires the boiler.

THE GEOPHYSICAL LABORATORY of the Carnegie Institution at Washington, in 1912, concluded an investigation into the study of minerals with the petrographic microscope upon a quantitative basis, so far as practicable. Chemically pure silicate preparations (mineral types) have imposed new and difficult problems to be solved by the microscope, and to meet new conditions, extensive alterations have been made to the instruments. As a general result, it may be stated that, on clear individual grains, measuring from 0.01 to 0.03 mm. in diam., all the optic properties ordinarily studied in the microscopic investigation of minerals in the thin section, can now be determined with a satisfactory degree of accuracy. The work has occupied six years, and the methods are finding a wide field of usefulness. Another investigation deals with the means for the more accurate measurement of temperatures, beginning with the low temperatures of every-day life, and extending upward to the melting points of the most refractory metals and oxides. Results showed greatly increased accuracy, and a trustworthy temperature scale has been devised to show at what point the component minerals of the earth are stable. The high-temperature section is now in use, but the low temperatures have only recently been determined. The accuracy now attainable in such instruments in the vicinity of 500°C. is perhaps $\pm$ 0.1°, and at 1500°C., perhaps $\pm$ 2.0 degrees.

LODES WITHIN PLACER CLAIMS involve legal complications. One mooted question is, has the placer claimant, before making application for placer patent, the possessory right to, and refusal of, all known lodes without having located them as such? One conclusion from the statutes is that he has. A court decision says that a stranger cannot enter within the lines of a placer location to prospect for lodes, and if he does so enter, and discovers and locates a lode, it is a claim initiated by trespass, and is void. But such a discovered lode now becomes a known lode, just as any lode uncovered in any way, or by anyone, up to application for patent. The placer claimant, or one to whom he has given his consent, may locate a lode. The Land Department has taken the stand that a placer locator has not the possessory right to the lodes within his location, so as to prevent the discovery and location of such lodes by others. This is the proper view, for under that of the court decision referred to, all the veins, as well as the placer mineral in a 160-acre placer location could be held by doing $100 worth of work annually. Undoubtedly, if a case came into court, the good faith of the placer claimant would be a great factor in determining how far a stranger might go in clandestinely prospecting for and locating the lodes within, a placer location. The placer locator may perhaps strengthen his right of possession to the known lodes by inserting in his placer location notice the proviso, "including the right to locate and patent all known lodes." But the proper plan is to at once locate all desired lodes. Lodes within placers should be located in the usual way, with the exception that 50 ft. is the maximum width.

Book Reviews

LEFAX. Compiled by John Clinton Parker. Pp. 12 monthly or 150 pages yearly. Price $1. Pennsylvania Building, Philadelphia.

This monthly publication is simply a loose-leaf system containing, in a convenient form, data of interest to the engineering porfession generally. The sheets are ready punched for filing in a pocket book, and blank sheets are furnished for an engineer's own notes. The information is collected from 31 technical journals, proceedings of engineering societies, and publishers of text-books.

BOOK OF STANDARDS. 1913 Edition. Pp. 516; index. National Tube Co., Pittsburg, Pennsylvania. Price, $2.

The ordinary conception of the function of pipe is for use as a means for conveying fluids. Engineers, however, fail to appreciate how large a part pipe in its various forms is playing in the world of industry. The new edition of the 'Book of Standards,' published by the National Tube Co., while giving due prominence to the ordinary use of pipe, shows that for some forms of work it possesses advantages that are unequaled by any other structural shape. The first part of the book, after discussing the various processes of manufacture, contains tabulations of general dimensions, weight, and test pressures of the various types of commercial pipe and tubing. Types and characteristics of pipe joints are illustrated and described, and their application for various duties discussed. Standard specifications are also given at length and these illustrate excellently the precision of modern pipe-making methods. The large amount of space given to electric line poles is an indication of the wide growth in the application of pipe to this purpose since the publication of the previous edition. The pages devoted to pump working-barrels, cylinders, and cylinder heads is especially interesting as evidencing the encroachment of wrought iron and steel pipe into a field in which cast iron has heretofore held undisputed sway. The fact that the joint between cylinder and head may in many cases be made seamless is not the least of the advantages offered by the substitution. The discussion and tabulated data given concerning the physical and thermal properties of pipe are exhaustive in their thoroughness and attention to detail. The mathematical formulæ, their derivation, and many curves comparing the results achieved by recognized authorities and investigators of the broad subject of the phenomena of fluid in pipes, will be much appreciated by engineers who would ordinarily have to refer to many books to obtain the information given here under one cover. One of the most interesting parts of the book, especially to oilmen, is that on the collapse of tubes due to external pressure. At the instance of the National Tube Co., Reid T. Stewart, dean of the mechanical engineering department of the University of Pittsburg, conducted an exhaustive series of experiments requiring the services of from one to six men for a period of four years. The results of Mr. Stewart's work are given in full and show conclusively the inapplicability of previously published formulæ to present-day conditions. In view of the fact that until the National Tube Co. took up this work the only basis for existing formulæ was the series of experiments conducted by Sir William Fairbairn in 1858, the importance of Mr. Stewart's investigations is at once apparent. Operating men in the oilfields will appreciate the advantage in using the data given as an aid in determining size of oil-well casing.

CLASSIFICATION OF THE PUBLIC LANDS. By George Otis Smith and others. U. S. Geol. Surv., *Bull.* 537. Pp. 597; Ill., index. Washington, 1913.

The most important development within the Geological Survey in recent years has been the land classification work. While land classification was specified as one of the duties of the Survey in the organic act of 1879, it was never taken up in any large way until the Conservation movement and the coal-land scandals of 1905 and 1906 called sharp attention to the necessity of having exact information about each piece of public land. The previous work of the Survey had resulted in the accumulation of a large amount of data that became immediately of value in this connection, and the force then organized has grown into one of the major divisions of the Survey. The classification of coal land, since a definite measurable amount of material is in question, has proceeded along fairly well established lines. It happens that under the law it is possible to value coal lands at any price above a fixed minimum, and the valuations found by the Survey have been adopted as the sale prices. In the case of oil lands it is not feasible, at least as yet, to do more than determine the probable from the improbable oil-bearing lands. The degree of success that may be attained even in this is dependent upon many factors, a large number of which may in any case be unknown. In the case of phosphate rock and potash salts, the price factor and speed of possible marketing is bound to be very important. The Survey is, however, working toward a solution of these problems. The classification of metal-bearing lands has as yet been scarcely attempted, and that is the big outstanding problem for the Land Classification Board. In the meantime, the Importance as well as scope of the Survey's work is illustrated by the following statement recently issued of its activities in March 1913: During the month the Survey classified 1402 acres of coal land, with a valuation of $20,629. It also classified 759,011 acres of withdrawn land as non-coal in character. One coal-land withdrawal of 8826 acres was made in Colorado, and coal-land restorations to public entry amounting to 433,195 acres were made in Colorado, Montana, South Dakota, and Wyoming. One phosphate withdrawal of 826 acres was made in Florida. Water-power reserves were created in California, Idaho, Nevada, Oregon, Washington, and Wyoming, amounting to 10,456 acres, and restorations of 674 acres previously withdrawn for power-sites were made in Colorado, Idaho, and Washington. A public water-hole reserve embracing 1200 acres was made in Arizona.

Recent Publications

METAL-MINE ACCIDENTS IN THE UNITED STATES, 1911. Compiled by Albert H. Fay. U. S. Bureau of Mines. Technical Paper 40. P. 54. Washington, 1913.

INVESTIGATION OF THE PEAT BOGS AND PEAT INDUSTRY OF CANADA, 1910-11. By A. Anrep. Bulletin 8. P. 61. Ill., maps. Department of Mines. Ottawa, 1912.

APPARATUS FOR THE EXACT ANALYSIS OF FLUE GAS. By George A. Burrell and Frank M. Seibert. Technical Paper 31. P. 12. Ill. U. S. Bureau of Mines, Washington, 1913.

IGNITION OF MINE GASES BY THE FILAMENTS OF INCANDESCENT LAMPS. By H. H. Clark and L. C. Ilsley. Bulletin 52. P. 31. Ill. U. S. Bureau of Mines, Washington, 1913.

OIL AND GAS WELLS THROUGH WORKABLE COAL BEDS. Papers and discussions by George S. Rice, O. P. Hood, and others. U. S. Bureau of Mines. Bull. 65, Petroleum Technology 7. P. 101. Ill., map. Washington, 1913.

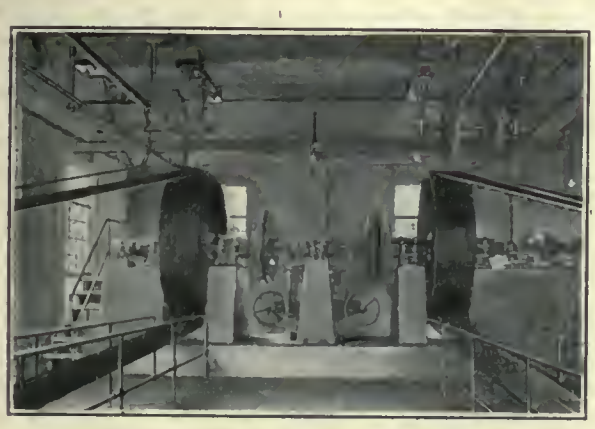
MINE GASES—A CLASSIFYING CHART. Compiled by C. K. Gloman. Supplement to *The Colliery Engineer*, Scranton, Pennsylvania. A useful chart for mining men generally, giving details of various gases and how to deal with them.

GEOLOGY OF THE COLUMBUS QUADRANGLE. By Clinton R. Stauffer, George D. Hubbard, and J. A. Bownocker. Geological Survey of Ohio. Fourth series, *Bull.* 14. P. 133. Ill., maps, plans, index. Columbus, 1911. This publication has been prepared mainly for geological students, and is written in as non-technical terms as possible. The maps were prepared by the U. S. Geological Survey in coöperation with the state. Chapter I on the 'Historical or Areal Geology' was prepared by C. R. Stauffer; chapters II, III, IV, and V, on 'Physiography or Surficial Geology,' by G. D. Hubbard; and chapter VI, on 'Economic Geology,' by J. A. Bownocker. The volume contains many excellent half-tones and s[illegible] plates of fossils.

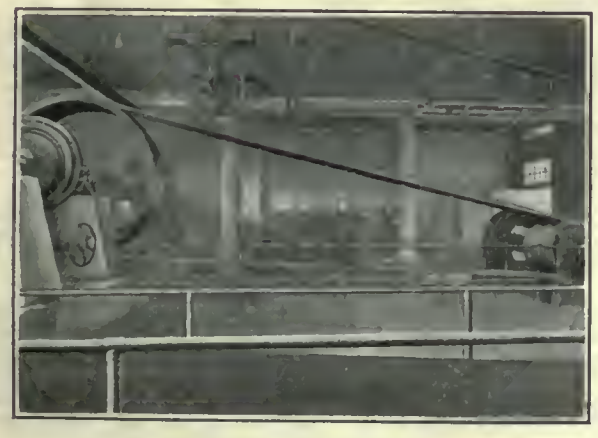
A Rope-Driven Ventilating Plant

In an effort to provide against interruption of service and secure the highest efficiency possible in operation, the Pittsburg Coal Co. has departed from the ordinary practice at its Crescent mine, California, Pennsylvania, duplicating the driving machinery in the fan-house and providing rope transmission between motors and fan. The Dodge Mfg. Co., which installed the system, supplies the following description.

For this particular mill it was not considered necessary to have a reversible fan. The equipment, therefore, was designed primarily for exhausting, and no provisions were made for operating it as a blower. The fan is a double-inlet 'Sirocco' type, manufactured by the American Blower Co., and was designed to deliver 350,000 cu. ft. of air at 157 r.p.m. against a 5-in. water gauge. The wheel is 13 ft. in diameter, 6 ft. 9 in. wide, driven by a central hub,



METHOD OF MOUNTING ON CONCRETE PIERS.



ROPE DRIVE FROM MOTOR.

and mounted on a shaft 10 inches in diameter which is reduced to 8 inches in diameter at the journals. The fan shaft extends into the motor-house and is carried in three Dodge adjustable bearings, one mounted on a concrete pedestal within the house itself, while the other two rest on bridges in the fan inlets. These bridges are of unique design, being constructed of ½-in. steel plate, so disposed as to offer a minimum resistance to the flow of air through the inlets. Only the inlet cones and upper half of the fan casing are steel plate; the lower half and the évasé chimney are of concrete construction.

The fan is driven by a Dodge American system rope drive from two 300-hp., 450-r.p.m., 2500-volt, 60-cycle, three-phase rotor, variable-speed induction motors. These are of the three-bearing type with extended sub-base, speed variation being accomplished by means of resistance in the secondary circuits. The stacks of grid resistance for each motor are inclosed with expanded wattmeters, one recording wattmeter, and two triple-pole automatic oil switches with low voltage release and inverse time limit overload relays. With the exception of the incoming lines, which are carried in the ceiling, all wiring for the motors is placed in conduits under the floor. Current for lighting is furnished by a 110-volt transformer from the high-tension line, the wiring being run in small pipes.

To provide for increased ventilation in an emergency, the rope sheaves are proportioned to operate the fan at normal speed with a motor speed of 400 r.p.m., so that full motor speed would run the fan at 127 r.p.m. or 10% above normal. The sheaves each carry 16 wraps of 1-in. Dodge 'Firmus' manila transmission rope, and are duplicates in every particular. The motor sheaves are of 42-in. and the driven sheaves 107-in. diameter. These latter are mounted on hollow or quill shafts, through which a 7-in. jack-shaft passes. The jack-shaft is rigidly connected to the fan axle with a flanged coupling, and is engaged by 48-in. Dodge patent split friction clutches, bolted to flanges on the ends of the quill shafts, and operated by handwheel and pinion. The quill and jack-shafts are supported independently in adjustable bearings, resting on concrete pedestals, which are joined by a continuous concrete footing to prevent uneven settling.

The motors are set at 30-ft. centres from the jack-shaft, which gives sufficient room to operate the tension carriages inside the building. The winding sheaves and tension-carriage tracks are placed directly above the driving ropes, and are bolted to timbers which are in turn secured by anchor bolts to concrete leveling-pads on the under side of the roof. With this arrangement, extreme accuracy in setting the anchor bolts is avoided and the alignment of sheaves and tracks greatly facilitated.

Pipe hand-railings are provided around the sheaves and ropes, while the clutches are protected by expanded metal guards. Either drive can be thrown in or out without changing the speed of the fan, in fact the sheaves and clutches on the quill shafts being split, one drive could be dismantled without interfering with the operation of the other. The ropes run exceedingly smoothly and are practically noiseless, and in addition, when worn out their replacement is a matter of small expense. In equipping this fan-house the company is looking forward to 35 years of life in active mine work. The output of the mine at present is 6000 tons per day.

A Large Electric Hoist

In a recent consular report is a brief description of a large hoist recently sold for use on the Rand. According to the report, one of the largest and most important electric contracts recently awarded in connection with the Witwatersrand gold-mining industry is that just received by the General Electric Co. of New York, through its subsidiary company, the South African General Electric Co., of Johannesburg, for supplying to the Crown Mines, Ltd., the largest electric mine-hoist in the world, and in fact the largest hoist of any kind whatever which has ever been ordered. The hoist, which is to be supplied by the Schenectady shops of the General Electric Co., will raise 16,000 lb. of ore per trip, in a vertical shaft 3540 ft. deep, at a speed of 3500 ft. per minute. The weight of the empty skip is 3700 lb. The rope is 2 inches in diameter, weighing 6.4 lb. per foot. The hoist will consist of two cylindro-conical drums, of which the smaller diameters are 12 ft. and the larger (cylindrical diameters) 20 ft. 8 in. The speed of the drums will be 53.5 r.p.m. To either end of the drum-shaft there are connected two direct-current, separately-excited electric motors, designed for 500 volts, and each capable of giving continuously an output of 2000 hp. at 53.5 r.p.m. The total weight of each motor will be approximately 142,000 lb., exclusive of shaft and bearing. These two hoist-motors will receive their power from a motor-generator set which converts 50-cycle three-phase power to direct current. The motor-generator will consist of one 5000-hp. (continuous rating), three-phase, 50-cycle, 2000-volt induction motor, operating at 375 r.p.m., direct-coupled to two 1650-kw., separately-excited, direct-current generators. There will also be one 60-kw. shunt-wound exciter for exciting the fields of the two hoist-motors, and the two direct-current generators. The system of control will be what is known as the Ward Leonard system. While

the capacity of the motor-generator set is equivalent to 5000 hp. continuously, the intermittent output from the hoist-motors may be at times 9000 hp., and the corresponding input to the motor-generator set approximately over 11,000 hp. The total weight of the motor-generator set will be approximately 138,000 lb., while its over-all dimensions will be approximately as follows: length, 30 ft., width, 11 ft. 6 in.; height, 10 ft. 3 in. The dimensions of the hoist-motor armatures are so great as to make their transportation over the South African railways impossible, and it will therefore be necessary to assemble and wind them on the spot. It is understood that the contract price for this electric hoist is approximately $125,000.

Jeffrey Swing Hammer Pulverizer

A swing-hammer pulverizer for laboratory use is now being made by the Jeffrey Mfg. Co., which supplies the following details. Crushing is done by means of hammers mounted on a horizontal revolving shaft and swinging out as a result of centrifugal force.

This machine is built especially for use in reducing many

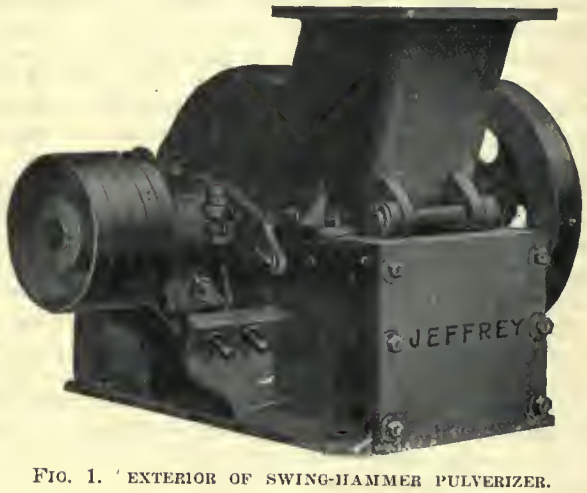


FIG. 1. EXTERIOR OF SWING-HAMMER PULVERIZER.

materials to a fine uniform product for various purposes. It is particularly useful in sampling coal and various ores, as it not only reduces the sample to a comparatively fine powder, but thoroughly mixes it into one homogeneous mass. It also has a place in many industries where a

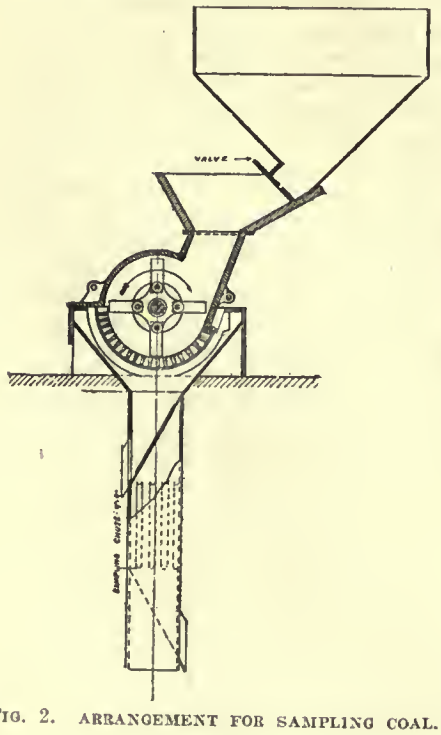


FIG. 2. ARRANGEMENT FOR SAMPLING COAL.

heavy duty or large capacity is not required. While any high-speed machinery is better for being placed on a solid concrete foundation, this machine is so well built that it gives good service when mounted on timbers on an ordinary wood floor, as would be necessary in placing it on one of the upper floors of a factory building.

A good laboratory outfit consists of a pulverizer directly connected to an electric motor. Both are mounted on a single cast-iron base and may be placed in any convenient position, and are furnished complete ready to run.

For sampling coal and kindred uses, the arrangement shown in Fig. 2 will be found excellent. It consists of a hopper large enough to hold a batch in which the material is held by a sliding valve at the bottom. This discharges into a second hopper which leaves an opening into which material may be shoveled without regard to the upper hopper. As the ground material passes out of the pulverizer it is caught in a sampling chute below. The first section of this chute rejects half of the material, the second section is placed at right angles to the first and rejects half the material passing through the first section, and so on, each section rejecting half of the material fed to it from the section above. It is usual to use four sections of sampling chutes, so that but one-sixteenth of the original material is delivered at the bottom of the chutes, but this material will be a true sample of the whole lot.

The construction and size of these hoppers and sampling chutes vary with different conditions and have never been standardized.

Catalogues Received

CROSS ENGINEERING CO., Carbondale, Pennsylvania. 'Simplex Rivetless Chain.' 8 pages. Illustrated. 6 by 9 inches.

OSBORNE PATENTED MACHINERY CO., 120 Liberty St., New York. Bulletin No. 1. 20 pages. Illustrated. 6 by 9 inches.

BAUSCH & LOMB OPTICAL CO., Rochester, New York. 'Engineering Instruments.' 155 pages. Illustrated. 7 by 10 inches.

CHICAGO PNEUMATIC TOOL CO., Fisher Bdg., Chicago. Bulletin E-28. 'Duntley Track Drill.' 8 pages. Illustrated. 6 by 9 inches.

WOOD DRILL WORKS, 30 Dale Ave., Paterson, New Jersey. Folder. 'Talks by the Drillmaster.' 8 pages. Illustrated. 4 by 9 inches.

A. LESCHEN & SONS ROPE CO., St. Louis, Missouri. 'Leschens Hercules' for March and April. 12 pages. Illustrated. 8 by 10 inches.

GOLDSCHMIDT THERMIT CO., 90 West St., New York. Pamphlet No. 29. 'The Thermit Welding Process.' 12 pages. Illustrated. 4 by 9 inches.

DODGE MANUFACTURING CO., Mishawaka, Indiana. Booklet. 'Dodge Capillary Self-Lubricating Bearing.' 14 pages. Illustrated. 3½ by 6 inches.

HYATT ROLLER BEARING CO., Newark, New Jersey. 'The Hyatt Way' for April. Special 'Kanawha' Number. 8 pages. Illustrated. 6 by 9 inches.

SPRAGUE ELECTRIC WORKS, 527 West 34th St., New York. Bulletin No. 115. 'Electrical Equipment for Buildings.' 22 pages. Illustrated. 8 by 11 inches.

INGERSOLL-RAND CO., 11 Broadway, New York. Bulletin No. 3312. 'Imperial XB Duplex Power Driven Air Compressors.' 20 pages. Illustrated. 6 by 9 inches.

MEESE & GOTTFRIED CO., 55 Main St., San Francisco. 8th Edition Price Book. 575 pages. Illustrated. 4 by 7½ inches. This is printed on thin paper by the offset process, making it in pocket form. It contains valuable drawings and tables for engineers and is a credit to the company.

The RIBBET TRAMWAY CO. reports that it has recently closed a contract for one of its high-speed tramways, about one-half mile in length, for the Idora Hill Mining Co., Pritchard, Idaho. Also that it has sold to Howard McBride, representing the Tyler Tunnel lessees, a high-speed tramway.

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EDITORIAL STAFF:

San Francisco

H. FOSTER BAIN - - - - - - - - Editor
EUGENE H. LESLIE, M. W. VON BERNEWITZ - - - - Assistant Editors

New York

THOMAS T. READ - - - - - - Associate Editor

London

T. A. RICKARD - - - - - Editorial Contributor
E. W. WALKER - - - - - - Correspondent

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

Announcement

Responding to a gratifying growth in our business, the *Mining and Scientific Press* has established an editorial office in New York City. Mr. Thomas T. Read is in charge, and at our rooms in the new Woolworth building visiting engineers will, as at our other offices, find always a cordial welcome. Mr. Eugene H. Leslie, recently of the *Mexican Mining Journal*, has joined our staff in San Francisco, and extra pages have been added to the paper to allow the publication of a larger amount of reading matter. These changes will permit of greatly improved service, and with strong editorial staffs in San Francisco, New York, and London, supplemented by special correspondents around the world, the *Mining and Scientific Press* is in a unique position. We shall expect to print not only the best but the most comprehensive weekly paper devoted to precious and semi-precious metal mining.

BIG BUSINESS, in Germany as elsewhere, seems prone to make use of a Krupption fund.

IDLE freight cars are in some degree an index of business conditions, and it is gratifying to note that the net surplus of idle cars is now considerably less than at the same period of last year.

FURTHER trouble for California copper smelters is forecast by the bill still under discussion at Sacramento placing them under the jurisdiction of the State Board of Health, and the action of the Shasta county grand jury in declaring the Kennett smelter of the Mammoth Copper Mining Company a nuisance. We believe neither step to be justified.

THE second annual mining exhibition organized by the Chemical, Metallurgical, and Mining Society of South Africa was held at Johannesburg last month, continuing through two weeks. In addition to exhibits of safety and rescue apparatus, of chemical, metallurgical, and mining apparatus, and of specimens, diagrams, maps, and photographs, there were lectures, demonstrations, and conferences. The whole exhibition should prove stimulating and helpful, and the example of the society with the long name might well be followed elsewhere.

RUMORS to the effect that control of the Bunker Hill & Sullivan Mining & Concentrating Company had passed to the Federal Mining & Smelting Company have been current at intervals for some weeks. Recently the story was revamped and unloaded upon a number of newspapers in some detail,

with the addition that Mr. Stanly Easton was to be at once succeeded by Mr. Harry L. Day as manager for the company. We are authorized to state that there is absolutely no foundation for this story. The control of the company lies where it has for years, and the Federal owns only the shares that came to it in settlement of litigation in 1910. Mr. Easton's excellent work is fully appreciated by his directors and they have no intention of letting him get away. Such rumors can only be started with deliberate intention to confuse public opinion. We are glad to state the belief that the Federal company had no hand in starting the particular rumor mentioned.

Leaching in Anaconda

Extraction of copper from its ores by hydrometallurgical processes has engaged the attention of metallurgists, for many leaching methods are attractive to experimenters because of their apparent simplicity, but, as was the case in the development of the cyanide process, it is quickly found in practice that a variety of mechanical problems present themselves, requiring to be overcome before continuous, cheap, and expeditious operations become possible. In addition, the dissolution of copper minerals involves a variety of chemical difficulties not incident to the cyanide process. In the latter only one mineral substance is to be dissolved, while in the case of copper ores the whole gamut of minerals containing copper must be attacked by the solvent. Like the philosopher's stone, a universal solvent would have many uses, but neither ancient nor modern alchemy has discovered any such. For this reason, in addition to others, it is in the highest degree improbable that any one process for the extraction of copper from its ores by leaching will ever approximate universal applicability. In districts where the ore exhibits uniform characteristics, a process may be developed of local utility, but as a rule the devising of a satisfactory hydrometallurgic method for copper will constitute an individual problem in each area; one which can be solved only by careful experiment. A further chemical difficulty is that in most cases a variety of other substances present in the ordinary ore are also attacked by any solvent that will attack the copper minerals. It is rare to find copper ores in which the gangue is silica alone. Finally, there is the factor of relative masses. In the cyanide process the quantity of valuable substance to be dissolved is only a small fraction of a pound. In a one per cent copper ore there are twenty pounds of copper, and a correspondingly greater quantity of the copper mineral, whatever it may be, must be taken into solution. This at once requires a greater consumption of the solvent, and entails a vigor of action that leads to attack upon the other minerals present. There is therefore little reason to suppose that wet methods for the extraction of copper will ever, other than in exceptional cases, be reduced to a basis as efficient and as cheap as the cyanide process in its present state of development.

As an example of the working out of a satisfactory method to meet a given set of conditions, the Washoe plant of the Anaconda Copper Company may be cited. Here Mr. Frederick Laist, the superintendent, has perfected a leaching process originally devised by him some years ago to meet the conditions existing at a remote mine in Utah. A long and careful series of experiments has demonstrated the feasibility of the method under the conditions existing at Anaconda and an 80-ton plant for the trial of the process on a full working scale is now in course of construction, and should be in operation before the end of the summer. A detailed description of the process should properly be left to Mr. Laist, but a brief outline of its general features will be of present interest. The material to be treated is the average tailing from the wet-concentration plant, containing about 0.65 per cent copper. This will be dewatered and, when nearly dry, sent to roasting furnaces of the McDougall type, of which the upper hearths will serve chiefly for drying and preheating, while upon the lower hearths salt will be added in small quantity, and the heat so adjusted that at the completion of the roast the copper will be in a form easily dissolved by the dilute H_2SO_4 used for leaching, while the iron present will be in insoluble form. The resulting calcine will then be leached in vats with dilute sulphuric acid made by the chamber process from the SO_2 gases drawn off from the roasters which treat the rich concentrate from wet concentration. The copper-bearing liquor will be removed by decantation and the copper precipitated by passing H_2S into the solution, precipitating copper sulphide and regenerating H_2SO_4, which may again be used for leaching. The production of H_2S would in ordinary cases probably prove unduly expensive, but at Anaconda there is available auriferous pyrite, from the Georgetown district, which would otherwise require treatment by direct smelting. This ore, by simple fusion, is reduced to iron matte which can be utilized in the hydrogen sulphide generators. The consumption of H_2SO_4 is thus reduced to the amount required for the production of the necessary H_2S, with the added amount that will unavoidably be lost in foul solutions. Since the acid can be cheaply made by the chamber process, it is confidently expected that a high extraction of the copper now being lost in tailing can be made at a cost not exceeding that by present methods. Should the work of the small leaching plant prove as satisfactory as anticipated, the alteration of the wet-dressing plant in accordance with the flow-sheet devised at Great Falls, as mentioned in our issue of January 4, will be abandoned. The single unit which has already been altered has shown results even better than expected, reducing the tailing content to 0.42 per cent copper, but, since leaching methods may be applied to the ordinary tailing with equal advantage, the capital expenditures required for alteration may with advantage be diverted to the construction of the leaching plant. Much work upon the development of leaching process is in progress throughout the metallurgical world, and results elsewhere will be awaited with interest. The increase in extraction that will be the result of the application of leaching and flotation to copper is an application of true conservation of our mineral resources, and merits heartiest approval.

Tariff Changes and the Metals

When the new tariff bill was made public the generally expressed belief was to the effect that the lowered duties on iron ore would benefit the independent producer rather than the Steel Corporation. More careful study of the bill discloses the fact that its provisions are not all favorable for the independents, as the present duty of $2.50 per ton on ferromanganese is increased to 15 per cent *ad valorem*, or $8 to $9 per ton. Practically all the ferromanganese produced in this country is manufactured and consumed by the United States Steel Corporation, so that the increased duty makes little difference to the Corporation, though a matter of moment to the independents. The imports of ferromanganese in 1911 were 80,263 tons, valued at $3,015,062. Manganese ore, of which considerable quantities are imported, remains on the free list, and the natural result of the new tariff, if it be enacted, will be to stimulate the output of ferromanganese. So far as the steel industry is concerned, the Underwood bill seems likely rather to stimulate American industry than to decrease it. In general, iron and steel men seem less worried over the impending changes than had been anticipated. Present business is good and the country is prosperous. Adjustments are expected to be made slowly. This year American furnaces will produce nearly half the world's total of pig iron. Since local consumption is about 10 per cent less, a substantial tonnage must be marketed abroad, and in order to do this American mills must be able, as they are, to compete with foreign manufacturers in neutral markets. This being so, it is hardly to be anticipated that foreign iron and steel makers will be able to make serious inroads on our home market. Iron and steel will be brought in, but the total amounts will be small in proportion to the tonnage manufactured and sold in the United States. To the extent that Americans buy iron and steel abroad, they will help raise foreign prices, and American manufacturers have now a large and growing stake in the foreign market. At present American furnaces are running nearly to capacity, but periodically the demand slacks off and many go out of blast. The iron and steel industry of the United States has shown great powers of adjustment. It is hardly likely that the new tariff bill will call for any greater change than that made in the years 1910 and 1911. If by large participation in the world's markets a greater share in the making of these periodical adjustments be passed to European iron and steel makers, the local industry will be helped rather than harmed.

Metal tariff changes of especial interest in the West relate mainly to lead, zinc, and antimony. Decreases in the case of all three are proposed in the bill pending. The reduction on pig lead will amount to approximately 60 per cent, and on lead ore a trifle more. Spelter rates are reduced about 50 to 60 per cent and antimony about 60. Closer figures cannot be given because, coincident with the reduction, there is a change from the specific to the *ad valorem* basis. It is anticipated by metal dealers that the new rates will cause retention in this country of lead smelted from foreign ores when lead sells at $4.15 and will permit importation of spelter or retention of metal made from foreign zinc ores at about the present prevailing prices. As to antimony, merely the matter of revenue alone need be considered, since domestic production is unimportant. The *ad valorem* basis avoids some causes for controversy, such as those relating to tariff on lead in zinc ores, but raises others, since the true value at the point of importation is not easily fixed. It is contended that the changes will lead to lower prices for ores and that there is not sufficient 'spread' between ore and metal rates, but it is impossible to be certain of results in advance.

Gold and Commodity Prices

Recent Treasury reports, as interpreted by the *Wall Street Journal*, indicate that the increase of gold circulation per capita, which was rapid in the twelve years from 1896 to 1908, rising from $21.44 in 1896 to $34.72 in 1908, has practically come to an end.

The following table gives a bird's-eye view of the total money in circulation, the monetary stock in gold (including both that in the Treasury and that in use) and the circulation per capita:

MONETARY STOCK OF THE UNITED STATES

April 1,	Total circulation.	Gold stock.	Circulation per capita.
1913	$3,339,898,947	$1,858,569,894	$34.46
June 30,			
1912	3,276,786,613	1,813,499,440	34.26
1911	3,214,002,596	1,753,134,114	34.20
1910	3,102,355,605	1,635,424,513	34.33
1908	3,038,015,488	1,615,140,575	34.72
1905	2,587,882,653	1,357,881,186	31.08
1900	2,055,150,998	1,034,439,264	26.93
1896	1,506,434,966	599,597,964	21.44

It will be seen that the increase in gold stock has scarcely kept pace with the increase in population. At the present rate of population increase in the United States, the amount of new currency annually required to maintain a circulation of $34 per capita is $51,000,000. The annual production of gold is now about $470,000,000. Allowing $120,000,000 for use in the arts and $100,000,000 for exports to India, there is left $200,000,000 to be added to the gold stock of the principal countries. The gold reservations in London for India amounted to £3,475,000 in the period January 1 to April 10, or over one-fourth of the arrivals in London in the same period. In securing one-fourth of the $200,000,000 available for European and South American countries, the United States is at least getting its share. That commodity prices have continued to increase while the per capita circulation remains stationary is, in the view of the *Journal*, explained by the fact that the stimulus given to production and to the extension of industrial equipment during the period of rapid monetary expansion tended for a time to continue from its own momentum, and is at last being checked only by the fact that the expansion of credit has reached the limit of gold reserves and cannot go further without invoking a repetition of the monetary stringency which has recently been felt so acutely all over the world.

Continuous Agitation at the West End Mill, Tonopah

By Jay A. Carpenter

Pachuca vats have been synonymous in technical literature with continuous agitation. Perhaps this is not so much due to the special adaptability of the Pachuca to continuous agitation as to the fact that the endeavor to find a more satisfactory method of agitation led to the introduction into common milling practice of the Pachuca vat, and continuous agitation at nearly the same time. The Pachucas have been sharply criticized for the large initial cost for a given capacity, and for their awkward height, which prevents either gravity flow into them, or a symmetrical design of a mill building to contain them. Their simplicity of operation is without dispute, but the statements of low power consumption have been sharply questioned. Continuous agitation has been called a fad, and in several cases tried and abandoned. Still the fact remains that companies such as the Santa Gertrudis and Tonopah Belmont, with ample capital and with the best of engineering talent, employ Pachucas with continuous agitation in their modern mills. It is evident from the study of the files of the technical magazines, that the unstinted praise given to the Pachuca in 1910 and 1911 has gradually changed to the sentiment that it holds its supremacy, not through its vastly superior work, but from the fact that no one of the many less costly types of agitators has as yet proved to the general satisfaction that under varied conditions it is the equal of the Pachuca for reliability and low operating costs.

Classification of Agitators

The agitators in use may be classified as follows, giving a well known example of each type.

1. Using a cone-bottomed vat, the motive power being: (*a*) compressed air, the standard Pachuca and the variations from it: (*b*) solution under pressure, the Patterson hydraulic agitator; (*c*) mechanical appliance, the Hendryx.

2. Using a flat-bottomed vat, the motive power being: (*a*) compressed air, the Parral; (*b*) solution under pressure, the Trent; (*c*) mechanical appliance, the old arm agitator; (*d*) mechanical appliance and compressed air, the Dorr agitator.

The variations from the standard Pachuca consist in using lower and wider vats with a flatter cone bottom. The higher first cost of the standard Pachuca is thus reduced, but it is an open question if at the same time the best features are not minimized. However, such an eminent authority as Philip Argall speaks very highly of this type of agitator in use at the Independence mill, at Victor, Colorado. In the hydraulic agitator, the form is the same as with the Pachuca, but solution under pressure from pumps is substituted for compressed air. This type is in successful use at the Portland mill at Cripple Creek, but like many other types of agitators convincing data are not presented by those who sing its praises. The Hendryx, using a mechanical device where the above two use air and solution, gives excellent agitation, but is handicapped by the small units used, and high power costs.

In all of the above, a form of vat is used that is more costly to buy and install than the flat-bottomed ones used in the other forms.

The Parral vat is an adaptation of the Pachuca air-lift principle to a flat-bottomed vat. It has much to commend it in cheapness of first cost and low cost for power and repairs, but to the average millman, it does not seem that the rotary action is positive enough to guarantee successful agitation under the varying conditions to be met with in practice. The Trent agitator is an adaptation of a form of hydraulic agitation to a flat-bottomed vat. The action is more positive than in the Parral, and although simple in design there are many wearing parts and the agitator requires careful attention to details to get successful results. Its apparent simplicity of operation and cheapness of first cost has won at many mills, but the fact that it has been abandoned in several cases shows that its simplicity is more apparent than real. The old style arm agitator that was abandoned in such haste for the newer designs is being returned to in a few cases as an old and reliable friend. Its efficiency has been increased by the addition of air lifts on the periphery, and it is probable that in new plants where the speed of the arms is reduced with the idea of depending partly on the air lifts for additional agitation, it is no longer to be sharply criticized for its power consumption. The Dorr agitator carries the change in the old arm agitator one point further by using the slanting arms of the Dorr thickener moving at a faster speed than in the thickener for the arm agitation, but depending to a greater extent upon the air lift which is centrally placed and fed somewhat thickened pulp by the arms. This type has won upon its apparent merits at several plants, the results of which are awaited with much interest.

Requirements for Continuous Agitation

Only part of the agitators mentioned above are well adapted for continuous work. For such work the pulp should be nearly the same specific gravity and the slime of the same screen test at all points in the vat, and the currents in the latter set up by the agitation should be of such a nature that they will aid in insuring the new pulp a definite length of time in the agitator before any part of it reaches the outlet. The standard Pachuca, when it is given from 75 to 100 cu. ft. of free air per minute at 30 lb. pressure, probably best fulfils these conditions. Cases can be cited in which it was necessary to increase the air to this amount before continuous agitation could be made a success. The variations from the Pachuca cannot be well adapted to continuous work.

The old style arm agitators, with the aid of peripheral air lifts, are in successful use for continuous agitation at the old Belmont mill in the Tonopah district, yet the same method was tried and discon-

tinued at its neighbor, the Desert mill of the Tonopah Mining Co. Why such opposite results should be obtained is difficult to understand. An accurate description of this method of continuous agitation at the Belmont would be of great interest.

The Parral and Trent agitators can both be used successfully for continuous agitation, providing, as in the Pachuca, that sufficient power be used to give the proper conditions in the vat. Bernard MacDonald has thus operated the Parral alongside the Pachuca, claiming for it a better extraction with less power consumption. It is unfortunate that with such an excellent opportunity for comparison, and with the excellent detail so ably presented by Mr. MacDonald, he did not use a more accurate method of measuring the air consumption than by comparing valve openings. From the description of the Dorr agitator, it would appear well adapted for continuous agitation if sufficient air be used. As to the Trent agitator, it is the purpose of this article to describe a successful installation with continuous agitation.

Each Has Its Place

In fairness to all these agitators, it may be said that each may be best adapted to some special ore and particular operating conditions, and since they are rarely found working under exactly the same conditions, and when they are these conditions may favor one of them, it would seem that the millman should not base his conclusions too much upon his own personal experience. There is a lamentable lack of accurate and detailed data upon the use of these various agitators. In searching the files of the technical journals for such data, one finds many general conclusions expressed upon the subject, or just enough data to make it easily possible to draw wrong conclusions. It is the purpose of this article to go into careful detail concerning the operation of one of these agitators, the Trent, with the hope that it will lead to a discussion of the subject of slime agitation based upon accurate data. Since the Trent is doing excellent work in many mills, and in others it has been thrown out, it is an appropriate subject for such an article.

The Trent agitator was invented by L. C. Trent of Los Angeles, modified from the overfeed to the underfeed type at the Montgomery-Shoshone mill at Rhyolite, Nevada, and brought into prominence by its successful operation at the Tonopah Extension mill, where the necessary changes and details of operation were worked out under the direction of the mill superintendent, J. P. Montague.

The principal features of this agitator are perhaps sufficiently familiar. The solution is agitated by means of a centrifugal pump delivering to a revolving arm agitator in the bottom of the vat through a submerged grit-proof bearing in an air-sealed chamber and with provision made for the small amount of slime pulp escaping downward through the joint, to flow out into the vat through the ports without rising up in the ball-race chamber. The bearings consist of the top and bottom castings. The bottom casting is provided with a renewable ball race and a ring to hold down the top casting in case it tends to rise. The top casting is one solid piece provided with a head into which are screwed the arms and upon which is bolted the mast. The method of operation is simplicity itself.

Importance of Pump

The centrifugal pump, which is not furnished with the agitator, should be considered an integral part of it, for the choice and operation of the pump has had more to do with the success and failure of the agitator than the agitating device itself. Upon the pump mainly depends the power consumption, the cost of renewals and repairs, and the behavior of the agitating device. To make the installation a success, the pump must be able to handle a gritty pulp day in and day out without undue wear, attention, or power consumption. The use of centrifugal pumps for transferring slime pulp from the bottom of cone-bottomed vats to the top was abandoned as a method of agitation, because of the power and repair costs. With this in mind, it was the intention of the inventor of the Trent agitator that the pump used on the agitator should only pump the nearly clear solution from the top of the agitator, thus avoiding the wear on the pump. This entails operating the agitator so that the pulp shall be thick on the bottom and thin on top. With the centrifugal pump made with chilled iron or manganese steel liners and runners and operated at a comparatively slow speed, it has been found that the wear on the pumps is only nominal, and that this fact in the case of the Trent agitator makes it advisable to pump a large volume of slime pulp, which, although it causes somewhat greater wear and greater power consumption, keeps the tank of nearly the same specific gravity top and bottom, thus giving a more thorough agitation and preventing the chance for quick settling of heavy pulp on a shut-down, making starting difficult or impossible.

There are many standard makes of pump not adapted to this work, either because of the speed necessary with the runner used, or of the wear and cost of the rather intricate repair parts. Again, the same make of pump will give varying results at different plants, due to the speed at which it is driven, or to the number or size of nozzles on the agitator.

Why Wear Varies

A study of the table, 'Average Performance of a Centrifugal Pump,' on page 886 of the 'American Civil Engineers' Pocket Book,' will aid in understanding why the power used and the wear on the pump varies so greatly at different plants employing the Trent agitator. This table is based on the fact that for a given centrifugal pump there is one speed against one head that gives the maximum efficiency, and that as this head is increased or decreased, the volume pumped decreases or increases, but the efficiency decreases rapidly in both cases. This decrease is due mainly to the slippage of the pulp in both cases, which increases the wear.

In the Trent agitator, the pulp must issue from the nozzles with sufficient force to cause the arms to turn. With a given pump running at a fixed speed, the area of the nozzles determines the head or pressure against which the pump works. By chance this

may just coincide with the maximum efficiency of the pump for the given speed, in which case the Trent agitator will be praised for its low power consumption. If the pump is working against only 50% of the correct head for the driven speed, its efficiency is but 66% of the best conditions, or if it is pumping against a 40% greater head, its efficiency is likewise only 48% of the best conditions. Since the efficiency of a centrifugal pump at its best performance is relatively low, such a drop as those indicated above make the pump an inefficient machine. Perhaps this partly explains the widely varying published figures of the horse-power consumption of Trent agitators. These range from the Goldfield Consolidated figures of 7½ hp. for 200 tons dry slime in a 1½:1 pulp, to the Hollinger figures, as given by Herbert Megraw, of as high as 18 hp. for a vat of 30 ft. diameter and 15 ft. high, filled with pulp heavier than 3:1, and probably containing 110 to 140 tons of dry slime.

Number and Size of Nozzles

When the agitator is revolving in good running condition, that is, revolving freely on the ball race when spun around in the empty tank, and all nozzles cleaned, it may be turned readily by hand when filled with pulp over the arms, showing that the force at the nozzles required to turn it must be small. It should continue to turn easily as long as enough pulp is introduced through the nozzles to counteract the natural tendency of the slime to settle, and with sufficient velocity to turn the agitator. Since the number and size of the nozzles plays such an important part in determining the head against which the pump works and the volume pumped, it is evident that a change in the size of the nozzle openings will play an important part in increasing or decreasing the efficiency of the pump. For instance, if a pump at a given speed is not turning the agitator fast enough, instead of running the pump faster to increase the agitator speed it is quite possible to obtain the same result by removing a part of the nozzles from the nipples, or increasing each nozzle area. Possibly the correction may be made the opposite way, by decreasing the size of the nozzles, depending upon whether for the greater speed of the pump head should be less or greater to get the maximum efficiency. At the Tonopah Extension, for an experiment, the agitators were run for a few weeks without nozzles at all, the greater volume pumped making up for the lower pressure and effecting the same result.

When the agitator is driven at a speed of about 3 r.p.m. by a slime pump working under an economical speed and head, it will successfully agitate week in and week out without any trouble or repairs, a slime pulp from 1.16 to 1.30 specific gravity with the slime varying from 60% through 200 mesh, to 90%, as long as the pulp does not contain wads of waste and wood pulp, broken bottles, tin cans, or other such material. Such an agitator can be stopped for several hours and started without trouble when working on thin pulp and coarse slime, and for a day or more when on thick pulp and fine slime.

A Few Difficulties

The following remarks concerning the operation, wear, and repair on this type of agitator are the result of watching the operation in several other mills, talking with operators from other districts, and of operating them for eighteen months in the milll under my charge. Having in the first few months often poked with a long stick at the mast and fished with a grab hook for the arms in a vain effort to make the agitator turn, and having waded in slime pulp pushing on the arms, I agreed with Whitman Symmes that the agitator hardly justified the effusive statement of the inventor, that with it "cyaniding, formerly a complex nightmare, becomes a delightful experience," but I am now sure that if the proper study and care be given the agitator, such performances are unnecessary and it will give service as satisfactory as the Pachuca.

The most frequent complaint against the agitator is the stopping of the nozzles by waste material. Since this same material gives trouble, but to a less degree, in launders, pipes, cones, thickeners, and pumps, it should be screened out at every available place; such as at the end of the classifiers, in the launders, over the tops of cones, and settlers. If this precaution be taken, with footboards on all walks, and the millmen interested in the subject, this complaint will be of minor importance.

Wear of Ball Race

The wear on the noozles and pipe arms is next to nothing, but the ball race will wear in spite of its protection. This wear varies greatly, depending on the amount of slime reaching it, which in turn depends upon how smoothly the agitator is operating. If the escape parts in the bottom casting become choked with settler slime, and a sudden jolt of air be given the agitator, or the agitator wobbles as a result of choked nozzles, then an extra amount of pulp passing the joint may flow over the ball race. The balls running in slime cut both the top and bottom race about equally and wear down in size. Since the clearance is made entirely too small on the original castings, the ball race of the upper casting may soon be rubbing on that of the lower casting, and the friction generated will gradually slow and finally stop the agitator. The remedy for this is to raise the top casting and chisel down the edges of the lower ball race, which can be done in an hours time, insuring at the West End mill several months run before repeating. The ball race in both the top and bottom castings should be made separate to be easily renewable. However, it will not be necessary to machine the castings and fit in new races until after two years or more of wear.

Another source of trouble met when an excess of air is suddenly applied or the pumps started with the nozzles pointed too steeply toward the bottom, is that the top casting rises and shifts so that the casting is suspended or hung up on the joint. The quickest way to right it is to empty the tank. In one case, to my knowledge, a raft was built and launched upon the cyanide sea in a vain attempt to right the submarine. In the latest designs a holding down ring prevents this distressing accident. In

the older type, J. W. Harcourt, master mechanic at the Desert mill, prevented this occurrence by extending the joint to 4 inches in length. Before the top could rise this high, it would bind on the joint and settle back in place as soon as the pressure was relieved. This joint should also be made with two removable bushings so that they could be easily replaced after a couple of years service, when the small stream of pulp has cut them enough to allow too large a stream of pulp to escape for the parts to handle. The expense and labor of inserting two each of the new cast iron ball-race rings and bushings would be but a small item and would make the agitator as good as new. A set of balls will wear from one to two years, and as they grow smaller, the race should be kept filled by addition of balls of a size.

Starting the Agitator

If, after a power shut-down, or pump repairs, the agitator fails to turn, it is due to the accumulation of thick pulp or sandy material back of the arms where the nozzle streams cannot reach them. Often starting the pump several times or rocking the mast will aid the arms to pass over or through this mud, and the nozzle then cuts it away, or a grab-hook caught on one of the arms and carried around a half turn may be used. Where the platform runs over the centre of the tank, as at the Rawhide mill, the men easily turn the agitator by hand power, turning opposite the usual direction of rotation, which causes the nozzles to clean the bottom of the tank in advance of the arms. After a part of the turn, the agitator, upon release of pressure, will reverse and the arms will then rotate freely and there will be no more trouble.

Gaining by Experience

In the first few months of operation at the West End mill, many of these troubles were met, but we had the advantage of our neighbor's experience, and at the end of six months the agitators were running so smoothly and with so little attention needed, that I devised a simple and effective method of continuous agitation and put it in operation. The essentials of this system are: (1) that the pulp be drawn from each tank of equal specific gravity and fineness as to that which enters the vat, in order that there will be no gradual accumulation of thick or coarse pulp; (2) that the chance for a quick passage of new slime through any one of the agitators into the next of the series be reduced to a minimum.

With the Pachuca, the average agitation given for continuous work is sufficient to keep all parts of the tank of the same specific gravity. The greatest trouble with its rapidly moving centre column of pulp the danger of carrying new pulp to the next vat, with but a short contact. After considerable discussion of this subject, the general conclusion seems to have been that this danger became of little consequence when 8 to 10 agitators were used continuously.

A Record of Tests

Tests upon the Trent agitators before installing continuous agitation, showed the following specific gravity and screen tests:

Record of Test on Trent Agitator

Depth of sample, feet.	No. 220, 90% through 200.	No. 222, 2 hr. agitation after 4 hr. shut-down.
4	1.208—1.190	1.242
9	1.192—1.208	1.240
15	1.206—1.208	1.242

On No. 220, 500 c.c. of pulp was screened through 200 mesh.

4	ft. gave	27¾	gr. on	200 mesh
9	"	27	"	"
15	"	28¼	"	"

There being as great differences between samples at the same depth as at different depths in the agitator, it was evident the agitation was as thorough as that of the Pachuca.

Having but four agitators, the second point was of great importance. Observations were made to determine the currents set up in the agitator. There seemed to be no definite rotary current, probably due to the fact that the arms moving in an opposite direction to the nozzle streams destroyed all currents. There was no rising current at the side of the vat, probably due to the force of the nozzle streams being exhausted before they had reached the side. It was evident that pulp delivered evenly to the bottom of the vat would not be subject to the action of currents bringing portions of it quickly to the surface.

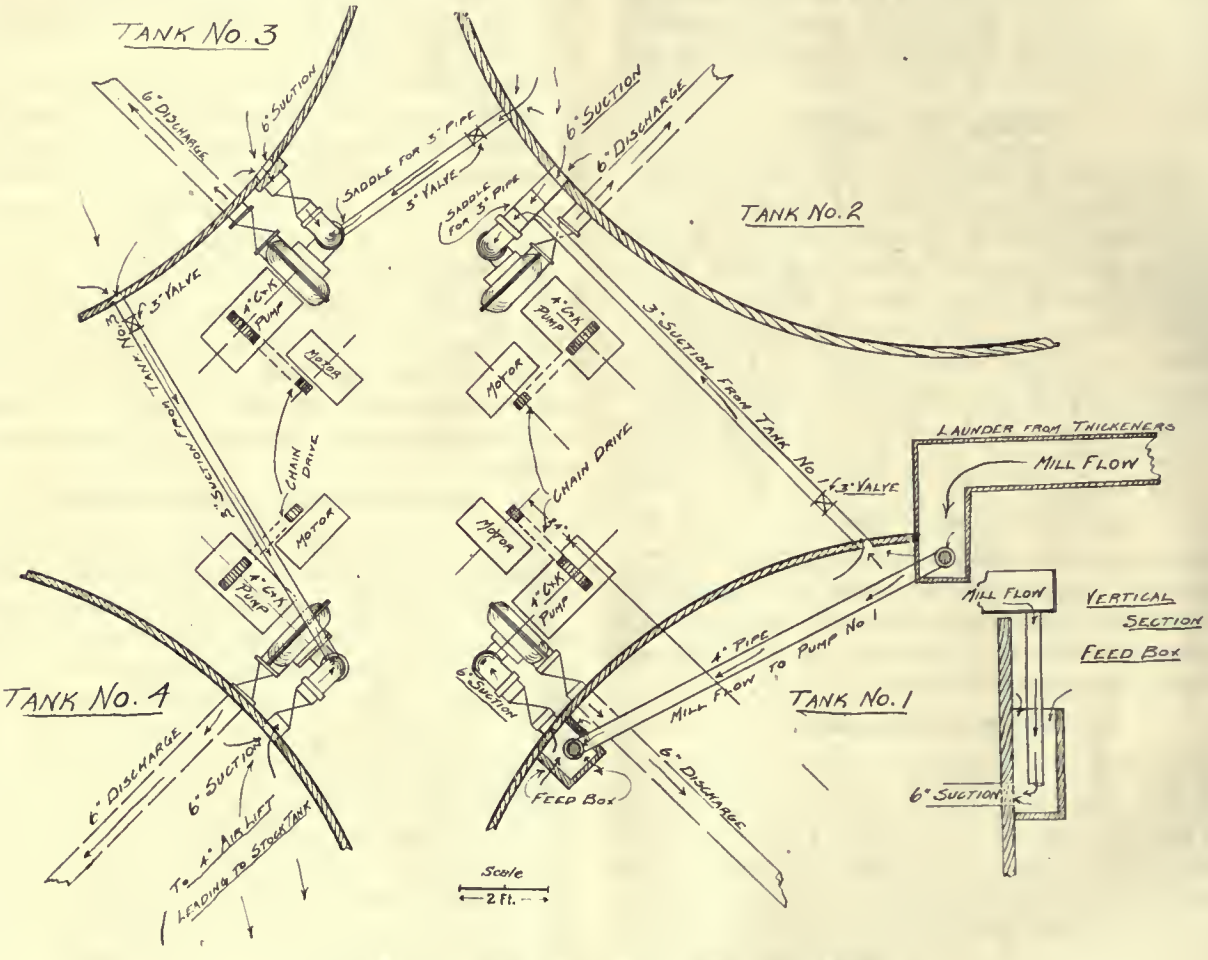
Arrangement for Continuous Work

Since the total pulp in the Trent agitator is not handled but once in three hours by the pump, it was evident that if the new pulp could be introduced in the pump suction and thus distributed over the bottom of the vat and the old pulp withdrawn at the top of the vat there would be little likelihood of any new pulp short circuiting through the vat. The accompanying illustration shows how this is done, using the agitator pumps as the means of transfer. The pulp from the crushing department is lifted from the bottom of Dorr thickeners by diaphragm pumps into a launder which delivers it at the edge of agitator No. 1 into a 4-in. pipe, which in turn delivers it to the bottom of a box over the suction of the pump. Since this is but a part of the pulp necessary to feed the pump, it is all drawn into the suction pipe by the current of pulp flowing into the box from the top of the vat.

The 6-in. pump suction of agitator No. 2 has a branch 3-in. suction to agitator No. 1 entering it at 3½ ft. from the top. Through this suction it draws pulp from No. 1 agitator fast enough to keep No. 2 level with No. 1, and if the flow into No. 1 is stopped. No. 2 will build up to 4 in. higher than No. 1. The pulp from No. 1 thus is distributed over the bottom of No. 2 tank and must rise nearly to the top of the vat to pass into the branch suction of No. 3 pump, thence to the bottom of No. 3 vat. Practically the only regulation required for this continuous system is that of the air lift taking the pulp from No. 4 agitator to the large Dorr thickener. In the design of the mill the thickener floor being limited, sufficient agitators were installed so that each agitator in turn was used as a collector until filled, agitating the pulp meanwhile. By changing to the continuous

system, the present 150 tons daily capacity of the mill is given 54 hours continuous agitation, whereas the 120 tons under the charge system received 58 hours.

After operating the continuous system for a year's time it was found that after two to three months of steady running the mast of about one of the four agitators would begin to describe a small circle, showing that part of the nozzles are choked. This does not mean that it needs immediate attention. When convenient an extra filter charge is run, making room to transfer No. 4 agitator to the large Dorr thickener. A rope is stretched across the vat and the top



ARRANGEMENT OF TRENT AGITATOR FOR CONTINUOUS WORK.

casting is raised by chain-block high enough to expose the ball race. The nozzles are looked into and cleaned, the ball race washed out if slimy, and additional balls added, and the race chipped if necessary. Then No. 3 is transferred to No. 4, partly by gravity through common suction to the transfer pump, and No. 3 given the same attention. Then 2 to 3 and 1 to 2, and then No. 1 is allowed to fill. The arm needing attention the worst will be found with many of the nozzles choked, and often most of the nozzles choked will be on one arm, which has caused the wobbling of the mast. The bottom of the vat needs no attention whatever, as there is no settlement of slime or sand. It takes about 10 to 16 hours to go around the circuit; about half the time is taken by the mechanic for his inspection and work, the rest being taken for transferring. The labor of transferring and inspection at such periods is small compared with the weeks of steady work insured.

The assumption upon which the Trent agitator was placed in the mill in preference to the standard Pachuca was that although it would cost more to operate, it would require three years of operation before the extra expense added to the original cost would equal the capital outlay for Pachucas. The comparison of cost was based upon figures of costs for the Pachucas at the Goldfield Consolidated and for Trent agitators elsewhere, with a liberal allowance for the power and maintenance cost of the Trent. After two years' experience I believe this statement is nearly correct. The cost of the Pachuca vats is now lower than at any time, but the cost of operating and maintaining the Trents is lower than was estimated. The comparison of cost is as follows:

Trent Agitators (f.o.b. Tonopah)	
Four 24 by 18-ft redwood tanks, each 7000-cu. ft. capacity	$2120
Four Trent agitators with piping	2041
Four 10-hp. motors	760
Four 4-in. C. & K. pumps	720
Four 10-hp. chain drives	140
One air-compressor for 80 cu. ft. at 20 lb., with 10-hp. motor	400
Erection	500
Total	$6684
Pachuca Vats	
Four 15 by 45-ft. Pachucas, 6800 cu. ft. each, weight 29,000 lb., $883 each f.o.b. Milwaukee	$3532
Freight to Tonopah, $573 each	2292
Erection at estimate of 2c. per lb	2320
Air-compressor for 320 cu. ft. of air at 30 lb., with motor, erected	1500
Total	$9644

The cost of operating the Pachucas at 6.5 hp. per vat, I believe is moderate, especially since this is nearly the minimum figure based on 80 cu. ft. free air at 30 pounds.

Power Consumption

After 18 months the cost of operating the Trent agitator is found to be as follows: With the agitators filled with the average charge of 88 tons of ore in a 1.25 specific gravity pulp, the horse-power consumed by the 10-hp. motors, being the horse-power input taken with a polyphase wattmeter, was 6.8, 5.9, 6.8, and 6.5 hp. respectively, or an average of 6.5. This reading includes all motor and transmission losses. Power data as given by the technical press are generally published without giving the method by which they were figured. Often the millman bases his figures on whether the given motor runs cold or hot, irrespective of the fact that motors vary so greatly as to make this method a joke. Also, very often, the assumption is made that a 10-hp. motor takes 10 hp. when running full load, while a wattmeter will show considerable excess, depending on the motor efficiency. Others who take a wattmeter reading, figure the horse-power consumed by a unit, such as the Trent agitator or a compressor for Pachuca work, as the horse-power delivered by the motor, thus deducting motor losses as a separate item. Others, over-zealous people, may figure the transmission loss as a separate item. The air used by the agitators amounts to 80 to 100 cu. ft. piston displacement at 16 lb., estimated at a total consumption of 6 hp. This makes the total consumption for each agitator 8 horse-power.

Pump Repairs

The cost of maintenance for the agitators also has been less, due to a choice of Campbell & Kelly pumps; for the greatest item of maintenance is in the repair of pumps. This pump, made at the local foundry and machine shop, has an enviable record for service and has replaced many pumps of standard makes in this district. Its advantages are in the ease with which repairs or changes can be made to any part, in the simplicity of design, and the durability of the wearing parts. Our records show that the pump on No. 2 agitator was started September 20, and ran practically 24 hours per day until June 20, 9 months, without a repair or any mechanic's time. At that time it required a new shaft and runner, and on October 1, over a year, it required a new liner for the shell. The average life of the repair parts necessary, has been a new shell liner every 10 months, a runner and shaft every 6 months, and the main bearing re-babbitted every 6 months, the wear on shafts and bearings being due to slime in the solution fed to the packing gland. The yearly cost for these repairs is $50 for materials, and $18 for labor. Renewals for chain drives and agitator parts, with all labor for maintenance, added to the $68 for the pumps bring the total for maintenance and repairs for each agitator to about $100 per year. The maintenance cost of the Pachuca system complete would easily total $60. For the four units the power consumption is 6 hp. greater than for Pachucas, or $630 per year. The cost of maintenance is $340 greater. On this basis the Trents would cost $970 per year more to maintain and operate, but the installation would be $2900 less, or nearly the amount of three years' operating costs.

Accurate comparison of the two agitators as to extraction and cyanide consumption is impossible in this case. However, the perfect aeration of the Trent has much in its favor, the air being minutely subdivided and slowly rising through the charge. The blanket of foam on the vat acts as a nonconductor, preventing radiation from the heated pulp, in sharp contrast to the centre column of the Pachuca. With the continuous system on the coldest days there is no mist over the agitators. When solutions are heated to 90 to 120°F., the absorption and radiation of heat by compressed air becomes an important consideration. Since the extra cost of the operation of Trent agitators above Pachucas, in our case, amounts to less than 2c. per ton, it is probably easily paid back in extra extraction and heat saving.

In Other Mills

The description above of the satisfactory work of Trent agitators is by no means an isolated case, for in Tonopah alone, the Tonopah Extension and the MacNamara mills, while not attempting continuous agitation, obtain equally and in some particulars better results with these agitators. At the Extension mill, the superintendent, J. P. Montague, gives the motor horse-power as 6, and the air consumption as 25 cu. ft. of free air at 18 lb. for the 24 by 16-ft. agitators. He has discarded the round nozzles for flattened nipples which allow waste materials to pass through more readily. Shell liners and runners last six to eight months, and shafts and bearings, due to using water on the packing glands, last over a year.

At the MacNamara mill, the superintendent, J. B. Tregloan, gives the following figures: A charge containing 97 tons of ore is agitated with a total of 9.5 hp. A charge of 1.26 specific gravity, with the slime screening but 70% through 200 mesh will not vary over 0.01 in specific gravity between top and bottom, and screen test within 5% through 200 mesh. At this mill the ore is almost entirely pure quartz without kaolin, and the sulphides show no oxidation. The ore has a specific gravity of 2.64 and the pulp is white in appearance and contains a small amount of colloid as distinguished from fine crystalline matter. In spite of the quick settling of this ore, these agitators have been stopped for days and started in a few minutes. There are other installations of Trent agitators in the Tonopah district that often grow weary and stop for the lack of a kind word. When Trent agitators give results as satisfactory as in the three mills mentioned above, they surely compare favorably with the standard Pachuca. On the average millsite they will reduce the costs over a Pachuca installation in (1) the excavation and concrete work on the millsite, (2) the building cost to cover them, and (3) the outlay to buy and install them. The small extra cost per ton to operate them is probably balanced by the saving in chemicals, heat, and elevating costs. When properly erected and operated they closely approach the Pachuca in its best feature, that of reliability of operation.

Who Sells the Copper

Agencies for selling copper usually handle the metal from several concerns. As the business is profitable, it is much sought, and changes are frequent. The most recent list, based upon pounds handled last year, and compiled by the *Boston News Bureau*, is given below:

UNITED METALS SELLING CO.

	Pounds.
Anaconda and North Butte	294,000,000
Lake Mines (Copper Range)	40,000,000
Arizona Copper Co	38,670,000
Utah Consolidated Mining Co	8,000,000
Greene-Cananea	48,346,000
Giroux	3,768,000
Pennsylvania Salt Mfg. Co	6,000,000
Imports	10,000,000
Total	448,784,000

AMERICAN SMELTING & REFINING CO.

Cerro de Pasco	48,000,000
Tacoma refinery and smelter product, Alaska, and miscellaneous	113,000,000
Utah Copper Co	95,200,000
Nevada Consolidated	63,500,000
Tennessee Copper Co	13,000,000
Ray Consolidated	35,400,000
Chino	28,700,000
Mason Valley	16,000,000
Ohio Copper	6,972,000
Total	419,772,000

AMERICAN METAL CO.

Old Dominion Copper Co	27,571,000
Shannon Copper Co	16,500,000
Granby	22,630,000
Imports, Ducktown, and miscellaneous	56,000,000
	78,630,000
East Butte	14,765,000
Teziutlan Copper Co	10,000,000
Torreon smelter	5,000,000
Total	152,466,000

CALUMET & HECLA

Calumet & Hecla	65,490,000
Osceola	18,154,000
Allouez	5,627,000
Ahmeek	16,197,000
Superior	3,900,000
Tamarack	7,783,000
Isle Royale	7,968,000
Centennial	1,732,000
Victoria	1,200,000
Total	128,051,000

PHELPS, DODGE & CO.

Copper Queen Smelter	123,276,000
Detroit Copper Co	24,976,000
Calumet & Arizona	55,200,000
Total	203,452,000

L. VOGELSTEIN & CO.

United States Smelting	22,500,000
Matte, smelter material, and imports	45,000,000
Orford Copper Co	15,000,000
United Verde Copper Co	33,000,000
Total	115,500,000

ADOLPH LEWISOHN & SONS

Miami Copper Co	32,814,000
Shattuck-Arizona (In 1913)	15,000,000
Total	47,814,000

BEER, SONDHEIMER & CO.

British Columbia	11,000,000
Cuba Copper	5,000,000
Miscellaneous	4,000,000
Total	20,000,000

E. P. EARLE

South Utah mines and smelters	2,000,000
Mexican imports	3,000,000
Japan imports	4,000,000
South American imports	4,000,000
Total	13,000,000

DIRECT TO TRADE

Quincy Mining Co	20,250,000
Stanton Mines	.....
Wolverine	9,120,000
Mohawk	11,995,000
	21,115,000
Franklin	2,450,000
Mass	1,400,000

W. PARSONS TODD

Winona	2,200,000
Lake Copper	800,000
Total	3,000,000

The leading metal concerns of Europe have representatives in New York who buy copper in large quantities direct from producers or selling agencies. Notwithstanding this fact the leading American producers and selling agencies have their own representatives in the various European markets. In London, C. S. Henry & Co. represent the Amalgamated Copper Co., Henry R. Merton & Co. the American Metal Co., while L. Vogelstein & Co., Phelps, Dodge & Co., and the American Smelting & Refining Co. also have men on the spot. Aron Hirsch & Sohn of Germany have close affiliations with L. Vogelstein & Co. and are represented throughout Europe; in addition they see much Australian copper.

Available Alkalinity of Lime

*The sample as delivered for analysis is contained in an air-tight vessel, having been passed through a 30-mesh sieve. It is crushed with a Wedgwood mortar and pestle, and the whole passed through a 60-mesh sieve, this operation being performed as quickly as possible. It is then placed in a clean, dry, wide-mouthed bottle fitted with a tight-fitting dry glass stopper so as to prevent any access of air. Two grams of the sample is carefully weighed out and agitated with 1 litre of a 2% cane-sugar solution (or 1 gm. with ½ litre of 2% sugar solution). If a shaking machine be available, 2 hours continuous agitation should be given, if not, 6 hours intermittent agitation, every care being taken to prevent coagulation of the lime, in order that the lime and solution may be brought into the most intimate contact during this period. When the agitation is finished the solution is filtered as quickly as possible, and aliquot portions titrated with N/10 or N/5 acid, using rosolic acid as indicator, avoiding delay so as to obviate undue exposure to the atmosphere. The distilled water used in the above determination must be made neutral to rosolic acid to counteract the presence of dissolved CO_2.

*Abstract from report of South African Engineering Standards' Committee.

Cleaning-Up at a Nome Hydraulic Mine

By C. W. Purington

*Cleaning-up at the hydraulic plant of the Pioneer Mining Co. on No. 1 and No. 2 Below Specimen on Anvil creek at Nome, offers some interesting variations on usual practice as a result of the use of steel sluice-boxes.

The use of these, both in the bedrock line leading to the elevator pit and in the tail sluice, has increased the efficiency of the plant over that at Glacier creek in 1904. The difficulty which was then experienced in getting the gravel from the face to the sump no longer exists, as it slides easily in the steel boxes used without riffles, to the elevator throat.

PREPARING TO CLEAN-UP. CLEAN-UP AT No. 2 BELOW.

The boxes are made so as to fit into each other with a lap of 2 in. and are bolted together, with one bolt on each side. The usual size is 24 in. wide on the bottom, flared to 30 in. across the top, made of one bent sheet of ¼-in. steel, 10 ft. long.

No attempt is made to save gold in the bedrock sluice. Should any concentrate remain in the elevator sump, after one operation is finished, it can always be shoveled from the bottom of the sump into the throat before the set-up is abandoned.

The tail-sluice is practically of the same construction as that described at the Glacier creek set up in my report of 1905.[1] The principal difference is in the use of the steel boxes, which are 30 in. wide on bottom and 37 on top. The head-box, in which the manganese steel hood is set, is of timber, as are the two succeeding boxes. The head-box is 12 ft. long by 30 in. wide and 3 ft. 6 in. high above the floor. It is strengthened by four yokes having 4 by 6-in caps and sills and 4 by 4-in. posts. The first two boxes, are set at a materially less grade than are those of the main string. The remainder of the sluice, 200 ft. long, is of steel. Riffles extend for the first 125 ft., the remainder of the boxes being clean. Riffles in the first boxes are wooden blocks, 12 by 12 by 8 in. high. They wear rapidly but are easily replaced. Riffles in the steel boxes are short sections of T-rail set in frames, 4 ft. 9 in. long by 11½ in. wide, with narrower sections on the side. They are so pinned together lengthwise that they cannot be lifted out except when starting from the upper end of the sluice. A steel bar, 31 in. long by 1 in. square is set between each two frames. Quicksilver is used in all the steel riffles, the wooden blocks in the upper boxes being kept free from it.

The main string of boxes is set on a grade of 5 in. to 12 ft., which is as low as can be used under present conditions. With this grade it is necessary to start piping the tailing soon after each set-up. As shown in the table printed last week, the tailing giant was at work 16 days and 17 hours, as compared with the piping giant for 21 days and 17 hours. The use of the tailing giant is not to be recommended if it can possibly be avoided. In future work in this locality it can probably be avoided almost entirely. If the hydraulic elevator itself represents a waste of water which has been obtained at great expense under pressure, the tailing giant is a much greater waste of this water.

A typical clean-up at the No. 2 Specimen operation started at 9 in the morning and was finished at noon-time. First, all the gravel, surrounding the elevator throat which had caught in the crevices of the bedrock was carefully shoveled into the elevator and any rich gravel which might have caught in the

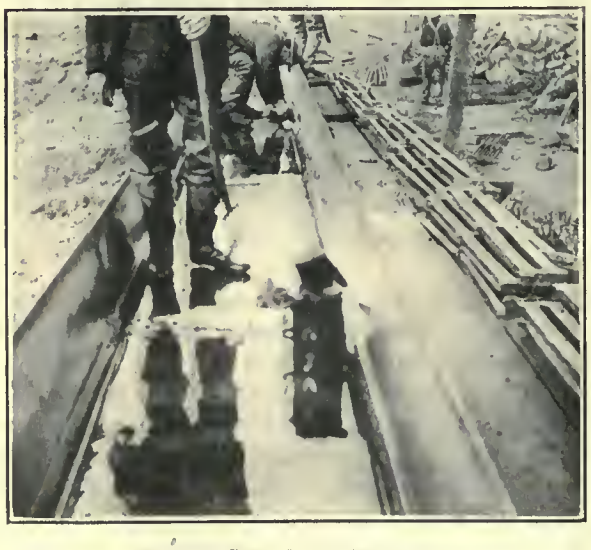
*For general description of operations and costs see *Mining and Scientific Press*, April 26.

[1]'Methods and Costs of Gravel and Placer Mining in Alaska,' Bull. 269, U. S. Geol. Survey.

vicinity of the throat was carefully collected in buckets. While the clean-up was going on, a little water was fed to the elevator, sufficient to clean the amalgam, while the heavy stones were being forked out. The photograph illustrates the clean-up and shows the amalgam in the bottom of the steel boxes. The amalgam is taken in buckets to the assay office at the mine, retorted, and sold as retorts to the bank.

A new set-up had already been made and sluice-boxes erected so that all that was necessary was

CLEANING-UP THE SLUICES.



CLEAN-UP, SHOWING STEEL SLUICE.

to break the pipe connections from the old set-up and join them to the new. It takes the work of two men for about four days to blast out the elevator pit in the bedrock. The dimensions of this pit are about 6 ft. square by 6 ft. deep. Generally 4 ft. in the clear must be allowed below the nozzle of the elevator in order to give room for placing the goose-neck. Formerly in the hydraulic elevator operations at Nome it was customary to use at least two small hydraulic pumps to help dispose of the excess water. Now the elevators have undergone so much improvement that one pump is sufficient, and sometimes even it is unnecessary.

Work of the Nevada Consolidated

By Pope Yeatman

*The mining area of the Nevada Consolidated Copper Co. during 1912 has been increased by acquiring the Watson No. 1, containing 2.9 acres and situated close to the Liberty pit. Rights for dumping privileges for overburden have also been obtained on portions of the Rex and Guptil claims, portions of Clipper, Clipper No. 2, and Fraction, a portion of Monarch Fraction, and a portion of Chispy and Quartette, having an area of 37.21 acres, and allowing for the disposal of two to three million cubic yards of overburden.

Prospecting and Ore Reserves

In addition to a large number of holes drilled for blasting purposes, in connection with the removal of overburden and mining of ore, 16 were drilled with a total footage of 5330 ft., in the Copper Flat area, and one 264 ft. deep in the Veteran area of the Cumberland-Ely ground—the latter for purposes of ventilation. The total number of holes drilled to date is 274, equaling 84,202 ft. These holes have shown more definitely the outlines of the deposit, and have proved more accurately the extent and grade of the orebody. While the lateral extent has been pretty well delimited, there is still some chance for development of additional ore at greater depth in places where the drill-holes have not been sunk quite deep enough. It is at the present time difficult to put these holes down on account of the surface having been disturbed by blasting in the preparation of the ground for removal of capping. As this is cleared off, more deep holes will be drilled. In the Cumberland-Ely some prospecting has been done in the west end. But little addition has been made to the ore reserves for the fiscal year. The estimate of ore developed and its assay value is as follows:

	Tons.	Cu, %.
Total to Dec. 31, 1911	49,410,087	1.70
Ore developed in 1912	600,000	1.59
	50,010,087	1.70
Unprofitable, account of slopes	1,419,300	1.21
Total profitable ore developed	48,590,787	1.71
Tons ore milled to Dec. 31, 1912	9,612,060 1.89%	
Tons of carbonate ore smelted to Dec. 31, 1912	125,176 2.99%	
	9,737,236	1.90
Profitable ore in reserve Dec. 31, 1912	38,853,551	1.67

Mining

Both mining by means of steam-shovel in the Eureka, Hecla, and Liberty pits, and underground mining in the Veteran mine have been carried out. The three pits are really in one orebody, the Hecla representing a narrower and poorer tongue of ore connecting the east and west portions of the orebody, the latter two having been determined first and the connection at a later period. As has been the case

*From annual report to the directors of the Nevada Consolidated Copper Company.

in the past, the Eureka furnished the largest tonnage. During the fiscal year the sulphide ore mined and shipped to the concentrator was as follows:

	Tons.	Cu, %.
Eureka pit	2,054,758	
Liberty pit	170,748	1.603
Hecla pit	371,485	
Veteran mine	253,365	2.605
	2,850,356	1.690

The ore mined was of lower grade than for the preceding year, due to the fact that ore from a greater depth, and therefore poorer, was mined in the Eureka pit, and also ore was mined for the first time from the Hecla area which is much lower grade than either of the other two. Siliceious carbonate ore, amounting to 88,428 dry tons and averaging 2.78% copper, was mined, of which 35,216 tons was crushed and delivered to the smelter and 53,212 was put into storage at the mine.

Stripping

Stripping of overburden has been done on the Copper Flat orebody in three areas in the following amounts:

	Cu. yd.
Eureka area	197,157
Liberty and Hecla areas	2,370,819
Liberty area	165,000
	2,732,976

With the exception of the grade slopes, all the overburden has been taken from the Eureka pit, but there still remains a considerable amount of stripping to be removed from the other two areas, or roughly as follows:

	Cu. yd.
Eureka area	640,743
Liberty and Hecla areas	9,275,281
	9,916,024

The total amount of stripping removed to January 1, 1913, is 8,771,659 cu. yd. The removal of the overburden is sufficiently advanced to easily allow an extraction of all the ore necessary for the requirements of the concentrator. Much the larger portion of the stripping to be removed lies in the grade slopes rather than directly above the orebody.

Costs

Including all charges of every description, such as labor, supplies, repairs, management, taxes, proportion of general and New York expenses, etc., the direct mining cost for Copper Flat ore has been 17.35c. per dry ton. This shows some increase over previous years, due mainly to the strike, which began in the latter part of September and caused a cessation of work in the mines until October 25. Even after this, it took some weeks before the force was again on a full working basis. Including redemption of stripping, the costs show a very decided increase, due to the fact that a considerable amount of ore was taken from the Liberty and Hecla pits, which entailed a greater cost to cover stripping redemption than in the case of the Eureka pit—the latter being 15c. per ton of ore, the Liberty 22c., and the Hecla 30c. Including Veteran ore, where the ore is mined underground, the total costs for mining were 33.04c. per dry ton. Stripping costs have been reduced to 33.64c. per cubic yard. The cost for mining carbonate ore was 68.8c. per dry ton, as compared to 74.4c. for the preceding year. One new Bucyrus steam-shovel and one 30-ton locomotive crane have been purchased. At the Star Pointer there have been built four 2-room houses and one bunkhouse; at Copper Flat small additions have been made to the Greek dwellings and to the storehouse, while one Greek boarding-house, two bunkhouses, and one new sand-house have been built. Eight thousand one hundred feet of permanent track for Ys, approaches, yards, and sidings have been laid, and 11,100 ft. of additional track for dumps. Transportation of ore from the mines to the Steptoe Valley plant has been most satisfactory, and even during the severe winter months there has been little or no delay.

Steptoe Valley Smelting & Mining Co.

Except for the occurrence of the sympathetic strike, the plant has worked successfully during the past year, and has shown improvement in all departments, considering the conditions under which it was operated. In addition to the treatment of Nevada Consolidated ore, 133,933 dry tons of ore from the Giroux Consolidated Mines Co. was concentrated and the concentrate smelted. A small amount of custom ore was also smelted. Though treating a lower grade of material, owing to improvements which had been foreshadowed in the last report, better extractions were obtained.

The following table shows by months the tonnages treated, assay of ore, percentage saved, and ratio of concentration:

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	*Oct.	Nov.	Dec.
Ore treated, dry tons	239,401	224,110	265,081	266,303	289,446	257,392	266,629	286,103	245,062	44,660	244,156	224,172
Copper assay, %	1.98	1.75	1.81	1.72	1.54	1.73	1.73	1.77	1.73	1.74	1.37	1.46
Recovery, %	68.09	66.49	69.80	69.01	69.97	69.16	68.17	66.89	67.24	69.45	66.06	69.21
Gold per ton, oz.	0.020	0.016	0.015	0.015	0.013	0.016	0.020	0.020	0.018	0.020	0.013	0.011
Silver per ton, oz.	0.061	0.036	0.044	0.048	0.040	0.039	0.073	0.055	0.054	0.055	0.048	0.031
Ratio of concentration	8.43	8.29	7.95	8.41	9.13	9.73	10.57	10.01	8.75	9.94	11.04	8.32
Copper in concentrate, %	11.34	9.65	10.02	10.00	9.86	11.63	12.44	11.87	10.15	12.03	10.03	8.42

*Low tonnage due to strike.

The results of the year 1912 were as follows:

Ore treated, dry tons	2,852,515
Copper assay, %	1.692
Copper extraction, %	68.25
Ratio of concentration	9.09
Gold content, oz.	0.016
Silver content, oz.	0.049
Gold extraction, %	45.84
Silver extraction, %	50.11
Average Au and Ag recovered per ton of ore	16.48
Average copper in concentrate, %	10.49

Smelting

Many improvements, all of which were charged to operation, were made in the roasters, by which

the capacity was increased from an average of 60 tons per furnace-day to 90 tons. Owing to this change, and to the building of new roaster-stack foundation, and also to the strike, the cost of roasting was increased 10.2c. per dry ton of concentrate over the previous period.

Great improvements were made in the reverberatories, and the capacity of the oil-fired furnaces was greatly increased. All furnaces are now fired by oil. The average amount smelted per furnace-day has been increased from 262 tons in the year 1911 to 371 tons for the year 1912. I am happy to say that during the latter part of the year even better work than the average shown above has been done. Changes of firing, improvement in design, and better operation have aided materially in increasing the capacity of the furnaces.

Additions have also been made in the converting department, and there are now two Pierce-Smith basic-lined converters, in which considerable improvement has been made in the way of operations. Owing to numerous changes, charged to operating costs, there has been no reduction in the cost of converting.

Improved efficieney and lower costs have been obtained in the power-house during 1912.

Quarters for Men at McGill

The foreign quarters at McGill have been materially added to in order to more conveniently take care of employees. A new staff annex building was constructed after the loss by fire of the old McGill homestead used as staff quarters. The approach of the slag dump on the lower townsite necessitated the removal of many buildings to new sites. After removal these buildings were remodeled and made more comfortable for the white employees. The old smelter fence was repaired and extended to completely enclose the smelter, and the time-office moved to the main entrance. At the site of the old time-office a building has been erected for the proper care of foundry patterns. An additional oil-storage reservoir of 15,000 bbl. capacity was begun and is about completed. This will give a total oil storage of 40,000 barrels.

Mill Changes

In the concentrator, in section No. 1, ten roughing tables were installed on a gallery floor to increase the tonnage of this section. The old classifiers were replaced by four 5-compartment Steptoe hydraulic classifiers. This change has resulted in materially increased tonnage. In sections No. 5 and No. 6 two sets of 15 by 36-in. rolls have been installed in the fine-grinding department to replace the Huntington and Chilean mills of each section. This was found advisable after an experience of over a year in section No. 4, wherein it was found that fine-crushing rolls were giving a lower cost for fine grinding, without increased copper loss, over the Huntington mills. Four Wilfley tables were installed on the vanner floor in each of the eight sections, replacing the corrugated vanners formerly used for this purpose. The old vanners are being used for the treatment of the finer tailing, where the heavy losses are made. Twenty-four 6-ft. Craven canvas-belt slimers have been installed in section No. 1, and two Dorr thickeners have been installed in each of sections No. 6, 7, and 8. The repumping equipment has been increased by the installation of a 2000 gal. per minute volute pump, supplementing the 11 sec-ft. pumping engine. Five slime-settling ponds were excavated at the lower end of the mill to supply fresh water to this pumping plant.

Yield and Cost

The yield from all ore mined and treated, and from silicious carbonate ore delivered to the smelter, has amounted to 63,063,261 lb. of copper for the year 1912. The total cost per pound of copper has been 8.86c., and, deducting miscellaneous earnings, but including fund to cover improvements and depreciation, this is reduced to 8.33c. These costs include all possible charges, such as costs in Nevada, shipping, refining, marketing, legal expenses, taxes, New York and other expenses.

The increased cost per pound of copper has been due, first, to treatment of a lower grade of ore; second, to an increase in the costs the latter part of the year, due to strike conditions; third, to greater cost of mining, due to underground mining at the Veteran; fourth, to greater cost of ore obtained by the steam-shovel mining in the Liberty and Hecla pits, by reason of a greater proportion of redemption charges for stripping; and, fifth, to proportional increase in tonnage smelted, owing to a decreased ratio of concentration in the concentrator, due to an increased percentage of sulphide minerals in the ore.

Order for 1000-Cu. Yd. Barges

Requisitions have been forwarded to Washington by the Isthmian Canal Commisison for six dump barges with a capacity of 1000 cu. yd. each, to be used in connection with the 15-cu. yd. dipper dredges, recently contracted for with the Bucyrus Co. of South Milwaukee, Wisconsin. These barges are to be delivered at some Atlantic or Pacific port of the United States for towing to the Isthmus by January 1, 1914. They are to form part of the dredging equipment for use in emergency work in the Culebra cut section, and will be towed up the canal to the point required.

A Model Change Room

A new change room was made ready for service at the Miami mine the middle of April. The building, 50 by 90 ft., is made of steel and concrete, the walls being of steel frame, corrugated iron sides, and metal lath, lined with plaster. The floor is concreted. The equipment includes 100 shower baths and 823 lockers, and the whole is steam-heated and carefully ventilated.

West African mines production for March was as follows:

	Tonnage.	Yield.	Profit.
Abosso	8,700	$ 74,000	$12,000
Ashanti	11,393	180,000	75,000
Broomassie	2,960	58,000	10,000
Tarquah	5,490	72,000	21,000

Rand Practice in Deep Shaft-Sinking

By Charles B. Brodigan

*Actual sinking is only half the work of the completed shaft. It has to be timbered, guides have to be put in, it has to be plumbed, and launders for preventing water from reaching the bottom—a most important matter—have to be constructed. In fact, a host of things have to be done, and they must be done in the morning shift.

The timbermen come down with the sinkers to clean off and make good any damage done by the previous blast. Having done this, they then proceed to the surface and get ready for lowering all timber, tools, and tackle they require. If there is a great pressure of work, two of them will take blocks and wedges down with them and 'block' a set that is already filled in. They do not work in the compartments in which hoisting is proceeding, but confine their efforts to the ends and centre of the shaft. This extra work will not be necessary more than two or three times a week. On the other days their time will be occupied in getting ready to start serious work as soon as the shaft is cleared out. Then the procedure will be as follows. They will load the buckets up with end-plates, dividers, and studdles, with which to 'fill in' a hanging set; that is, two complete wall plates which are hanging by bolts from the last blocked set. 'Filling in' consists in placing the studdles, dividers, corner posts, and end-plates in position, and then screwing up the hanging bolts until the studdles are tight. The corner blocks are then put in, and by the aid of wedges and four plumb-bobs the set is carefully fixed in position parallel to and vertically under the sets already fixed.

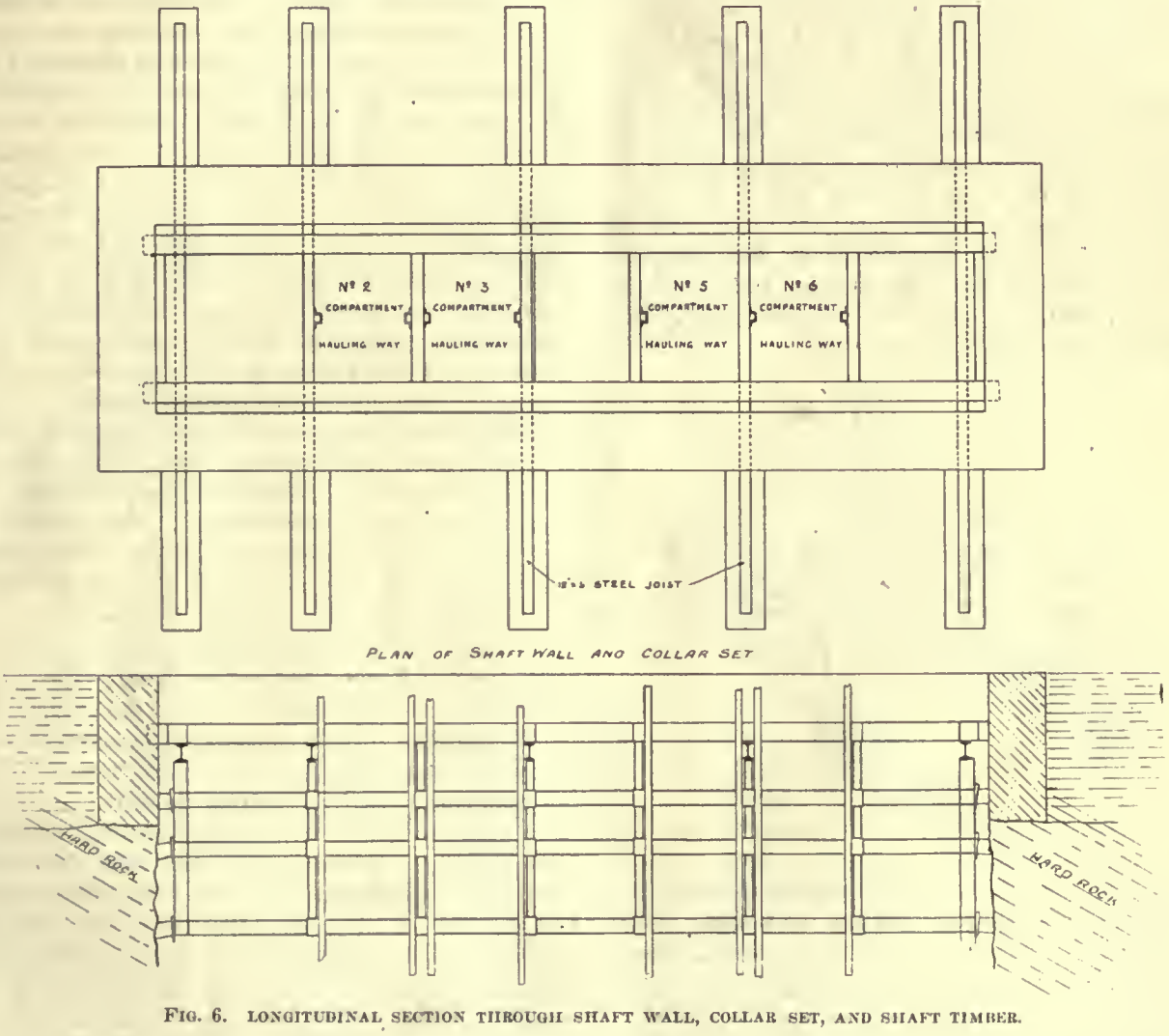


Fig. 6. Longitudinal Section through Shaft Wall, Collar Set, and Shaft Timber.

To facilitate the plumbing of the sets, each wall plate has a vertical line mark cut into its face 6 in. from each corner, and this line must be wedged to coincide with a plumb-bob suspended from a corresponding position on a reference set, which is itself specially plumbed from the collar set once a month. The vertical alignment is secured from the same plumb-bobs. As soon as the ends are made fast, it is plain sailing to secure the set, blocks being firmly wedged opposite each divider.

There is one golden rule about fixing blocks in a shaft, namely, cut the blocks to suit the shape of the ground against which they will rest, and always wedge between the block and the wall plate, never between the block and the rock. Some authorities advocate giving the blocks a slight inclination up-

*Continued from page 614.

ward. The tendency should be slightly upward but only slightly. Give attention to having a good surface against which the block will rest, and then wedge both from above and below the wall plate, and satisfactory work will result. Too much insistence cannot be placed on the importance of good blocking. The success of a shaft depends entirely on the way in which it is blocked. If the work is not done in a satisfactory manner, rapid hauling can never be done in it, traveling in it will be a matter of danger, and constant repairs will be necessary.

Blocking the Timber

In every shaft the timber should be completely and adequately supported by the blocking. As an additional precaution to safeguard the shaft in case of bad blocking or bad ground which would not allow satisfactory blocking to be done, it is a universal practice to put in bearer sets at intervals of 100 to 150 ft. throughout the sinking. These bearers at the Brakpan were composed of strong baulks of timber 12 by 18 in. at the ends and 7 by 18 in. under the dividers. They are securely fixed in hitches cut in the sides of the shaft, and distance-pieces are fixed between the bearers and the ordinary wall plate to insure the bearers taking the weight in case of settlement.

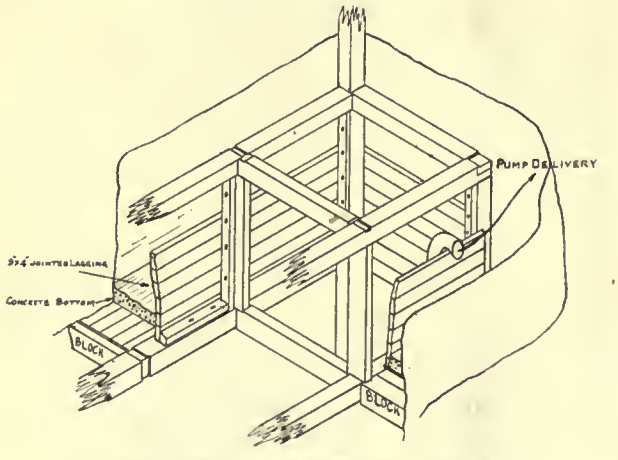


FIG. 7. PERSPECTIVE VIEW OF TIMBERING.

When the timbermen have finished blocking the set they have to prepare for the next day's work. This consists in lowering two, four, or sometimes six complete wall plates, suspending them by the hanging bolts from the blocked sets. This operation is performed in the following manner. The wall plate is suspended in a vertical position by a rope from the bottom of the bucket, and is then lowered to the bottom. Here the hanging bolts are inserted in the hole already bored to receive them. Two ring-bolts are also placed in the other two hanging-bolt holes. The wall plate is now swung into a horizontal position. While in this position, hooks from tackle suspended from blocked sets up the shaft are attached to the ring bolts and the wall plate is lifted clear of the rope and swung into the side of the shaft, from which position the hook of the hanging bolt can be hooked to bolts from the set above. The second engine must, of course, be used to hang the wall plates in the other section of the shaft. If rapid sinking is being done, it will be necessary to 'fill in' a set in addition to hanging two or three sets. This filled-in set will provide work that can be done during the clearing time.

The sizes of timber used in the shaft for making up the sets were as follows:

	Inches.		Inches.
Wall plates	9 by 9	End plates	9 by 9
Corner posts	8 by 8	Dividers	7 by 10
Studdles	12 by 4	Brattice	6 by 1¼

Handling Water

In sinking it is the rule, and not the exception, that at some period the even course of progress will be interrupted by an inrush of water, so it is well to describe the methods that are used to overcome the trouble. It is axiomatic that no rapid sinking can be achieved if there is water, even in small quantity, at the bottom of the shaft; so every endeavor must be made to get through the fissure as soon as possible and catch the water in a ring launder, constructed in the timbers. From such a ring the water can be bailed or pumped to the surface. To sink through water at all it is obvious that a pump will have to be provided, and as it would be impossible to equip with great Cornish lifts, as is done in the great colliery sinkings in the North of England, the engineer is practically restricted to reciprocating pumps actuated by compressed air. There is too much grit at the bottom to justify recommending the hanging centrifugal pumps.

Reciprocating pumps with a low lift must be used. Wherever good work has been done against difficulties with water, these pumps have been fixed on the timber in the end compartments. The timber in such cases is kept close to the bottom of the shaft. The pumps are kept at work right through the shift, and are provided with strong wire-bound suction, which can be quickly detached from the pumps and hoisted out of danger just before firing. The water which pours into the shaft as soon as the pump stops at blasting time acts as a cushion to the rock thrown up by the explosion. This in a great measure saves the pump and the timber from damage.

As soon as the blast is completed the pumpmen come down to the water-level and give the water mark to the engine-drivers, who forthwith proceed to bale with the engine which under such circumstances would be set aside for bailing purposes alone, until control is established. As soon as this is accomplished, the suction is attached to the pump and it is started, pumping to the ring launder, from which bailing may be resumed, leaving the bottom clear for the sinkers. The construction of these ring launders is evident from the isometric projection of one end of the shaft, given in Fig. 7.

Steel Guides Used

The guides used in the Brakpan shaft were made of mild steel and are known as Wood's slotted steel guides. The section of the guides can be seen in Fig. 6. They were selected because it was thought (1) they would provide a smooth running way for the skip; (2) that they would strengthen the whole shaft owing to the long length of steel tying the timbers together; (3) that accidents resulting from broken guides would be entirely prevented; (4) that the expense of upkeep would be less than with wooden

guides and there would be fewer interruptions.

They are much more expensive than wooden guides. In fact, for a shaft with four hauling-ways they cost £2 per foot of sinking more than wooden guides. I believe that in a truly vertical shaft they are worth the additional money, but it is a question of trial and experience, and before asserting positively that they are the best, I would prefer to await statistics relating to their wear at Brakpan. They have been used and condemned at other shafts, but the shafts were known to be notoriously out of true in vertical and horizontal direction; I cannot therefore accept the evidence as conclusive. Where acid water is present their use would be inadvisable.

Cost of the Work

A general summary of the items entering into the cost of the work is given below.

Cost of Temporary Plant

	£	s.	d.
Boiler-house	450	10	5
Engine-house	533	5	1
Boilers, including erection	4,304	12	8
Engines, including erection	4,634	9	0
Sundry offices and sheds	130	11	10
Change-houses	760	7	0
Headgear, including foundations	1,151	11	6
Signals	42	15	5
Pulleys	497	4	2
Ropes (for whole period of sinking)	1,324	1	0
Doors (safety and flap doors)	59	18	10
Kibbles and balling tanks	359	0	1
Cross-heads (for whole period of sinking)	234	7	1
General fittings	82	4	9
Painting	23	7	1
Chutes	54	6	11
Dismantling	143	15	4
	14,786	8	2

Supplies Consumed in Sinking Shaft No. 1

		Value. £	s.	d.
Gelatine, lb.	103,000	4,477	6	9
Detonators	114,000	135	4	8
Fuse, coils	59,167	1,373	15	11
Drill steel, lb.	65,834	949	3	3
Shovels	648	99	7	6
Picks	367	41	3	1
Hammers	796	69	16	9
Sundry tools		184	3	2
Carbide, cwt.	133	202	12	10
Paraffin, gal	1,805	106	17	10
Sundries, lamps, electric globes, etc.		151	7	5
Shaft sets, cu. ft.	44,000	11,513	9	10
Blocks, lagging, wedges	20,628	3,347	3	2
Bratticing, linear ft.	24,961	555	4	4
Guides	826	6,688	5	6
Hanging bolts, sets	452	1,297	17	1
Steel and iron, lb.	32,473	298	12	9
Sundries		347	16	6
		31,839	8	4

Complete Cost of Shafts

	Shaft No. 1. 3098 ft. to reef. 3129 ft. total depth. £	s.	d.	Shaft. No. 2. 3696 ft. to reef. 3777 ft. total depth. £	s.	d.
Sinking	53,277	13	10	57,244	4	5
Hoisting	7,524	2	6	11,753	4	8
Timber	36,023	14	2	43,249	3	9
Surface handling	4,215	13	10	5,703	2	3
Pumping and bailing	3,799	9	4	6,033	16	11
	104,840	13	8	123,983	12	0

Progress Record

During the process of sinking the two shafts a very satisfactory rate of sinking was maintained. Thus the hoist at No. 1 shaft started on September 26, 1905, the shaft being then 66 ft. deep, and the reef was reached at a depth of 3098 ft. on September 30, 1907, almost exactly two years from the start. This gives an average sinking of 126 ft. per month over the whole period. In No. 2 shaft scarcity of labor and delays in delivering the sinking equipment prevented the shaft being pushed until it had reached a depth of 1143 ft. From this point until the reef was reached at a depth of 3724 ft., an average rate of 152 ft. per month was maintained. The strange feature about the sinking was that the average rate of sinking increased with the depth of the shaft. The record for vertical shaft-sinking was beaten during the sinking of this shaft, and this record has since been handsomely beaten at both the Modder Deep and the State Mine. Both of these mines are situated in the immediate neighborhood of Brakpan. At the latter the first sod was cut on May 24, 1905, and the battery started on the same date six years afterward. During the period approximately £1,250,000 had been spent on the property.

As soon as the sinking of the shafts had been completed, the question of running the connection in dead ground, and with a difference in elevation of about 700 ft., had to be considered. F. G. A. Roberts gave the direction from a plumb-bob survey. The 4413-ft. connection between the two shafts was made, working from both ends, on lines derived from his survey of the two shafts, and the holing was within about ⅛ inch in both level and direction.

Machine v. Hand Drilling

It is constantly being urged upon one that there would be a great saving of labor if machine sinking was adopted. To show that this saving is unlikely, it is only necessary to describe the methods of machine sinking that have been used on the Rand.

Taking a shaft similar in size to the Brakpan shaft; that is an excavation of about 43 ft. by 9 ft. To drill over this area eight horizontal bars on which the machine drills would be fixed would be necessary. There would be a machine on each ordinary bar, probably two on the sump bars. White miners would be in charge of the machine on each bar, and they would be responsible for the drilling of six holes each. These holes would be at least 8 ft. deep. In fact, when the best footage was obtained the sump holes were put down about 14 ft. and the ordinary holes 12. To do this work the men had to stay down continuously at their work from 12 to 18 hours, depending on luck. The holes were then blasted and shovel boys sent down to clear away the stuff. Kaffir shovelers cannot work more than 8 hours at such arduous work, and it took at least 4 shifts of 8 hours each to remove the broken rock. During this long period water trickles to the bottom and cements the débris, rendering it difficult to shovel. Then, owing to the impossibility of conducting the perfect explosion of gelatine in such deep holes, second and third firing has to be done.

The upshot of the matter is the using of three shifts of boys for shoveling alone, who from the cementing of the stuff and the neeessity for re-blasting, are working under most disadvantageous conditions. As a result, it will be found that if the shoveling shifts alone were put to work under hammer sinking conditions they would almost attain the same footage as is obtained by the aid of machines. Further, eight white men are engaged in running the machines. These men must be paid an adequate wage, for shaft-sinking is dangerous work, although they only work about 17 shifts during the month. This is an extravagant way of using white labor. The greatest footage that has ever been attained in a vertieal shaft with maehine sinking is 168 ft. The eost eompared with hand sinking is prohibitive in this field.

There is one way in whieh maehines can be adapted to shaft-sinking with a reasonable hope of sueeess. It is to use small hammer machines with which boys could put in, say, four holes per shift. These boys would first have to elean out the stuff resulting from the previous blast and then drill the new round. In this way it would be possible to save about 30 boys per shift, and the work could be organized on the eight-hour basis, which in my opinion is the only unit of time that lends itself to satisfactory and economical sinking.

In conclusion, I will put before you the points both in favor of and against the rival systems of 'bucket' and 'skip' systems.

Use of Buckets

The following points favor the use of buckets:

1. Ease of handling in shaft. The bucket ean be easily detached from the rope and in eonsequence three buckets ean be used with eaeh engine. This feature makes for rapid sinking in depth, as the speed of elearing is rendered independent of depth; one bucket is being filled while the other is being hauled up the shaft.

2. It ean be tipped easily at the bottom. This is usefnl when loads of drills are taken down; they ean simply be tipped out upon the shaft bottom instead of having to take them out one by one as from a skip.

3. By their use the timbers can be kept 50 ft. away from the bottom; this in a great measure prevents the timber from being damaged by the blast.

4. The bueket can easily be removed in case of damage or in case a bailing skip has to be put on in a hurry.

There is one point against the bueket which outweighs all the others. It is the liability, which amounts to a eertainty, owing to the fact that the bueket hangs free below the eross-head, that it will swing in the shaft. This swinging may beeome so violent that the bucket strikes the timber and the eateher becomes disengaged, the bucket turns over, and the contents are spilled down the shaft. It is an extraordinary thing that although this has happened many times, it is rare indeed that any accident results, most of the falling stones being caught in the timbers. By the provision of the brattice partition down the centre of the shaft, any stones that fall elear of the timber are confined to one end of the shaft, so when the noise resulting from the stones falling is heard at the bottom, there is a rush of all the boys to the other side of the shaft; this fact has, of course, contributed to the smallness of the number of aeeidents resulting from this cause.

The Argument for Skips

The points in favor of skips are: (1) the skip is guided throughout its journey through the shaft and eannot vibrate or swing; (2) by virtue of this fact it ean be made of greater capacity than a bueket. This saves money be reducing the number of trips.

Against skips it may be urged that in order to secure the point that the skip must always run to gnides, it is necessary to carry a long slipper on the top of the skip which will bridge over the distance between the bottom of the shaft and the bottom blocked set. This distance eannot on the average be less than 15 ft. and is sometimes 20; therefore, the slipper is usually eonstrueted about 25 ft. long. The slipper is of neeessity an awkward, heavy affair, that while effieient in seeuring the purpose of keeping the skip guided, has many disadvantages, not the least among which is the fact that it makes the skip awkward to shovel into. It is impossible to ehange skips at the bottom, so in deep sinking time will be lost owing to the fact that the natives cannot shovel during the hoisting period. To sum up. My opinion, based on experience, is that bueket sinking is, in average ground from 10 to 20 ft. per month faster than skip sinking. but the risks taken are greater.

Diesel Engines at Morenci

The power supply for the smelting plant of the Detroit Copper Mining Co. has been derived from a battery of Crossley gas engines, the gas being generated from eoal at the Detroit concentrator and transmitted in pipes across the hill. This plant having beeome somewhat antiquated, the gas engines are now to be replaeed by two 1000-hp., 2-eycle, 4-eylinder Diesel engines, made by Carels Frères, of Ghent, Belgium. These will be direct connected to 60-eycle alternators, operating in parallel, and are guaranteed to deliver 1000 hp. each, at an elevation of 6500 ft, using not to exeeed 0.48 gal. oil per boiler horse-power hour.

The Allis-Chalmers Co. has been taken out of the hands of the reeeivers by the new company, the Allis-Chalmers Mfg. Co. and operations were begun April 15, all the legal formalities of the reorganization having been completed. The officers of the new company are: J. H. MeClement, of New York City, as chairman of the board of directors; Fred Vogel, Jr., of Milwaukee, as chairman of the executive committee; Otto H. Falk, of Milwaukee, as president of the eompany; Max W. Babb, viee-president and general attorney; L. F. Bower, secretary; and F. Woodland, treasurer, all of Milwaukee.

Cloths on the vacuum-filter at the Goldfield Consolidated mill have been on for four years, and are now to be renewed.

Goldfield Consolidated Report

During the month of March, according to the general manager, Albert Burch, the total production was 30,005 tons, containing $725,621, or an average of $24.18 per ton, of which 27,542 tons was milled with an average extraction of 92.41%, and 2463 tons was shipped of an average value of $26.82 per ton, the net recovery from all ore being $22.51 per ton. The net realization was $470,113, or $15.66 per ton. Development work covered 3417 ft., and the total cost of mining, development, transportation, milling, office, and general expense, was $7.02 per ton, distributed as follows:

Mining, including stoping and development	$3.24
Transportation	0.08
Milling	2.08
Marketing	0.08
General expense	0.35
Bullion tax	0.25
Marketing ore	1.00
Total cost of operation	$7.08
Miscellaneous earnings	0.06
Net cost per ton	$7.02

In the Combination section of the mine the sill of the 136 BX stope was slightly extended during the month, and the stope continued to produce a fair grade of ore; but the output was somewhat curtailed during the latter half of the month for the purpose of doing necessary filling. The sill of the 215 KX, which is a downward extension of the 136 BX, at an elevation of 16 ft. above the No. 3 level, was commenced during the month. The diamond-drill hole from the bottom or 380-ft. level referred to in last month's report, passed through the Reilly vein at a vertical depth of 50 ft. and cut 7 ft. of $25 ore. A winze station (414-D) was commenced for the purpose of sinking to open this ore, and produced 63 tons of ore averaging $43.40 per ton.

In the Mohawk the 114-X cross-cut, driven from the 111-DX raise, to prospect the ground upward from the southern portion of the 111 stope, cut 4 ft. of ore, and the drift (121-X) from it produced 74 tons averaging $27.90 per ton. The 490-R sill, adjacent to the 448 cross-cut referred to in last month's report, produced 175 tons of ore averaging $6.60 per ton. The 478 drift, which is an intermediate, running southeasterly from the 410-O raise, at an elevation 60 ft. below the No. 3 level, encountered the downward extension of the old Mohawk-Jumbo orebody, and produced 267 tons averaging $9.70 per ton.

In the Laguna the 303-N raise was driven into the hanging wall of the main No. 3 level, and at a vertical height of about 25 ft. cut about six feet of $7 ore, which is the downward extension of the ore reported last month as cut by the 303-M raise, thus developing this orebody for a total distance of about 150 ft. on its dip. A cross-cut from 347 intermediate, to connect with the top of the 303-M raise, passed through 16 ft. of ore and produced, including a short drift, 288 tons averaging $7 per ton.

In the Clermont the 420 stope, mentioned in the last two monthly reports, continued to produce a large tonnage of good ore during the early part of the month; but about the middle of the month it was considered good policy to stop production, and fill the stope, in order to prevent caving adjacent blocks of lower-grade ore, which must be mined. It is probable that a comparatively small amount of rich ore remains to be mined, and this will be available in a few months. The 802-A sill was extended, and produced 887 tons of $38 shipping ore. The upward boundary of this lens of ore was reached before the end of the month, but the bottom has not been found. The 910 drift, off the 907 intermediate, directly below the 802-A stope, produced 167 tons of $20 shipping ore. It is evident that this orebody continues downward, and an effort will be made to determine its trend by another raise from the 1400-ft. level before doing any more work in search of it on that level.

Costs at the Hollinger Mine and Mill

The mill at this property, at Porcupine, started treatment in June 1912, and dealt with 45,195 tons of ore, yielding $933,682, with 95.80% extraction. Although operations at the mine and mill were upset by a strike, and the plant only worked part of the year, costs are of interest.

COST PER TON

Mining:			
General and superintendence	$0.179	Drill steel	$0.298
Diamond-drilling	0.027	Sampling, assaying, surveys	0.064
Stoping and driving	1.969	Change-house and lights	0.013
Timbering stopes	0.219	Handling explosives	0.025
Tramming	0.551	Handling waste	0.016
Drainage and pipes	0.092		
Hoisting	0.170	Total mining	$3.588
Dumping	0.063		
Milling:			
General and superintendence	$0.235	Handling concentrate	$0.012
Heat, light, watchman	0.105	Grinding concentrate	0.036
Handling pulp	0.022	Agitation	0.029
Thickening	0.012	Filtration	0.147
Sampling and assaying	0.104	Acid treatment	0.013
Coarse crushing	0.073	Neutralizing	0.023
Conveying	0.034	Precipitation	0.074
Stamping	0.181	Clean-up	0.063
Classifying and tube-mills	0.277	Pumping solutions	0.020
Concentration	0.057	Cyanide	0.041
		Total milling	$1.493

The annual report states that the mill operated in a satisfactory manner. Originally the system was to amalgamate the concentrate in pans, but after a good deal of experimenting, amalgamation was abandoned in favor of cyanidation. This necessitated no change in apparatus, the substitution of cyanide for mercury in the pans being all that was required. The agitators installed were not suitable for the heavy ores of the Hollinger mine, so the Trent was discarded in favor of Dorr device, in the same tanks. By this substitution, continuous decantation became possible, and it is expected to increase the recovery and reduce costs.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Extralateral Rights and the Prospector

The Editor:

Sir—Mr. Van Wagenen's letter in your issue of May 19, 1912, and his later one dated March 12, 1913, in discussion of 'Extralateral Rights and the Prospector,' led me to look over the annual reports of the Minister of Mines for the province of British Columbia. During the year 1911, 11,456 individual free miners' certificates, at $5 each, were issued in the province. If it is true that while British Columbia had an apex law "the rugged region hummed with explorers, and that when it was repealed they faded like snow before a chinook", why was there any demand for free miners' certificates? It would not appear that there was a mining blight on the province when during the year 1911 5967 mineral claims were located and 572 placer claims, making a total of 6539.

C. W. GOODALE.

Butte, Montana, April 21.

Legislation at Sacramento

The Editor:

Sir—Anent your recent comments upon legislation affecting the mining industry pending before the California Legislature, it may be noted that there seems to be rampant at this session a desire to attack all vested interests as well as private morals. The latter gives the average man less concern than the former; the trend of the attack, springing from no public demand whatsoever, upon vested rights has gained such momentum that it is high time that there should be some general protest. To be specific, there is pending an 'alien land bill,' leveled avowedly against the aggression of Japanese who are rapidly gaining a foothold on valuable land in the Sacramento valley. The ethics of the movement against this aggression of a foreign race that cannot be amalgamated with ours will not be discussed; there is undoubtedly some right and some wrong in the agitation. If handled in a respectful and intelligent way free from any suspicion of jingo politics, the problem might become very simple, just as the question of Japanese immigration of the coolie class was disposed of two years ago, when upon proper representations the Japanese government itself settled the matter. It is possible that the present controversy could be disposed of as readily.

In order to head off the aggressions of an alien race that brings no capital but its hands, and in order not to give direct offense, our wise statesmen proposed that all foreign *capital* shall in effect be barred from California—a new state and of such vast undeveloped resources that it must be for many years dependent upon outside help and needs all that can be attracted. The surgeon receives a patient with a sore toe that may require amputation; in order to make a job of it, the surgeon saws off the leg at the hip! He succeeds, of course, in removing the toe—fine surgery! clever statesmanship! The proposal is cowardly on the face of it. Whether or no this bill, or any bill of similar intent, is passed, the damage lies in the proposal.

A 'blue sky' law to regulate all investments is about to be passed, proposed because of the sporadic operations of a few wild-cat mining promoters. Professedly, its purpose is to stamp out the harpy and coward who, because of his devious ways could be put out of public harm by simple and direct means if intelligently applied. Not so at Sacramento, they place a gatling gun at the head of a crowded street and mow down everybody in sight to get a few harpies! Every business operation in the future in California is to pass under the scrutiny of a Commissioner, who shall have powers no public official ever before possessed, and whose qualifications, training, and fitness for the position, and whose tenure of office shall be at the will of one other man —the Governor.

It is unnecessary to repeat further instances of the ill-advised and ill-acting (though they may be sincerely acting) of this body of statesmen. A workmen's compensation act was passed at the previous legislative session, whereunder the loss of a simple careless miner can wipe out any operator of modest means, or a company of moderate capital that has not yet developed a paying mine. The law was framed to apply to large corporations, as for instance the Southern Pacific Railroad Company, to going concerns of immense capital, or to public-service corporations, which are allowed by law to protect themselves in their charges against compensation for accidents. Wherein, however, is the miner to protect himself *out of his industry*? It is now proposed to revamp this already trying and unfair law (in its present broad provisions) to pass which it was necessary to abrogate common law doctrines and principles that have stood for hundreds of years as just and equitable between man and man, and in the revamping to make its provisions more exacting and onerous upon all industries. Wherein has the necessity arisen for putting down the screws the tighter? Is it not at the behest of one class only?. If this be class legislation, is it acceptable to the body politic?

FAIR PLAY.

San Francisco, April 21.

[Our friend who writes this letter is a mining engineer in general practice, especially familiar with California conditions. How deeply he feels is indicated by the letter itself, and in some particulars we join him. It is fair to note, however, that none of the legislation of which complaint is made has reached final form, though, as he says, the very agitation of some of it is harmful. There are sharp differences of opinion as to all three of the bills cited. For our part, we see no good in the anti-alien bills or in their being proposed. A properly drawn 'blue sky' bill we would endorse, but we have no knowledge, and therefore no opinion, regarding the particular bill under discussion at Sacramento.

and recognize that an improperly framed 'blue sky' law may do much harm.—EDITOR.]

Records of Drilling

The Editor:

Sir—Replying to the editorial in the *Mining and Scientific Press* of April 12, I beg to say that the following is a record I have kept of several contests in drilling:

At Goldfield, Nevada, in biotite granite, 46⅛ in., made by McCormick and Chisholm, in 15 minutes, October 2, 1909; 53 7/16 in., made by Jalich and Burns, in 15 minutes, October 2, 1909; 53 1/16 in., made by Ross and Jones, in 15 minutes, October 2, 1909; 49½ in., made by Johnson and Sander, in 15 minutes, October 2, 1909; 49¼ in., made by Amson and Forsham, in 15 minutes, October 2, 1909.

At Tonopah, Nevada: 45 7/16 in., made by Page and Pickens, in 15 minutes, July 4, 1912; this team averaged 66 blows per minute throughout the contest); 38 7/16 in., made by Porter and Goddard; 41 7/16 in., made by Lundquist and Dahlen. I am unable to classify the granite in which the last three teams drilled, but I am under the impression that it is a biotite granite, such as is found near Tonopah. I trust the above may be of some assistance.

F. E. BROWNE.

Hart, California, April 21.

The Intermittent System of Cyanidation

The Editor:

Sir—In reply to Noel Cunningham's criticism in the *Mining and Scientific Press* of March 15 of my article on the intermittent system in cyanidation printed February 8, I beg leave to submit a few comments.

Contrary to the attitude of assuming "to once and for all settle the question of intermittent *v.* continuous agitation," I specifically stated that I thought the "popularity of the continuous system was an unfair verdict against the intermittent," feeling that there were sufficient points in favor of the intermittent system to entitle it to consideration. The article does not even savor of the finality with which Mr. Cunningham consigns the Pachuca to hard-by oblivion. In reference to the figures adduced by him to condemn the tentative system that I proposed, I assert that they are as aptly applicable to the continuous decantation system. I took it for granted that it was a universally accepted understanding that only a low-grade ore is suitable for treatment by the decantation system as operated at present, whether continuous or intermittent. Adopting Mr. Cunningham's assumed data, my calculations would give the following results: 40% extraction in milling, with the 6 to 1 mill solution thickened to 3 to 1 recovers $2 of the $10. Assuming the extraction completed in the agitator, each ton of solution carries $2.66 ($0.66 extracted in milling and $2 extracted in agitation) plus $1 (carried in the battery solution), giving $3.66. Decanting to 40% moisture leaves $1.46 per ton dry pulp, diluted to 3 to 1 and again decanted to 40% moisture leaves $0.195 per ton pulp, and thus after the fourth decantation the pulp carries about ½c. in dissolved gold per ton of pulp. However, in the comparison of the two decantation systems, figures may be dispensed with and the following observations noted: that in each instance it is a case of diluting the value-bearing solution imprisoned by the pulp, and that the pulp can be settled intermittently to a lower moisture content than it can be thickened continuously; therefore, the same amount of solution in a continuous and in an intermittent system will take the pulp to a lower dissolved value content in the latter. Relative to the uniformity of treatment in the continuous system of agitation, it appears to me that the element of "probability and chance" obtains to almost as great a degree as it does in coning and quartering a sample. A given portion of pulp enters the agitator, the agitator thoroughly mixes it with the rest of the tank contents (a habit, I take it, with flat-bottomed agitators as well as cone-bottomed ones), and a certain very definite portion of the given portion leaves the agitator. It is mathematically demonstrable that of a given portion of pulp, some of it is leaving the system while some of it still lingers in the first agitator. My reference to the racing of sands and heavy particles in the continuous system was made, admittedly, having in mind the practice of taking the feed for one agitator from the column ejection of the preceding one, the statement being in the nature of an 'aside'.

Mr. Cunningham says: "By regulating the height of discharge, any desired concentration of coarse and quick settling particles can be secured." Certainly, when the plant is operating under normal conditions, the pulp leaving the agitator must give the same screen analysis as that of the inflowing pulp, so how can this "concentration" be brought into play in the continuous system? Again quoting Mr. Cunningham: "Regulation of time of agitation upon the basis of settling qualities can be readily obtained in any flat-bottomed agitator, *especially the Dorr agitator*," etc. H. A. Megraw, in the *Engineering & Mining Journal* of March 29, records of the Dorr agitator that "it is stated that tests have shown that the pulp within this agitator maintains its homogeneity at all points within 2% when tested by specific gravity, pulp assay, or screen test." How would "regulating the height of discharge" effect a variation in the character of the discharge?

The article subjected to Mr. Cunningham's criticism perhaps did not clearly explain the lift pipe, which would have nothing to do with the thickening of the pulp, that end being attained by means of a baffle concentric with the tank. The merits claimed for the lift-pipe arrangement inhere in the vertically adjustable protective column (patent granted to L. P. Hills, P. H. McHugh, and J. F. Thomasson, June 6, 1911) which obviates difficulty in getting a settled pulp into a condition of suspension, and also, in conjunction with the discharge door, makes the air pipes accessible without discharging the tank. As to the labor involved, at least that of the intermittent decantation system will compare favorably with the continuous.

LEON P. HILLS.

Tuolumne, California, April 11.

Special Correspondence

LONDON

ROYAL CHARTER ASKED FOR I. M. M.—FAMATINA TROUBLES CONTINUE.—TOMINIL FINANCING.—ANGLO-CONTINENTAL AND THE MINING MAGAZINE.

The English mining societies are becoming alive to the necessity of obtaining a royal charter. To an American, the advantages of such a possession are naturally vaguely appreciated, so I may as well explain that unless this official recognition is won, a society has no legal status. It has no power to dictate to its members what they shall do or not do from the point of view of professional etiquette, and it cannot appropriate to its members the sole right to practice professionally. Law and medicine and other learned professions can claim this right in their own spheres. A man cannot call himself a lawyer unless he has qualified himself and belongs to the recognized coterie. The same is true with medicine: quacks are not allowed, and members of the profession are severely treated if they transgress the rules of the societies with royal charters. Bedford McNeill, the new president of the Institution of Mining and Metallurgy, made an eloquent appeal in his presidential address for such recognition, and among other things he said that with a charter they would be able to prevent their members from writing reports for publication on mines they had not examined. The Institution of Mining Engineers is also petitioning for a charter. This society is a federation of numerous local societies throughout Great Britain interested chiefly in coal mining. The leading member of the group is the North of England Institute, with headquarters at Newcastle on Tyne. This society already has a charter of its own, but it is obvious that the advantage should be shared by the other societies and by the federation of the whole group. I may add that the Civil, Mechanical, and Electrical Engineers already have their charters, and it is somewhat in the nature of a reproach that mining should hitherto have been outside the pale.

The troubles of the Famatina copper enterprise in the Argentine continue unabated. With a laudable but mistaken object of getting to the producing stage as early as possible, the smelter was started before all the plant was complete. W. G. Perkins, under whose direction the metallurgical plant was designed, is now on the spot, and has discontinued operations until the arrival of the magnesite bricks for converters. Llewellyn Parker, the new manager, reports that the ore extracted is not equal in quality to expectations, and he is now engaged in re-sampling the mine. Furthermore, the company has once more come to the end of its financial resources, for the £20,000 guaranteed by the principal shareholders at the time of the last reorganization in the summer of 1912 has been spent. The directors are seeking further financial assistance.

The Tominil company, working silver-gold mines in the southwest of Durango, Mexico, is asking shareholders to subscribe for 44,413 shares of 10s. each for the purpose of continuing development on a small scale. Last summer it was found necessary to suspend mining and milling on account of the revolutions. By means of the cash obtained by the issue, it is hoped to keep the mine in order and develop a substantial reserve of ore. In addition, money will be available for the debenture interest, which is nearing default. The shares now offered are in the proportion of one to ten of the present capital. Until the stoppage of operations last year, Pearse, Kingston & Browne were the consulting engineers.

It is just a year ago that *The Mining Magazine* waged war on the absurd statements made by the Anglo-Continental Mines Co. in connection with the alleged tin lode at Jemaa in Northern Nigeria. At the meeting of shareholders then held, the chairman indulged in wild statements about a tin lode 75 ft. wide, averaging 24% tin, traced for 500 yards. Just a year afterward, the chairman had the mortifying duty of confessing that the Jemaa was valueless. He threw over the old managers, whose reports had been used in engineering the boom, and pinned his faith on W. R. Rumbold, who had burst the bubble. But he did not explain why Mr. Rumbold's advice and views were not published earlier. To give an idea of the position, I quote part of the chairman's speech: "Ultimately we were able to obtain the services of Mr. Rumbold as our consulting engineer in Nigeria. He sailed at the end of July and arrived on the property on August 29. His mailed report was communicated to the shareholders in the circular of October 10. The effect of it was that the result of the development work, which had been proceeding continuously since the early part of April, had been extremely disappointing, the lode was narrow and poor, and no profitable ore had been disclosed. He referred incidentally to the comparatively large amount of float existing on the property. Developments continued to be unsatisfactory, and the directors gave instructions in the month of November that all work on the lode should be discontinued, and that attention should be given exclusively to prospecting for alluvial. A circular with some further information was issued on December 6. Mr. Rumbold again visited the property early in February, and in the circular of February 14 we reported to you his telegram stating that there was really no hope for our properties at Jemaa, lode or alluvial."

Exit Jemaa!

NEW YORK

CHILEAN COPPER AND IRON MINES.—MEXICAN CONDITIONS.—COPPER IMPROVING.—NORTH BUTTE.—BRITISH COLUMBIA COPPER.—HOLLINGER.—BEAVER CONSOLIDATED.

It is a little bewildering to attempt to follow the mazes of the organization of "the newest thing in coppers," noted editorially last week. A few days since there was organized, under the laws of Delaware, a corporation, under the name of the Chile Exploration Co., with a capital stock of $95,000,000, since increased to $110,000,000, and authorized to issue bonds to the amount of $15,000,000. This recent organization is to acquire the capital stock of the Chile Exploration Co. of New Jersey, which in turn owns the capital stock of the Chile Exploration of Maine. The last-named company—sit fast!—owns the mining property toward a description of which I have been gradually working. The announcement so far made is so staggering, especially in the face of the oft-repeated slogan of the copper producers that no new copper properties of any magnitude are being discovered, that it is with some diffidence that details are set forth. The claims owned by the Maine organization are described as the Chuquicamata claims and are the ones to which Fred Hellman recently went as manager. They are credited with having already in sight over a hundred million tons of ore, with an average copper content of 2.4% and, with the proposed development and equipment completed, an ability to produce copper at 6c. per pound. This is the "latest pebble on the Guggenheim beach," and from the description it appears to be a somewhat formidable potential factor in the long look ahead for ascending copper prices. The Guggenheims, whose beach, by the way, may now be said to extend nearly all the way from Bering sea to the Magellan straits, are to take all of the huge capital stock just created, save the part necessary to be held in the treasury for the conversion of the bonds, and in addition bonds to the amount of $5,000,000 which are to be sold to the public without any stock bonus. The funds so realized, will, it is said, be sufficient to put the property on a producing basis within two to three years. Like the present leader of the low-cost group, this is a steam-shovel mine which will require, it is said, but comparatively little work in stripping. Plans have already been made to treat the ores by leaching, using dilute sulphuric acid, which will be made from sulphide ore found on the property. A large part of the exploration of the property has been by means of core drills. Some holes have been sent down to a tremendous depth without reaching the bottom of the ore-bearing formation; from which it is argued that the estimate of 100,000,000 tons of ore may prove to be not more than half large enough. Up and down the Pacific Coast the

Guggenheims continue activity. Last week another million was paid by the Kennecutt Mines, being the fourth dividend of this amount within the year. Braden Copper is being spoken of as an early entry into the dividend list, though the company is having some trouble getting the Minerals Separation process up to its guaranteed degree of efficiency, at least as regards the whole output of the mine. With Ray and Chino each waiting only for a more favorable turn in the metal market to make initial distributions, it is easy to foresee a fair degree of market interest in the various Guggenheim issues. Another American venture in Chile is recalled in the announcement that C. A. Buck, recently chosen one of the vice-presidents of the Bethlehem Steel Co., is to be head of the Bethlehem Chilean Iron Mines Co., and as such to have charge of the venture of Charles Schwab and associates in iron mining in South America.

While all goes well in the far south, conditions in Mexico go from bad to worse. The mining interests of Americans and other foreigners are evidently to be called upon by the present federal leaders in that country to furnish the sinews of war necessary to be used in establishing the present Huerta administration firmly in power. In Sonora the mining companies have been notified of the levy of a tax equivalent in amount to the combined state and federal tax; the new imposition is to be collected immediately, not only for the current year, but for the year following as well. Private advices state that conditions prevailing in Mexico are fast becoming desperate, and unless the hands of the authorities are so strengthened as to enable them to restore order, the result will be almost chaotic. A bill is being sent through the Chamber of Deputies levying a tax of 10% upon exports of gold, being an attempt to hold enough within the troubled country to stave off threatened bankruptcy. The American public has always enjoyed those theatrical farces that have treated of the armies of Central American states as clamoring for arrears, or deserting on account of non-payment, but it is evident that in Mexico the element of farce has disappeared and the demoralization of the great body of the people is almost complete and wholly tragic.

The copper-metal market is apparently in satisfactory condition. A price of 15¾c. is being generally maintained and a decrease in accumulated stocks is anticipated when the Copper Producers' figures appear covering refinery output for the month of April. Copper people are attaching a great deal of importance to the recent interview given out by John D. Ryan in which he states that the electrification of the St. Paul road will be begun within one year and completed within three years. This will mean a large demand for copper. The committee acting in behalf of the holders of preferred stock in the United Copper Co. have succeeded in getting something more than one-half of the outstanding preferred stock deposited with the trust companies in New York and Boston. The shareholders so depositing are contributing 30c. per share toward a fund to be used by the committee.

The annual report of the North Butte Copper Co. for the year ended December 31, 1912, shows a production of 26,480,123 lb. of copper, 1,377,468 oz. of silver, and 1367 oz. of gold. These figures are approximately the same as those of the year preceding. Crediting the gold and silver to cost of production, the copper cost 9.652c. per pound. The important and encouraging item in the report is the statement that the ore reserves in the North Butte have been largely increased. While no specific statement is made as to the actual amount of ore blocked out, some idea may be gained by comparison with figures of a year ago, when ore reserves were estimated at 710,920 tons, with a copper content of 4½%, and 4½ oz. of silver per ton.

The shareholders of the British Columbia Copper Co. are reassured by the announcement just made by Newman Erb, president of the company, in reference to ore reserve. Mr. Erb states that there has been blocked out about 1,000,000 tons of ore. He also states that this is a larger ore reserve than the company has ever had in sight at one time. The average copper content is stated to be 1½%. It must be borne in mind that the British Columbia ores have always run very high in precious metal.

The shareholders in the Hollinger Gold Mines, Ltd., are anticipating an increase in monthly dividend checks. Production has been running at about $250,000 per month, while the present rate of disbursements of 15c. per month requires but $90,000. The surplus which has accumulated since January 1 is about $100,000, which together with $450,000 brought forward at the close of last year, gives the Hollinger a present surplus of more than $500,000 after deducting the three dividends which have been paid this year amounting to $270,000. The Beaver Con. Mines Co., of Cobalt, is about to pass the current dividend. The management has been putting a large amount of money into development and does not feel justified in continuing dividend payments at this time.

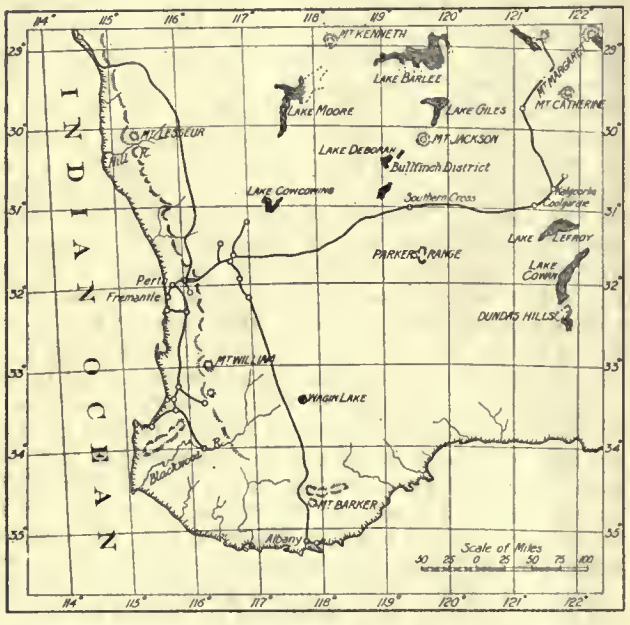
KALGOORLIE, WESTERN AUSTRALIA

VICTORIOUS MINE AND ORA BANDA DISTRICT.—GREAT VICTORIA AND BULLFINCH. — VACUUM-FILTERS. — GWALIA CONSOLIDATED.

The Victorious at Ora Banda, owned by the Associated Northern company, is proving a much better property than anticipated when bought in December 1911. At that time, after six months' working option, the main shaft was down 318 ft., and levels had been driven at 100 and 200 ft., and started at 270 ft. Ore reserves above 200 ft. were estimated at 200,000 tons, with a recoverable value of $5.50 per ton, and a net profit of $3 per ton, equal to a total of $600,000. As the mine cost $110,000, development $90,000, and equipment $150,000, there was an apparent profit in sight of $250,000. Since then the shaft has been sunk to 400 ft., and a new level started at 370 ft. In a south cross-cut, a branch oxidized lode was found, which assayed $10 for the first 5 ft., $5 for the next 5 ft., and $2 for the last 5 ft. A drift has since proved that for a distance of 220 ft. the ore-shoot assays $28 per ton over an average width of 9 ft. Beyond this point both faces dropped to $2.50 per ton, but after driving 35 ft. the east drift improved to $5.75 per ton. Four rises have been put in ore ranging from $7 to as high as $65 per ton. In No. 2 rise, at a height of 43 ft., a south cross-cut has been driven 20 ft. in ore assaying $20.50 per ton. Before this discovery was made the 350,000 shares in the company were quoted nominally at $1.25 each, but have since been up to $5.50, and are now at $3.75. The ore, which is very soft, carries rich splashes of mustard gold in places, and this is regarded as a sure indication of the presence of telluride in the sulphide zone. For the half-year ended December 31, the mills treated 35,068 tons, yielding $123,200, or $4.01 per ton, whereas during January 9600 tons was treated yielding $63,900, or $6.66 per ton, including ore from the new orebody. The difficulty with the carbonates and salt in the water has been overcome by using coarser filter-cloths, and 10,000 tons per month will be treated in future. Although the Ora Banda lodes strike east and west, the ore-channel has been pronounced to be the northerly continuation of the Kalgoorlie-Boulder belt by such well known geologists as C. O. G. Larcombe and A. Montgomery, state mining engineer of Western Australia, Richard Hamilton, manager of the Great Boulder, has thrown up the company's option on the Great Victoria mine near Southern Cross. This mine has a lode over 100 ft. wide, and worth, according to 10,500 tons milled, $6.70 per ton. The new shaft put down by Mr. Hamilton cut quicksand at a depth of 100 ft., and sinking was suspended. A cross-cut in the lode at 80 ft. showed low-grade ore, and as the purchase price of the property is fixed at $250,000 cash and one-eighth share interest, or $500,000 cash without a share interest, Mr. Hamilton decided not to risk it. He has taken and relinquished options on over a dozen mines on behalf of the Great Boulder Proprietary and Great Boulder No. 1. The former company's property has produced $42,218,600 from 2,227,500 tons, and paid $19,784,000 in dividends.

The Bullfinch treatment plant, after many annoying delays, made a start during the last week of February with 15 out of the 20 stamps. After two years it is suddenly discovered that another tube-mill and grinding pan will be

required before the remaining 5 stamps can be profitably used. The head-frame at the mine is 80 ft. high, and the ore is fed through a Symons gyratory rock-crusher into a 200-ton bin. Self-feeders deliver the crushed ore upon a Robins conveyor, which carries it to the 400-ton capacity mill-bins. The ore is crushed in cyanide solution, and the pulp is elevated by a 40-ft. tailing wheel into Callow classifiers. The coarser particles gravitate into a tube-mill, and then into a Cobbe adjustable grinding pan. The overflow from the classifiers passes into mechanical thickeners, is pumped up to the three Ridgway vacuum-filters, and the solution then passes into the zinc-boxes. Power is supplied by three 250-hp. Babcock & Wilcox boilers supplying a 350-hp. engine built by James Howden & Co., driving a Bruce, Peebles & Co. generator. There is an 18-drill Ingersoll-Rand air-compressor, as well as a 14 by 30-in. first-motion hoist. Water is supplied by the Goldfields Water Scheme, and to insure a constant supply, two tanks, each of 30,000-gal. capacity, are erected on an elevated stand. The full capacity of the 20 stamps is said to be 600 tons per month, or 10 tons per stamp per 24



WESTERN AUSTRALIA.

hours, and the profit is estimated to be $57,000 per month. No estimates of ore reserves have ever been given, and all progress reports issued have been vague. It is, however, known that the original rich ore-shoot, from which $430,000 was extracted from 1776 tons, between September 1910 and April 1911, has never been picked up at the 310-ft. level. The orebodies developed at this level, and 446 ft. north and 300 ft. south of the shaft, respectively, will entail a lot of tramming.

In spite of the United States courts decreeing that all vacuum-filters are infringements of the Moore patent, other types of vacuum-filters continue to be installed here. For instance, the Bullfinch has just put in three improved Ridgways, similar to those on the Victorious at Ora Banda, while Bewick, Moreing & Co. are placing on the Queen of the Hills an ordinary vacuum-filter, similar to that at the Mountain Queen at Marvel Loch. The Moore filter tested at the Great Boulder Perseverance in 1904 was considered too clumsy and slow. Most of the presses in this state are of the ordinary stationary-leaf type, made locally, the first having been erected at the Gwalia Consolidated and Sons of Gwalia in 1906. In May 1908 a similar plant was erected at the Lake View Consols, and has been treating 9500 tons of old residue per month ever since. In all, some 540,000 tons have been treated, yielding $1.35 per ton, at a cost of 60c., leaving a profit of 75c. per ton, or say $405,000. In January 1909 two similar filters started work at the Oroya Brownhill, and finished treating the dump in June 1911. They treated 22,000 tons per month, or a total of say 660,000 tons, yielding $1.25 per ton at a cost of 56c., leaving a profit of 69c. per ton, or $455,400. One of these filters is still used by the Oroya Links company and has been treating 9000 tons per month since July 1911. Most of the Kalgoorlie mines still retain the old Dehne mechanical press, which does excellent work, but labor costs are against its working as cheaply as vacuum-filters.

Ben Howe, manager at the Gwalia Consolidated mine, is so satisfied with his experiments in the treatment of that mine's refractory ore by his volatilization process, described in the *Mining and Scientific Press*, March 29, 1913, that he has induced the directors to reconstruct the company and to provide $50,000 cash working capital, with power to levy assessments of $125,000 more when required. The lode on the Gwalia Consolidated is 60 ft. wide, and has been favorably reported on by Mr. Lander, a mine inspector, Frank R. Powell, Edwin King, Vincent Shallcross, Harvey Urquhart, and Bewick, Moreing & Co., but the refractory nature of the ore and the isolated position of the mine, it being 548 miles by rail from Fremantle, made working costs prohibitive. Mr. Howe's process may revive the Lancefield, Bellevue, and Transvaal mines, all of which are shut down owing to the presence of copper, arsenical pyrite, and graphite in the ore, rendering success by any of the old and well known processes impossible.

JOPLIN, MISSOURI

DRY CONCENTRATION FOR ZINC SULPHIDE ORES.—ELECTRICALLY DRIVEN MILL.—MARY C TO BUILD MILL.—UNDERWRITERS HAS SHEET GROUND AND WILL MILL.

The Clifford Ore Concentrator Co. has constructed a mill for the treatment of mine tailing on a lease of the Reliance Lead & Zinc Co.'s land at Duenweg. The plant differs from any other mill of the district in that it employs air currents instead of water in concentration. Fans are placed at the back of each table, causing an exhaust draft which may be regulated to suit the requirements by the opening or closing of gates at the ends or sides of the tables, or by the quickening or retarding of the revolutions of the fans. The tables, which have a movement horizontally, caused by eccentrics, are covered by immovable sheets of glass and galvanized iron. This covering may be raised or lowered at any point to create the kind of air current desired. The tailing, before reaching the tables, passes through a drying furnace and then through rolls and is pulverized. The lighter particles are removed by the suction, and the zinc sulphide delivered to an ore-bin. At the new plant of the What Cheer Mining Co., at Duenweg, an innovation in electrical equipment in mill construction in this district has been introduced. Electricity is used for power, and 23 separate motors, ranging in size from 1 to 52 hp., are employed. Each piece of machinery in the plant is driven by a separate motor.

The Mary C Mining Co., a London, England, organization, contemplates the erection of another mill on its lease of the Mexico-Joplin land at Thoms Station. The former mill was sold and removed. The English company purchased the Mary C mine from $165,000 from the T. Coyne Mining Co., several years ago. After operating for some time the mine was closed and the mill sold to the Dutchman's Dream Mining Co. Drilling on the lease, since the mill was removed, has revealed extensive ore deposits that had not been worked. The Underwriters Land Co., operating north of Webb City and in West Joplin, will begin erection of two large concentrating plants in the West Joplin field soon. Sheet-ore at from 108 to 125 ft. in depth has been blocked out in drilling. The ore dips sharply to the north. The same condition is found to prevail in the Webb City field, where a northward dip is noted. This company maintains a complete sludge department at the mill now being operated in the West Joplin field. Through a series of settling tanks and ten sludge tables the great part of the mineral is reclaimed. On the Aylor land at Alba, William Davidson, who holds a lease on 220 acres, has constructed one 300-ton concentrating plant and is beginning two others of the same size. The ground has been drained by large pumps and operations will be conducted down to a depth of 225 feet. Prices and production are discussed on another page.

SALT LAKE CITY, UTAH

Death of Mercur.—Centennial-Eureka Leases King William Mine.—Silver King Coalition Pays Dividend and Puts in New Equipment.

When the management of the Consolidated Mercur G. M. Co. closed the mine early in April there ended not only the largest gold-producing mine of Utah, but one of the most remarkable in the history of Western mines. There ended also a gold-mining district once termed the 'Johannesburg of America.' Twenty years ago the Mercur district of Utah was the hub of the gold-mining world, and the story is still told of the three Nebraska farmers, John Dern, John Heimerich, and E. H. Airis, to whom a smooth-talking promoter sold a big block of Mercur district mining stock after the height of the boom had passed, thinking he had duped the Nebraskans. They came to Utah, investigated the Mercur properties, and returned much discouraged. They took with them, however, three sacks of what people in the district laughingly styled Mercur mud. At Omaha they had this assayed. The next morning the assayer paid the farmers $13,653 for the gold contained in the three sacks. The upshot of the matter was that these Nebraska farmers returned to Utah and mapped out a program which resulted in the merger of the principal mines of Mercur into the Consolidated Mercur G. M. Co. Included within this merger were the Mercur G. M. Co., with a record of $1,491,588, and the De La Mar Mercur M. Co., with a production up to that time of $689,812. The Consolidated company was organized in July 1900. It was in the Consolidated Mercur milling plant that the cyanidation of gold was developed on a commercial scale and the Moore vacuum-filter was invented. When the mill was completed so as to handle 1000 tons of ore per day, it was the largest of its kind in the world, and the engineers who planned and built it considered it the final word in milling.

The ore deposits of the property consisted of three blanket veins in altered limestone, which accounts for the fact that the property has been mined only to comparatively shallow depth, 550 ft., yet throughout the 900 to 1000 acres within the company's lines there were driven almost countless miles of drifts, cross-cuts, winzes, and rises, the extent of the underground work being better appreciated when it is mentioned that there is an electric underground tramway in the mine three miles in length. One of the first reports issued by the company set forth that in 1900 there were 1,117,320 tons of gold ore in sight, of the value of $6.08 per ton, with only one-fourth of the total property prospected. It will be of interest to learn that when the mine closed, it had produced over 5,700,000 tons of gold ore, the mill having operated at a daily capacity of 800 tons for 20 years without an interruption until the last few years. The Consolidated company has paid $1,235,000 in dividends, while the property in the hands of its predecessors paid out $2,180,313, bringing the total to $3,415,313. This record was made by the production of about $15,000,000 worth of gold-bearing ores. In 1900, when the orebodies developed averaged $6.08 per ton in value, it was figured that the cost of mining and milling would be $3 per ton. Were the company today in possession of ore averaging $3 per ton in gold, that would be considered sufficiently high to enable it to operate at a profit, for the ore which many years ago ran as high as $20 gold per ton has in the last few years of operation averaged as low as $3.15; making the Mercur one of the lowest-grade gold mines operated anywhere in the world.

The details have been released here of the deal whereby the Centennial Eureka company acquired the option on the King William territory at Tintic. Work is now under way from the 1200 and 1600-ft. levels of the Centennial-Eureka property; the 1600-ft. corresponds to the 2000-ft. level of the Grand Central mine. Most of the previous work in the King William was done from the 1000-ft. level of the Eagle & Blue Bell mine adjoining, which was equivalent to a vertical depth of 1900 ft. in the King William. The option is for the term of two years beginning February 21, 1913, and the price for the land is $250,000, with the Centennial-Eureka company obligated to take up some $4000 worth of the King William company's debts. The royalty is 30% of the net shipping or smelter returns on all ore shipped from the mine.

The Silver King Coalition Mines Co. of Park City has paid a 15c. per share dividend, which amounted to $187,500. The management of the company is now engaged in the installation of one of the finest lines of electric mine equipment in the West. This consists in part of a Wellman-Seaver-Morgan, direct-connected, electric hoist of 500 hp., and a Sullivan electric-driven compressor, with a smaller compressor to be used in case of emergencies.

TORONTO, CANADA

Kirkland Lake.—Swastika.—Nipissing and Cobalt News.

The Kirkland Lake goldfield is attracting British capital. The Woodward-Murray claims in that area, four in number, have been sold under a working option for $60,000 to J. Walter Young, of Haileybury, representing an English syndicate. The Lucky Cross mill at Swastika has at last, after considerable delay, begun crushing ore, treating between 40 and 50 tons per day. It has been decided to erect five additional stamps. The shaft is down to the 220-ft. level, on which three veins have been cut. Operations at the Pearl Lake and the Schumacher have been suspended owing to the failure of the power supply.

The financial statement of the Nipissing as of April 1 showed cash in hand $1,008,893, ore and bullion in transit $173,848, ore on hand and bullion ready for shipment $202,350, a total of $1,385,092. The La Rose financial statement as of April 1 showed a cash surplus of $1,472,510, and ore in transit, etc., $322,222, making a total of $1,794,732. A shipment of 40,000 tons of ore from the Silver Bar mine has been made by the Preston-East Dome, which is now operating the property. Work on the Silver Leaf, which is under lease to the Crown Reserve, has been resumed. The Beacon Consolidated in the Elk Lake district is installing a new compressor. Some ore has been found on the 200-ft. level, but the company will sink to 500 ft. before doing much more work on the upper levels. The Miller-Lake-O'Brien in the Gowganda district has shipped a car of high-grade ore, the second within two months, running 3500 oz. per ton.

MIAMI, ARIZONA

Changes in Mill.—New Unit Shows Improved Results.

Arrangements have been made for the construction of a wire-rope span over the 18,000-ton stock pile which lies south of No. 4 shaft of the Miami Copper Co. By means of a ¾-cu. yd. grab bucket, the ore is to be picked up and conveyed to the ore-bins. The necessary operating power is to be furnished by the small hoist which was used in sinking shaft No. 4. Work on the remaining 75,000 tons of ore in the stock pile at No. 2 shaft, which has been suspended for a short period, is to be resumed immediately. At the mill the re-treatment middling plant and the four Deister multiplex tilting tables recently installed in the sixth unit are running smoothly and proving highly efficient. This sixth unit is saving 1½ to 2 lb. more copper per ton of ore treated than any other in the mill, due partly to the re-treatment of the middling and partly to the better result secured by the use of the tilting tables. The crushing plant is being re-modeled so as to insure a ½-in. product. Specifications call for the additional equipment of two sets of rolls, two screens, and two elevators. The remodeling of this branch is largely due to the greatly increased hardness of the ore as disclosed by milling operations over the theoretical hardness assumed in the designing of the plant. All of the original rolls have been entirely replaced by the massive, 42 by 16-in. spring, Traylor special rolls. With the exception of unit No. 5, the Chilean mills have been replaced by those of the Hardinge type. The Chilean mills in No. 5 are in such excellent shape that it will not be necessary to replace them for some time. During the autumn it is highly probable that the lower part of the mill will be remodeled, and possibly two more units will be added.

General Mining News

ALASKA

At Washington, D. C., the Senate Territorial Committee, on April 25, began a hearing on Alaskan railway development. Several bills proposing a Government bond issue to build railways are before the Committee, and one will be reported to the Senate before the end of this session. Government ownership of the roads constructed, routes, and other questions, upon which Alaskans disagree, have been put aside, and an effort will be made to get the bill authorizing lines through Congress as soon as possible.

JUNEAU

During March the Alaska Mexican and Alaska United mines produced the following output:

	Alaska Mexican.	Alaska United.
Stamps working	120	240
Total time worked, days.....	30.30	30.60
Ore crushed, tons.....	20,139	39,081
Concentrate saved, tons.....	401	912
Gold from amalgamation.....	$16,245	$49,172
Gold from cyanidation	22,714	49,135
Operating expenses	23,383	50,417
Construction expenses	2,808	2,809
Net profit	12,379	44,098
Development work, feet.....	197	581

NOME

It is stated that 'pay' has been found under the sea between the bar and the present beach by E. C. Roberts, and is covered by from 3½ to 12 ft. of water. The gravel varies from 3 to 18 in. deep, and contains coarse gold. The Caisson dredge was placed in this section, but for some reason sank during the night of February 28.

ARIZONA

COCHISE COUNTY

Twenty lead-silver claims between the Higgins and Copper Queen properties are to be consolidated. In the Warren district the most important lead-silver producers are the Shattuck and the Higgins Leasing Company.

GILA COUNTY

(Special Correspondence.)—At the Miami mine, as a sequel to the recent cave-in, three of the six units of the mill were closed on April 21. Some time ago the raise

MIAMI, LOOKING SOUTHEAST.

through which the ore from the stock pile is handled, caved, necessitating immediate repair, and this temporary loss of tonnage, combined with the loss following the cave-in on the 245-ft. level, are the direct causes of the partly suspended mill operations. N. O. Lawton, mine superintendent, stated that the repairs are rapidly nearing completion, and that the mill will be running at its normal capacity within the next week. Negotiations for the shipment of concentrate to the International smelter at Tooele, Utah, were completed last week, and shipments to that point began on April 22. Since the cessation of operations at Cananea, the railroad officials have been furnishing all the cars necessary to handle the concentrate, and there is now over 100 cars of the company's concentrate stalled between Miami and Cananea. On April 23 an American workman, while at work in the mill, was electrocuted. J. Parke Channing, who has taken charge of operations during the absence of B. Britton Gottsberger, is at Phoenix attending the state legislature, which is at present engaged in preparing a suitable mine-taxation bill. At the Warrior property, Fiske and Snell, lessees, have made arrangements with the Hayden smelter to handle their ore during the strike at the El Paso smelter. Shipments are now being made at the rate of about 125 tons per day. At the Iron Cap, shipments during the past week have been held up by the El Paso smelter strike. However, the company expects to resume shipments at the end of this week. Development on the No. 6 level is encouraging. About $60,000 worth of ore has been blocked out on this level, and the shoot opened shows no signs of diminishing either in metal content or size. Work in the raise from the No. 8 to the No. 6 level, after a short suspension, has been resumed. The raise is now up about 50 ft., and a cross-cut is being driven to the vein to determine its width.

At the Inspiration Consolidated, the underground force has been increased, and the monthly development should again exceed 5000 ft. At the millsite the cement warehouse is fast nearing completion, and workmen are busy excavating for the rock and sand-bins. Excavation for the foundations of the coarse-crushing plant is progressing rapidly. Rails have been laid to the millsite, and they are now being carried toward the main working shafts. Recently a gang of workmen has been engaged planting cottonwood trees along the main water-courses passing through the company's ground. They are spaced about 35 ft. apart and are set on both sides of the channels. Over 500 trees have already been planted, and while the original idea was to strengthen the channels, they will also develop and furnish a much needed addition to the landscape of the district.

Miami, April 26.

The Ray Consolidated Copper Co. is being sued for $40,000 damages by an employee who lost a leg at the mine in January 1912.

CALIFORNIA

AMADOR COUNTY

Taxes have not been paid by the Clinton Consolidated Mining Co., at Jackson, for 21 years, and the sheriff and tax collector were served on April 23 with a restraining order to prevent the sale of the company's Pauch and Union Quartz properties to E. R. Elliott, of Modesto, who had already paid in $6119, the amount of the taxes, to a Modesto bank. The order alleges that the taxes are exorbitant, and the case will be heard on May 3 at San Francisco. A suit has been started against the South Eureka Mining Co. for $30,000 by the administrator of the estate of F. Mengual, who was killed on the 2000-ft. level last December. It is alleged the shaft was improperly protected.

CALAVERAS COUNTY

A decision was rendered at San Andreas against the Lightner Gold Mining Co., of Calaveras county, which failed to pay for supplies furnished by the Manuel Estate Co., owner of the property. The mine taxes have not been paid either, and an assessment of 5c. per share has been levied on shareholders of the Lightner company. The mine was sold in 1911 to the present company for $200,000, of which $50,000 has been paid, and another $50,000 was due on April 1, 1913, but not paid. A considerable sum has been spent on development, and the 60-stamp mill was worked in 1912. The Lightner Mining Co., of Stockton, has a man in charge awaiting further development.

NEVADA COUNTY

(Special Correspondence.)—Final deeds to the Champion property at Nevada City, consisting of about 40 mineral claims and equipment, were passed from J. M. O'Brien

today to the North Star Mines Co. of New York, final payments amounting to $150,000 having been made in accordance with the deeds, and deposited in Wells Fargo Nevada National Bank. The Champion has been under bond for nearly two years, and during that time about 9000 ft. of exploration work has been done. The principal vein has been cut at a depth of 2400 ft., and the mill is working continuously on a good ore. Further details of the work may be seen in the issue of this journal of April 12. This deal is of great importance to the Nevada City mining district, as the Champion has always been conceded the principal group of mines in this famous old 'camp.' These mines have been worked continuously since early days, and the purchase of this group by the North Star Mines Co., which is somewhat conservative, shows the faith of Eastern capitalists in the old established mines of the state.

Nevada City, April 24.

The Nevada County Narrow Gauge railroad, which connects Grass Valley and Nevada City with the Southern Pacific system at Colfax, 17 miles distant, has been sold by Mrs. John F. Kidder, but the buyers are at present unknown. The railroad company had a capital of $400,000, and the line has been in operation since May 1876. Of late there has been talk of making a standard-gauge line, and this will probably be done now.

PLACER COUNTY

Alexander Bros., of Los Angeles, have purchased the Crandall mine, near Auburn, from Abbott & Morton for about $50,000. Eight men are now employed, and an electrically-driven hoist, air-compressor, and pumps are to be installed, while the mill will be overhauled and enlarged. A pumping plant has been installed by F. Stormfedder at one of the gravel mines at Bowman. Waldo & Adams are now operating their new mill at that place.

SHASTA COUNTY

The Mt. Shasta mine, two miles from the town of Old Shasta, has been bought by H. O. Cummins and associates. The property has produced about $200,000, but has been idle lately. Arrangements have been practically completed at Heroult for a large test of the Heslewood system of reducing smelter fume. Several small experiments have been made by the inventor, W. R. Heslewood. The Noble Electric Steel Co. has lent a furnace. During smelting, sulphur fume is drawn through a flue and condensed in water.

COLORADO

GILPIN COUNTY

The Inita Silver-Lead Mining Co. has been formed by New York people to operate the American Eagle, St. John, Bradford, and other claims at Black Hawk. The American Eagle adit will be used to work the other claims. In the Bradford there is high-grade silver-lead ore. At the Pittsburg mine in Russell gulch, the 1000-ft. level is in 695 ft. in good ore. Leyner drills are used, the rock being fairly hard.

THE SAN JUAN

At the Congress mine, near Silverton, the winze is finished, and a cross-cut is being driven to cut the ore at the new level, 100 ft. below No. 6. It is estimated that there is about 1000 tons of ore in an old stope, and from the new level shipments will be made as soon as possible. During March, the Tomboy mill treated 11,500 tons of ore, producing $18,700 at the mine and $70,500 from 1750 tons of concentrate, making a total realizable value of $89,200. Working expenses were $50,500, leaving a profit of $38,700.

Excavation has been started on the new 300-ton cyanide plant for the Junta Gold Mining Co., situated two miles from Telluride. Justin H. Haynes is in charge of the work.

TELLER COUNTY (CRIPPLE CREEK)

The Modoc Mining & Milling Co. did 4000 ft. of development in its mine last year, with fair results. The shaft is to be sunk deeper, and other lower levels opened. A mill to cost about $20,000, to treat 85 tons per day, is to be erected by the Alta Vista Mining Co., which has 560 acres of placer ground two miles south of Victor. Machinery has been ordered, and the Barnhard process, over which there has been some discussion, will be used in the plant. Twenty-five men are employed at the plant of the United States Reduction & Refining Co., at Florence, and regular operation will be started in a few days. The Pike's Peak placer ground, north of Cripple Creek, which is said to carry $1.50 per ton in gold, is to be worked, and machinery has been ordered costing $8000. The machine will be similar to the dredge used at Breckenridge, only somewhat smaller. Water will be supplied from the Cripple Creek mines. Gold valued at $80,000 was recovered here in 1895. Twenty-five men will be employed. It is probable that some additional work will be necessary at the head of the Roosevelt drainage tunnel, as it is thought that the water channels have been partly clogged from various causes. The Miners' Protective Association has 4360 members on its roll. Every mine employer and employee must be a member of this association.

IDAHO

IDAHO COUNTY

(Special Correspondence.)—The recent discovery in the American Eagle mine is developing satisfactorily, and the company expects to sink the shaft 300 ft. deeper. The Crooked river placers are being operated by E. N. Farr. The Little Butte mill has started, and the South Fork mill has also started working one shift, and water power is to be used. The Golden Rule placer is operating, and the Erickson placer is ready to start. The Center Star is still being examined. The Mogul mine is being cleaned up ready for work, and the Mineral Zone property will be operated soon by Mrs. Parr. It is reported that work will soon commence on the June Bug group. Foss Bros. of the Snow Shoe mine are hauling ore to be treated at the American Eagle mill, while the American people are extracting ore and several deals are pending.

Elk City, April 19.

SHOSHONE COUNTY

The lessees of the Tyler mine have leased the old south mill of the Bunker Hill & Sullivan company, and will start working one shift as soon as possible, the capacity per 8-hr. shift being 250 tons. A 5-ton Packard motor truck and 3-ton trailer, costing $5600, will be used to carry ore to the mill. In the *Wallace Miner* of April 24 is an interesting table, compiled by the Shoshone Abstract Co. of Wallace, showing that in the Coeur d'Alene district there are 327 corporations and individual groups controlling 961 patented and 1929 unpatented mining claims, aggregating 57,800 acres, upon which $15,068,790 has been spent on development and improvements.

MICHIGAN

HOUGHTON COUNTY

The best developments in the Pewabic formation in the Hancock mine are in the Pewabic lode at the 3650-ft. level. Recent work at that depth has proved a grade of copper ore about equal to that of the Pewabic lode in the Quincy, and is only lower in value than the ore at No. 16 and 18 levels. A winze is being sunk between these levels. Ore shipments should be made within three months.

MARQUETTE COUNTY

The Cleveland Cliffs Iron Co., Ishpeming, will install in its plant at Gwinn 350 and 400-hp. motors and a switchboard. The apparatus has been ordered from the General Electric Company.

ONTONAGON COUNTY

A new process of copper ore treatment is being tried at the Nonesuch mine, which was recently reopened. 'Rock' is first crushed by a jaw-crusher to ½-in. size, then it is rolled and pulverized, and a machine produces a product in pellet form. The 'rock' averages 3% and the concentrate 85% copper.

MISSOURI

JASPER COUNTY

The What Cheer Mining Co. is installing 23 motors, ranging from 1 hp. driving a compressor pump, to 75 hp. driving the 6-drill air-compressor, at the plant in the north

section of the Duenweg district. The two hoists are operated by 52-hp. motors each; mine pump, 35 hp.; crusher, 20 hp.; one 15 hp. for each set of rolls; tailing elevator, 15 hp.; roughing jig, 10 hp.; and sludge tables, 5 hp. each. The ore in this mine, which is hard, occurs in the sheet formation at a depth of 190 to 210 ft., and contains about 3% blende and a little less galena.

The Clifford Ore Concentrator Co. is to treat the old tailing of the Reliance Lead & Zinc Co. at Duenweg, which is said to carry 3 to 5% blende. The new plant has a capacity of 100 tons per shift. The tailing will be elevated to a hopper, dried in a revolving oven, ground by rolls, screened, fed to 8 tables, working at 140 to 225 strokes per minute, and the lighter material will be removed by suction, leaving the concentrate behind. Dust is minimized at various points by fans.

NEVADA

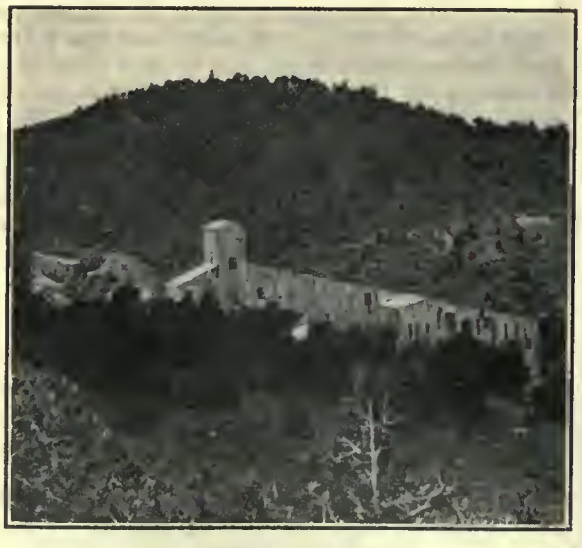
Considerable interest is being taken by mining men in Nevada in a railroad which is to be constructed from Argenta, east of Battle mountain, southerly, to connect with the Owens Lake road through Los Angeles. The Southern Pacific Co. has a corps of surveyors near Ledlie, Nevada, examining the country.

Esmeralda County

The St. Ives shaft of the Merger mine is down 1648 ft., and there has been a change in the formation. On the 1330-ft. level, considerable prospecting is in progress. A report issued by the Sandstorm-Kendall Consolidated Co. covers the period from November 1912 to April 1913. On the 500-ft. level the main cross-cut has been driven 311 ft. from the shaft, and the east cross-cut was extended to 375 ft. At 310 ft. a vein was cut and driven on, carrying gold, silver, and copper. It makes considerable water, and all the workings produce about 100,000 gal. per day, and a pump of 150,000-gal. capacity has been installed.

Humboldt County

The Rochester Milling & Reduction Co. has been formed by H. and R. M. Henningsen, surface rights have been purchased on three blocks of the Limerick company, and a mill of 50-ton capacity will be erected to treat ore from the Limerick, Plainview, Plainsight, and other properties. Water will be obtained from the Spring Valley canyon, where 56,000 gal. is obtainable per day.



ASSOCIATED MILL, MANHATTAN.

Lyon County

The Reno-Yerington claims have been sold to Pittsburg people, and seven men are now employed in sinking a shaft. An adit 400 ft. long had been driven by a previous management. The Montana-Yerington is shipping 50 tons per day to the Mason Valley smelter. Ore is being hauled from the Blue Jay, and rich ore has been opened on the 100-ft. level.

Nye County

At Manhattan, a hoisting engineer, while handling a rail which came into contact with a high-tension power line at the Jumping Jack lease, had 6800 volts pass through him. Apart from shock and a few burns, the man was unhurt. The Brady lease on Union No. 9 claim is making a 300-ton shipment to the mill; and the lease on the Earl has opened 5 ft. of ore on the 350-ft. level. A 20-hp. electric hoist has been installed at the Mayflower claim, under lease to Mushett & Wittenberg. The winze in the Kendall-Douglass lease on the Manhattan Consolidated is 47 ft. below the 150-ft. level, and the rich shoot is still showing strongly. The White Caps company is shipping high-grade ore through the Western Ore Purchasing Co. Ten Tonopah mines produced 47,008 tons of ore during March, and during the week ended April 26, treated 9444 tons, valued at $211,095, a lower yield than usual, due to electric-power troubles and a shut-down of two days at the Belmont mine. The North Star is shipping about 150 tons of ore per week from the new shoot on the 900-ft. level. On the 660-ft. level of the Tonopah Extension, a high-grade shoot has been opened, while the MacNamara company has cut 4½ ft. of $100 to $160 ore on the 300-ft. level east of the shaft.

Storey County

An agreement has been made between the Truckee River General Electric Co., which was about to shut off power from the United Comstock Pumping Association, and the Association. A. M. Walsh, engineer for the Pumping Association, is preparing estimates of cost for a generating station, which is to use water from the Sutro tunnel, or 1600-ft. level of the C. & C. shaft. It is estimated that an annual saving of $35,000 would be made by this installation. The Ophir cyanide plant at the Comstock treated 2780 tons of tailing during March, yielding $12,228 at a cost of $782 for transport and $4805 for treatment, or $1.72 per ton. Since the plant started work it has made a profit of $23,000.

White Pine County

Samples from the reported rich gold discovery at Cherry creek returned a trace of gold and silver. Nobody should go out there, as the place has been grossly misrepresented.

NEW MEXICO

Socorro County

The Socorro Mines Co., Mogollon, will install a 187-kva. generator, with 10-kw. exciter and switchboard, recently ordered from the General Electric Company.

OREGON

Baker County

The Gold Center Dredge Co. has been organized with a capital of 100 shares of $1000 each, by Sumpter people. Mr. Weaver is manager. A 3 cu-ft. capacity dredge will be installed by the Yuba Construction Co. The new company has 200 acres of ground, eight miles west of Sumpter, on the Granite road. The case against the Columbia Gold Mining Co., in which a boy was alleged to have lost his legs through disease contracted while playing in a stream in which residue from a cyanide plant was discharged, was quickly dismissed on April 21.

Jackson County

(Special Correspondence.)—Among the quartz mines in the Gold Hill district to receive equipment is the Nellie Wright, situated two miles east of Gold Hill. This property is being fitted with a 15-stamp mill, concentrating plant, and auxiliary electrical machinery. The management hopes to have the stamps dropping within two months. The mine is developed to a depth of 300 ft. and has a large body of ore in reserve. Mill tests on this ore give returns of from $12 to $18 per ton, mostly free gold. The mine is easily accessible, and has every facility for operation, including water, power, and timber. The Nellie Wright is owned by P. C. Donovan, of Winnipeg, Canada, who bought it only a short time ago. Henry Ray is local manager. Besides the placing of machinery on the property, the camp itself is being laid out on better lines, and larger and more commodious buildings erected.

Philomath, April 26.

MALHEUR COUNTY

A half interest in the Red, White and Blue quartz claims and stamp-mill has been sold to Boise, Idaho, people for $35,000, and operations are to be extended. Developments in the Humboldt mine, in the Merman basin, are encouraging. Sluicing has been started at the Lynn placer claim, about a half mile from Malheur, and eleven men are employed, six more to be added within a few days. During 1911-12 this property produced about $9500.

TEXAS

EL PASO COUNTY

The strike at the El Paso smelter continues, and small mines in Arizona have been greatly affected thereby.

UTAH

JUAN COUNTY

Ore shipments from Tintic during the past week totaled 187 cars, of which 42 were from the Centennial-Eureka, Iron Blossom 22, Chief Consolidated 21, Eagle & Blue Bell 17, Grand Central 16, and Dragon, Gold Chain, and Bullion Beck 12 cars each. The Centennial has paid a dividend of $1.50 per share, the United States S. R. & M. Co. holding 99.86% of the shares. A winze below the 700-ft. level of the Iron Blossom has opened high-grade copper and silver ore. A dividend of 10c. per share, equal to $100,000, has been paid. Results at the Chief are encouraging. Rich silver-gold ore is coming from No. 9 and 13 levels of the Eagle & Blue Bell. The Dragon is supplying iron ore for the Murray smelter. The Gold Chain Mining Co. is to prospect the Fairview section of the property, and a drift is being driven 1500 ft. from the main-adit level of the Gold Chain.

SALT LAKE COUNTY

The annual report of the Utah Copper Co. shows that, to date, about 21,000,000 tons of ore has been mined, leaving 316,000,000 tons in reserve. Overburden moved to the end of 1912 covered 97.43 acres. Mining costs were 30.32c., and milling 41.58c. per ton. Ore treated was 5,315,221 tons, yielding 91,366,337 lb. of copper. The Garfield Smelting Co., at Garfield, will install in its plant two 25-ton electric locomotives recently ordered from the General Electric Co. The Montana Bingham adit is in 1560 ft., and porphyry similar to that mined by the Utah Copper Co. has been cut.

TOOELE COUNTY

Owing to the final shut-down of the Consolidated Mercur mine and mill, traffic agreements between the Salt Lake & Mercur railroad and other transportation companies have expired, and while passenger service has ceased, the line will be operated occasionally to carry away machinery from the mine. There are now only about 150 people at Mercur, 75 being employed at the Franklin lease, a few at the West Dip mine, and others are engaged dismantling at the Mercur property.

WASHINGTON

SPOKANE COUNTY

(Special Correspondence.)—The Spokane section of the American Institute of Mining Engineers will meet with the Western branch of the Canadian Mining Institute, at Rossland and Trail, British Columbia, on May 22, 23, and 24, leaving Spokane on the morning of May 22 and returning on the evening of May 25. The mines and the smelter will be visited, and papers relative to the district will be read and discussed.

Spokane, April 22.

CANADA

BRITISH COLUMBIA

The Britannia company is making a tailing assaying 0.2% copper in the small plant now working. The material treated is slime from the old mill. When the whole plant is changed over to flotation, as is now being done, the engineers are confident of being able to make a tailing of 0.15% from an ore assaying about 6 per cent.

The Rambler-Cariboo mine and mill are being worked full time. Drifts on the 800, 900, 1050, and 1200-ft. levels are being extended, ore being opened in the two latter levels. Shipments to the smelter total five cars per week, and 52 men are employed.

Work on the new smelter for the Granby company, at Granby Bay, is progressing well, and machinery should be shipped from the various factories early in May and delivered by the middle of June. Raises and stopes being opened in the mine have proved better ore than cut by diamond-drill. The Bonanza properties, two miles from the smelter site, are developing well. A 45-ft. vein, averaging 2.2% copper, has been cut by drilling. There is still 30 in. of snow in the district.

ONTARIO

Plans for draining Cobalt lake are well under way. This body of water is approximately 3900 ft. long, 800 ft. wide, and 50 ft. deep, and belongs to the Cobalt Lake Mining Co., save 4½ acres at the south end which is owned by the Right of Way and McKinley-Darragh companies. Residue from three mills has been discharged into the lake for some time past. The scheme of unwatering includes the operation of two electrically-driven turbine pumps of 4000-gal. capacity each per minute, placed on scows on the lake, and the building of a concrete dam at the south end to back up water flowing in from Little lake, south of the Princess mine, and the creeks connecting it with Bass lake. The work will take about five months.

YUKON

The White Horse district is fairly active at present. The Atlas company is employing 150 men on the Pueblo claim and is shipping copper ore. This company has an option on the Valerie claim, and prospecting has been satisfactory, while it is examining the Grafter and other properties. The Kluane district is attracting some attention. Fifteen tons of supplies have been bought at Whitehorse for the Scolai Mining Co. The Ventura Mining Co. plans extensive work this season on its claims on the Fourth of July creek. About $30,000 was spent in prospecting in 1912.

KOREA

(Special Correspondence.)—The new 40-stamp mill of the Chiksan Mining Co. was recently started. The placer deposits owned by the Colibran & Bostwick Development Co. have been examined by J. J. Martin, now of the Chiksan Mining Co., and so far 700 acres of ground has been proved gold bearing. Bids are now being received for the construction of a dredge of 13½-ft. capacity.

Chiksan, April 7.

MEXICO

CHIHUAHUA

Troops are searching for Pancho Villa and followers, who captured 122 bars of bullion early in April, and a reward of ₱5000 is offered for his capture. According to the official report of the Mexico Northwestern Railway Co., a claim for ₱10,000,000 damages to its property, through the revolution up to January 1, 1913, has been submitted to the Mexican government. One particular bridge was burned 26 times by rebels.

MEXICO

During March the El Oro mill worked 27 days and treated 20,970 tons of ore and 16,330 tons of tailing, producing $179,970. Working expenses were $126,970; improvements, $980; and London expenses, $3360; while the profit was $67,520, including $9260 from the railway.

SONORA

At El Tigre in March the Tigre Mining Co.'s mills and cyanide plant treated 5738 tons of ore, and 5527 tons of current and 1808 tons of dump tailing, yielding a total of $119,883 from shipping ore, concentrate, and local treatment. Mining and development cost $19,827; milling, $30,271; general and taxes, $9068; and marketing $16,331; which left a profit of $44,386. On April 1 a refund of zinc duty, amounting to $10,643, which had been paid under protest, was refunded. A dividend of 3c. per share was paid on April 3. Operations at the Greene-Cananea mines and smelter are being resumed, and J. S. Douglas, who was forced to quit Cananea recently, will return.

Schools and Societies

The Massachusetts Institute of Technology announces its summer courses during June, July, August, and September, which supplement the work of the regular school year. These courses are open also to persons who are not students of the Institute. The requirements for admission, and in general the work performed and final examinations, are expected to correspond with those of the regular school year. Applicants not connected with the Institute should correspond with the Secretary of the Faculty in regard to qualifications.

The University of Washington College of Mines held its annual spring inspection trip this year in the western part of the state of Washington during the week ended on April 14. Sixteen members made up the party, including Dean Milnor Roberts, Joseph Daniels, and others. Camp No. 2 of the city water supply, at Cedar Falls, was first visited. Here, rock-tunneling, diamond and chilled-shot drilling, gravel washing, concrete masonry work, aerial tram and cableway operations were studied. The party next visited the new Milwaukee tunnel, at the summit of the Cascades. Various methods employed in driving the headings, benches, and stopes, the timbering, methods of disposal of rock, and the power-plant and shops were all inspected. From this point the party traveled to Cle-Elum, Washington, for a four days' stay, visiting the various coal mines of the Northwestern Improvement Co., the Roslyn-Cascade Coal Co., and the Roslyn Fuel Co. in the Roslyn district. Time was divided between underground and surface work. The various systems of mining and drawing coal, transportation methods, ventilation, and pumping, as well as the surface equipment and power arrangements were thoroughly studied. Leaving Cle-Elum, the party drove to Liberty, a former prosperous placer camp, 20 miles east of Cle-Elum. Here the various methods of drift mining were studied in detail. Recent lode developments in the camp came in for a share of attention, in the study of prospects and deposits opened up by adit and shaft. A small stamp-mill recently installed gave opportunity for an inspection of ore treatment. On the trip Mr. Roberts gave several illustrated lectures at the different camps on the subject of 'Gold Dredging,' and Mr. Daniels on 'Recent Coal Mining Machinery and Appliances.'

The Faraday Society held its sixty-eighth ordinary meeting at the Municipal School of Technology, Manchester, England, jointly with the Manchester Section of the Society of Chemical Industry, when a general discussion on 'The Corrosion of Iron and Steel' took place. Bertram Lambert read a paper on 'An Electrolytic Theory of the Corrosion of Iron.' It was shown that a simple and natural development of the ideas of Faraday on electrolysis will give the foundation of a satisfactory theory of the corrosion of iron. Commercial iron is always heterogeneous in character, and, when a piece of this metal is put in an electrolyte like water, the electrically different parts tend to set up an electric current between them, with the passing into solution of the metal at the relatively electropositive points. Iron is practically insoluble in water. Oxygen probably plays two different functions in rusting of iron: (a) it helps the iron to pass into solution in the water by electrolytic action, probably by oxidizing the film of hydrogen at the electro-negative points, a non-conducting film which would, unless removed, reduce the strength of the current to a negligible value; and (b) the oxygen produces ferric hydroxide (rust) from the dissolved iron. The ferrous ions produced when the iron passes into solution cannot be oxidized to ferric ions by molecular oxygen. They first combine with the hydroxyl ions, always present in water, to form undissociated ferrous hydroxide, and this is then oxidized to ferric hydroxide by the oxygen. The properties of chemically pure iron were shown to give substantial support to the theory.

A lecture, illustrated by experiments and lantern slides, on 'The Electrolytic Methods for Preventing the Corrosion of Metals,' was delivered by W. W. Haldane Gee. He showed that the corrosion of metals can be lessened or prevented in two ways: (a) by connecting the metal to be protected to a more electro-positive metal, so that a primary cell is produced; and (b) by making the metal to be protected the cathode in an electrolytic cell, supplied by an external electrical pressure. The history of Sir Humphrey Davy's application of zinc and iron protection for the prevention of the corrosion of copper sheathing on ships, and subsequent inventions for the protection of condensers and pipes, were detailed. The patents of Harris and Anderson, in which aluminum alloys are used for the prevention of corrosion of condenser tubes, were shown to be primary cell methods.

A paper on 'The Nature of Over-Voltage' was read by J. T. Crabtree. It is probable that over-voltage is simply a manifestation of the difference between the rate of production of ions at the electrode, and of the combination of these to form complexes. Over-voltage may be of importance in the case of the corrosion of a metal, as either (a) having a tendency to retard the deposition of hydrogen or oxygen on its surface, which might tend to assist or prevent corrosion; (b) by setting up a high back electromotive force, which would diminish the effect of a decomposing current in cases of corrosion due to electrolysis; and (c) by assisting or preventing the solution of a metal. W. Rosenhain read a paper entitled 'Note on a Specimen of Ancient Iron from Ceylon.'

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

Howard D. Smith is in France.

J. A. Holmes is in the Oklahoma oilfields.

J. F. Kemp was in Washington last week.

Charles Janin is visiting southern France.

W. R. Calvert has been at Cushing, Oklahoma.

N. B. Knox has returned to London from Spain.

William Hague was in San Francisco last week.

R. E. Smith has joined the staff of J. P. Hutchins.

Ross B. Hoffmann is expected in San Francisco on his way from London to Alaska.

D'Arcy Weatherbe has returned to London from South America.

F. L. Sizer will be in San Francisco on May 20 and will remain about ten days.

E. Gybbon Spilsbury returned recently from Texas to New York and has left again for the West.

Forbes Rickard has resigned as consulting engineer for the company operating the Valdez Creek placer mines.

P. R. Hines has left Morenci, Arizona, for Dzanzul, Russia, where he will be with the Caucasus Copper Company.

Alexander Leggat, who has been visiting the Arizona copper mines, was in San Francisco this week on his way back to Butte.

C. R. Corning is engaged in professional work on the west coast of South America, expecting to return to New York early in June.

R. E. Cranston has been appointed chief engineer in charge of mining exploration for Breitung & Co., Ltd., and sailed for Barranquilla, Colombia, this week.

John Langton and D. B. Rushmore have been added to the committee of the American Institute of Mining Engineers that is studying the use of electricity in mines.

J. J. Martin has been appointed general manager for the Chicksan Mining Co., of West Virginia, but operating at Chicksan, Korea, in place of A. W. Taylor, who has resigned.

E. V. Daveler, recently assistant superintendent of mills for the Ray Con. Copper Co., has gone to Juneau to take charge of the experimental mill of the Alaska Gastineau Company.

C. F. Rand and Bradley Stoughton were in St. Louis early in the week in connection with the establishment of a local section of the American Institute of Mining Engineers at that place.

The Metal Markets

LOCAL METAL PRICES

San Francisco is not a primary market for the common metals except quicksilver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for sattlement on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksilver, which is quoted in dollars per flask of 75 pounds.

San Francisco, May 1.

Antimony	12—12½c	Quicksilver (flask)	41
Electrolytic Copper	16¼—16½c	Tin	52—53¼c
Pig Lead	4.75—5.70c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES

(By wire from New York.)

NEW YORK, May 1.—Copper is easier on account of weakness in the London market. Lead remains unchanged. Spelter is still pressed for sale.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
April	24	April 2	57.70
"	25	" 9	58.50
"	26	" 16	59.80
"	27 Sunday	" 23	59.77
"	28	" 30	60.56
"	29		
"	30		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	59.26	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
April	24	April 2	4.30
"	25	" 9	4.30
"	26	" 16	4.33
"	27 Sunday	" 23	4.39
"	28	" 30	4.50
"	29		
"	30		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
April	24	April 2	5.70
"	25	" 9	5.62
"	26	" 16	5.50
"	27 Sunday	" 23	5.42
"	28	" 30	5.36
"	29		
"	30		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
April	24	April 2	14.86
"	25	" 9	15.17
"	26	" 16	15.37
"	27 Sunday	" 23	15.44
"	28	" 30	15.26
"	29		
"	30		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
May	1912	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
April	1912	125,694,001	69,513,846	53,252,326
May		126,737,836	72,702,237	69,485,945
June		122,315,240	66,146,229	61,449,650
July		137,161,920	71,093,120	60,121,600
August		145,628,521	78,722,418	70,485,150
September		140,089,819	63,460,810	60,264,796
October		145,405,453	84,104,734	47,621,342
November		134,695,440	69,369,795	55,906,550
December		143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February		130,948,881	59,676,402	72,168,623
March		136,251,849	76,585,471	77,699,306

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
April	2	April 16	41
April	9	April 23	41
		April 30	41

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	....	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.63	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

The Nova Scotia Steel & Coal Co. has secured a contract to deliver a large amount of high-grade iron ore to the Krupp firm of Essen, Germany, for use in the armament works. There has for some time been a steadily increasing demand for this ore in the European as well as the American markets and the company expects to export over 500,000 tons this year. The same company has discovered a new coal seam of high quality in its territory adjacent to Sydney Mines. There is a shortage of labor which at present restricts production and they are seeking to secure 1500 more men.

New York Metal Market Review

Copper alone was active in the period from April 1 to 24. It was taken liberally in the early part of the month by both American and foreign consumers, causing prices to advance and firmness to prevail. Lead was advanced 15 points to 4.50c. New York, late in the month, despite the lack of any notable activity. Spelter has declined and been unsatisfactory generally. Antimony was dull and lower. High prices resultant from speculation in London have prevailed for tin, but domestic consumers, not having faith in the market, have kept out of it. Aluminum weakened a little, but is otherwise unchanged. General business affiliated with the metals showed in April an increasing amount of apprehension over results which might follow tariff readjustments and a consequent tendency to wait and "see how things go."

COPPER

Near the close of March, buying started in good volume, gathering momentum which caused it to last well into April. Large quantities were taken by both domestic and foreign consumers, with deliveries for April and May the heaviest. With the activity came better prices, and in the four last days of March, prices advanced about 12½c. per day, until on April 1 the quotation for electrolytic stood at 15.12½c. cash, New York and Lake at 15.37½c. cash. Following a further advance, all but two agencies selling electrolytic on April 5 raised their prices ⅛c., to 15.50c. cash, leaving only two interests offering at 15.37½c. cash, while Lake had mounted to 15.62½c. cash. At this time a shortage developed in Lake because of the fact that stocks had been nearly exhausted by the heavy trading. The report of the Producers' Association for March, issued April 8, had a strengthening effect on the market, though it did not cause any renewed flurry of buying, and by the middle of the month conditions were quiet again, but with prices higher and stiff at 15.75c. cash for Lake, and 15.50c. cash for electrolytic, and the matter of buying was not nearly so much of a problem as was the obtaining of deliveries. The third quarter of the month saw the market still firm at 15.75c. cash for Lake, and 15.62½c. cash, New York, for electrolytic despite the absence of any real business. Near the end of the month Lake copper sold for export on a basis of 16c. delivered abroad. The exports up to April 25 were 30,960 tons. The average price paid for copper in the Naugatuck valley in March was 15.12½ cents.

LEAD

During the greater part of April lead was without interesting feature, quotations standing at 4.35c. New York and 4.20c. St. Louis, from April 1 to 23, when the A. S. & R. Co. advanced its price 15 points, to 4.50c. New York. It had been felt by the trade that the price of lead should advance, and it probably would have done so sooner were it not for the approaching announcement of a proposed new tariff rate. When this came and it was seen that the rate specified in the new bill was 25% *ad valorem*, the advance followed shortly after. The new duty, it was seen, would prohibit any soaring of prices, yet would not interfere with higher prices than had been prevailing. The first effect of the tariff announcement was a hardening of price and advance of about 2½ points in St. Louis. At no time was there any exceptional business, although there was some fairly good buying at times. Abroad lead advanced steadily until April 23, when it was quoted in London at £18 per ton.

SPELTER

Throughout April the spelter market was unsatisfactory. Since the last monthly report prices have steadily declined. April 1 they stood at 5.90c. New York and April 23 at 5.60c. New York, and correspondingly low in St. Louis. In this entire period business was lacking almost entirely, and the words "dull and weak" were constantly heard. The downward tendency was helped along about the middle of the month by offerings at considerably below the ruling market figure. While large quantities were being consumed by both brass mills and galvanizers, it consisted of metal being delivered under contract and did not mean new business. Toward the end of the month sellers of the higher grades were not anxious to sell at the ruling prices, and in some cases withdrew from the market. Meanwhile manufacturers of sheet zinc reduced their price ¼c. per pound.

ANTIMONY

This metal was dull and listless from April 1 to almost the end of the month. Prices underwent no change, with Cookson's quoted at 9c., Hallett's at 8.50c., and Chinese and Hungarian grades at 7.50 to 7.62½c. April 24 found deliveries still heavy under old contracts and prevailing quotations below the import cost.

TIN

There was not much action locally in tin in April. Early in the month the erratic behavior of the metal in London, which is a frequent characteristic, caused a lack of confidence in the domestic market. Some idea of the London fluctuation may be gained from the fact that on April 14 the price in London advanced £6 10s. and dropped £2 10s. the following day, all of which was attributed to heavy buying by a large London house and efforts on the part of bear operators to cover short contracts. On April 14 the metal touched 50c. in New York and it hovered between that price and 49.75c. until April 23. In the third quarter of the month the market became so dull as to be described as "stagnant." Of course, the quietness might have been expected to a considerable extent because of the heavy buying and shipment into consumption in March. In this connection it may be stated that in the March report, it was said "there is some doubt as to the ability of consumption to absorb 5900 tons of the metal in one month." It later transpired that actual consumption in March was not as large as reported, despite official figures, by probably 500 tons. Buying was heavy, it is true, but some of the metal went into warehouses for future use. Some say openly that a trick was played. With tin so high in London and no tendency to buy on this side, quotations ranged ½c. below import cost, a condition which would not last long with any good demand. The arrivals to April 25 were reported as 2730 tons and there was afloat at that time 2750 tons. The lowest prices of the month to April 23 were 47.45c. and the highest 50.10 cents.

ALUMINUM

Aluminum was slightly weaker from April 1 to 23, at 26.75c. to 27c. for No. 1, guaranteed over 99% pure in ingots for remelting. For 100-lb. lots the prices ranged up to 33c. All deliveries were quoted the same.

Joplin Ore Market

At the close of April, zinc sulphide ores in the Missouri-Kansas-Oklahoma district sold for $38 to $44 per ton, assay basis of 60% metallic zinc. Choicer grades brought a premium and sold for as high as $47. These prices were $4 per ton below those that prevailed at the close of March. At the close of April 1912, the basis range was $50 to $54, with a top price of $56 for choicer lots. This district is now turning out approximately 5800 tons of sulphide zinc ore per week and 350 tons of calamine. Lead ore prices are better at $53 to $54 per ton than they have been in several weeks. Pig lead is stronger at $4.40, East St. Louis quotations.

The United States Steel Corporation, April 29, declared its regular quarterly dividends of 1¼% on the common and 1¾% on the preferred stock. The earnings of the corporation for the quarter that ended on March 31 were $34,426,801; the net income for the quarter, $25,696,509; and the surplus, $7,369,500.

The Bunker Hill & Sullivan M. & C. Co. will pay, Saturday, May 3, 1913, dividend No. 188 of $65,400. This makes the total amount of dividends paid $14,238,750.

Nevada Wonder M. Co. will pay its initial dividend of 10%, on May 20.

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb	0.10	0.20
Borax, cryst. and conc., bags, ℔ 100 lb	3.00	4.35
Borax, powdered, bbl., ℔ 100 lb	3.38	4.50
Borax glass, gd. 30 mesh, cases, tin lined, ℔ 100 lb	10.50	13.50
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb	5.50	6.50
Bromine, 1-lb. bottle, ℔ lb	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb	9.50	10.00
Lead acetate, white, broken casks, ℔ 100 lb	10.50	10.75
Lead acetate, white, crystals, ℔ 100 lb	12.50	12.75
Lead, C. P., test., gran., ℔ 100 lb	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb	11.50	13.50
Litharge, com'l, ℔ 100 lb	8.00	9.50
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—½% Fe)	36.00	47.50
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb	7.50	9.00
Potassium permanganate, drum, ℔ lb	0.10½	0.13
Silica, powdered, bags, ℔ lb	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb	3.15	3.50
Soda, caustic, solid, 98%, drums, ℔ 100 lb	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb	11.55	13.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb	9.75	11.00

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ℔ ton	*$22.00	$25.00
Arsenic, white, refined, ℔ lb	0.04½	0.04¾
Arsenic, red, refined, ℔ lb	0.08	0.09
Asbestos, according to length and quality of fibre ℔ ton	100.00	350.00
Asbestos, lower grades, ℔ ton	5.00	50.00
Asphaltum, refined, ℔ ton	10.00	20.00
Barium carbonate, precipitated, ℔ ton	42.50	45.00
Barium chloride, commercial, ℔ ton	42.50	45.00
Barium sulphate (barytes), prepared, ℔ ton	20.00	30.00
Bismuth ore, 10% upward, ℔ ton	*75.00	upward
Chrome ore, according to quality, ℔ ton	10.00	12.50
China clay, English, levigated, ℔ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ℔ lb	2.50	
Coke, foundry, ℔ 2240 lb	14.50	15.00
Diamonds:		
Borts, according to size and quality, ℔ carat	2.00	15.00
Carbons, according to size and quality, ℔ carat	55.00	90.00
Feldspar, ℔ ton	5.00	25.00
Firebrick:		
Bauxite, ℔ M	175.00	
Magnesite, ℔ M	190.00	275.00
Silica, ℔ M	42.50	47.50
Flint pebbles for tube-mills, ℔ 2240 lb	19.50	22.50
Fluorspar, ℔ ton	10.00	15.00
Fullers earth, according to quality, ℔ ton	20.00	80.00
Gilsonite, ℔ ton	35.00	40.00
Graphite:		
Amorphous, ℔ lb	0.01½	0.02½
Crystalline, ℔ lb	0.04	0.13
Gypsum, ℔ ton	7.50	10.00
Infusorial earth, ℔ ton	10.00	15.00
Magnesite, crude, ℔ ton	5.00	7.50
Magnesite, dead calcined, ℔ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ℔ ton	10.00	25.00
Manganese, prepared, according to quality, ℔ ton	30.00	70.00
Mica, according to size and quality, ℔ lb	0.05	0.30
Molybdenite, 95% MoS_2, ℔ ton	400.00	450.00
Monazite sand (5% thoria), ℔ ton	150.00	200.00
Nickel metal, refined, ℔ lb	0.45	0.60
Ochre, extra strength, levigated, ℔ 100 lb	2.25	3.25
Platinum, native, crude, ℔ oz	40.00	45.00
Silex lining for tube-mills ℔ 2240 lb	32.50	35.00
Sulphur, crude, ℔ ton	20.00	25.00
Sulphur, powdered, ℔ ton	40.00	45.00
Sulphur, 80%, ℔ ton	16.50	18.50
Talc, prepared, according to quality, ℔ ton	20.00	50.00
Tin ore, 60%, ℔ ton	475.00	500.00
Tungsten ore, 65%	450.00	600.00
Uranium ore, 10% min.	25.00	per unit
Vanadium ore, 15% V_2O_5, ℔ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ℔ ton	*15.00	20.00

*Extra charge for packing nitric acid for shipment to conform to regulations.

The Stock Markets

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	May 1. Bid	May 1. Ask
Adventure	$ 1⅞	2
Allouez	31½	32
Calumet & Arizona	63	63½
Calumet & Hecla	455	460
Centennial	12½	13½
Copper Range	41½	42
East Butte	11⅝	12
Franklin	6	6¼
Granby	81½	62
Greene Cananea	6⅞	7
Hancock	18	19
Isle-Royale	22½	23
Mass Copper	3	3½
Mohawk	$ 50	—
North Butte	28½	28¾
Old Dominion	45½	47
Osceola	83	84
Quincy	67	68
Shannon	9⅞	10
Superior & Boston	3	3½
Tamarack	27½	28
U. S. Smelting	38¾	39
Utah Con	7½	7¾
Victoria	1	1½
Winona	2	2½
Wolverine	50	51

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 1.

Atlanta	$ .14	Mizpah Extension	$ .70
Belmont	5.75	Montana-Tonopah	1.70
Big Four	.80	Nevada Hills	1.05
Buckhorn	1.05	North Star	.62
Con. Virginia	.17	Ophir	.21
Florence	.40	Pittsburg Silver Peak	.56
Goldfield Con	1.95	Round Mountain	.59
Halifax	1.20	Sierra Nevada	.25
Jim Butler	.95	Tonopah Extension	2 25
Jumbo Extension	.23	Tonopah Merger	1 02
MacNamara	.19	Tonopah of Nevada	5.65
Manhattan Consolidated	.07	Union	.08
Mexican	.76	West End	1.50
Midway	.53	Yellow Jacket	.24

LONDON QUOTATIONS

(By cable, April 30, through the courtesy of Catlin & Powell Co., New York.)

	£	s.	d.		£	s.	d.
Camp Bird	0	17	6	Alaska Treadwell	8	12	6
El Oro	0	15	0	Alaska Mexican	2	10	0
Esperanze	1	6	3	Alaska United	4	15	0
Mexico Mines	5	17	6	Stratton's Ind	0	2	0
Oroville Dredging	0	7	6	Arizona Copper	1	18	9
St. Gertrudis	0	6	3	Rio Tinto	78	10	0
Tomboy	0	16	8				

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, April 30.

Associated Oil	$40.50	Orcutt	$ .55
Caribou	.90	Palmer Union	.18
Claremont	.60	Premier	.28
Coalinga Central	.20	Republic	.15
De Luxe	.50	Sterling	1.00
Maricopa 36	.33	United Oil	.34
Monte Cristo	.50	W K Oil	2.22
New Pa Pet	.45		

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

May 1.

	Bid.	Ask.		Bid.	Ask.
Alaska Mex.....	11	12	Mason Valley...	6	7
Alaska Tread...	40¾	42¾	McKinley-Dar. .	1⅞	2
Alaska United..	20⅜	22⅜	Miami 6s 168		173
Alaska G. M....	10⅝	10¾	Mines Co. Am..	2½	2⅝
Braden Copper..	74	75	Nipissing	8¾	8⅞
B. C. Copper....	2⅜	2⅞	Ohio Copper....	¾	⅞
Davis Daly.....	2¼	2½	San Toy.....	19	21
Dolores	2	4	Sioux Con.....	2	5
El Rayo	1	2	S. W. Miami....	5	7
First Nat.....	2¼	..	So. Utah .....:	¼	⅜
Giroux	2⅜	3	S. O. Calif.....179		181
Green-Can.	6¾	7	Tri Bullion	⅛	¼
Hollinger	17	17⅛	Tuolumne	2	2⅛
Inspiration	18	..	United Copper..	½	⅞
Iron Blossom...135		142	Wettlaufer	14	16
Kerr Lake.....	3⅛	3¼	Yukon Gold.....	2¼	2⅝
La Rose	2⅛	2¼			

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, April 30.	Unlisted.	Closing prices, April 30.
Associated Oil 5s.....101		Natomas Dev. 6s.....	99¾
E. I. du Pont 4½s.....	93½	Pac. Port. Cem. 6s.....	99
Natomas Con. 6s.....	94¾	Riverside Cem. 6s.....	77
Unlisted.		Standard Cem. 6s.....	91⅝
Associated Oil 1st ref..	90	Santa Cruz Cem. 6s....	85⅝
General Petroleum 6s..	59¾	So. Cal. Cement.....	78

STOCKS.

Listed.	Closing prices, April 30.	Unlisted.	Closing prices, April 30.
Associated Oil	40¾	Mascot Copper	2
Amalgamated Oil	87½	Noble Electric Steel....	15
E.I. du Pont Powder pfd.	90	Natomas Consolidated..	8
Pac. Coast Borax, pfd..100½		Pac. Coast Borax, old..206	
do com.	80	Pac. Portland Cement..	59
Pac. Crude Oil.....	35c.	Riverside Cement.....	55
Sterling O. & D.....	1.00	Standard Cement	17
Union Oil of Cal.....	91½	Standard Oil of Cal....187	
West Coast Oil, pfd....	70	Santa Cruz Cement....	30

THE CURB MARKET

The listing committee of the New York Stock Exchange has decided to strike the shares of the Goldfield Con. from the Stock Exchange list unless the transfer requirements of the Exchange are met on or before June 16. The outside mining market lost its leader when Goldfield "went inside." Under the present market conditions, it is rather a matter of doubt whether the outside mining market will now gain anything by the return of its former market leader. The followers of mining-share markets in New York are adding their fervent prayers to the wishes of the prospectors who are going into the new camp of Platoro in Colorado. It is universally recognized throughout the East, especially since conditions in Mexico have been so much unsettled, that nothing would revive interest in mining shares and mining ventures as would the discovery of a new district. An untried but promising new field would do more to enlist new followers than the payment of dividends by the properties that have been two or three years in the making.

UNITED STATES STEEL

The U. S. Steel Corporation reported a decrease of 187,000 tons in unfilled orders for March. Production has been at over 90% of the corporation's capacity, and since the first of the year there has been a material decrease in the volume of business as compared with that taken during the closing months of 1912. At that time incoming business was at the rate of 55,000 to 65,000 tons per day, while for the past several weeks the average has been about 38,000 tons per day. New business is now picking up and steel trade authorities anticipate better demand during the next few weeks. It is not expected at this time that the next unfilled tonnage statement will show as large a decrease as the March report. Earnings for the quarter that ended on March 31, amounting to $34,426,801, although slightly less than for the preceding quarter, were nearly double those for the corresponding period in 1912.

Book Reviews

REPORT OF THE STATE WATER COMMISSION OF CALIFORNIA, 1912. Pp. 74. 32 map-profiles in pocket. Sacramento, 1913.

The State Water Commission, consisting of C. D. Marx, S. C. Graham, H. T. Power, and W. F. McClure, succeeded on March 24, 1912, the State Board of Control, Water Power, and in connection with the State Conservation Commission has been engaged in planning a system for control and use of water in California. The need for such a system is indicated by the following extract from this report:

"The Board of Control, Water Power, made a complete record of all water filings for power purposes on each and every stream in the state of California. Examinations by the engineers of the Board disclosed the fact that fully 90% of the filings made in accordance with the old method of the location of water filings were not made in good faith, and that practically nothing whatever had been done by these water claimants toward the development of the streams on which they had filed. Many of these speculative filings have been the cause of much litigation, because when attempt is made by *bona fide* claimants to actually develop water power, they are compelled either to buy off the speculator or have his filing declared by the courts to be invalid. Judicial proceedings are expensive and naturally require much time before being finally determined. hence, in order to avoid delay, a person desiring to really make a power development usually purchases the mere water rights of the speculator. Since capitalists are loth to invest where they are immediately confronted with expensive litigation, they become discouraged and indignant, so that the project is abandoned, and as a result the water not only continues to remain unused, but also the state's commercial progress is retarded, and many are deprived of the employment and benefits that necessarily arise in the development of water power. Under the law creating this Commission, speculative filings are impossible."

The Commission discusses the present unsatisfactory status of the federal laws and regulations regarding use of water on public lands. It also presents the result of preliminary studies of the American, Pit, Feather, Tuolumne, and San Joaquin rivers as regards power, and of the storage possibilities of the Sacramento basin. The engineering work upon which the report is based was done by the United States Geological Survey in coöperation with the Commission and excellently illustrates how much can be obtained with small expenditure when right methods are employed. While the results are carefully specified to be preliminary, they are startling as indicating the amount of power probably available and now unused. The available power on Pit river, for example, on a basis of 70% efficiency, is estimated at 412,500 hp. without and 650,960 with storage. Incidentally, the Original M. & M. Co. is now developing power on Merced river under license of the Commission and is thus among the pioneer power-users in coming under the new system.

Recent Publications

SOUTH AFRICAN ENGINEERING STANDARDS COMMITTEE PUBLICATIONS, Johannesburg: 'Standardization of Coal Sampling,' P. 12; 'Standardization of Coal Analysis,' 'Determination of Calorific Value, and Standardization of Sizes of Coal,' P. 13; 'Lime—Standardization of Methods of Sampling and Determination of Available Alkalinity,' P. 4.

MINING SCIENCE. Edited by Charles T. Downey. P. 68. Ill. Denver, Colorado, April 1913. This technical journal is now issued monthly instead of weekly as heretofore. The first number in its new dress is quite interesting, editorials covering 11 pages with illustrations, discussion 4 pages, a review of the work of the American Mining Congress, a good number of reviews of papers, metal markets, and general mining news; in all, a readable production.

Company Reports

RAY CONSOLIDATED COPPER COMPANY

This company has mines at Kelvin, Pinal county, and a concentrating plant at Hayden, Gila county, Arizona, and the report of the president, S. Aldrich, is as follows:

During the last quarter of 1912 the average daily ore production was 5602 tons, and mining costs were 71.05c. per ton, as against the average of 77.5c. for the full term. The ore treated averaged 1.67% copper, and mill recovery was 68.27%, as against 63.01% in 1911, at a cost of 46.87c. against 59.45c. per ton. The average price received for copper was 15.76c. per pound, and the cost was 9.83c., inclusive of a charge of 12.5c. per ton of ore for extinguishment of prepaid development charge. It is expected that 8000 tons per day will be treated during 1913, which should considerably lessen operating costs. The general manager, D. C. Jackling, states that no work was done for the purpose of opening additional ore reserves, and therefore no changes have been made in developed tonnage, save in additions from the purchase of the Ray Central mine. Reserves now total 82,904,368 tons averaging 2.19% copper. The year's results are as follows:

Operating revenue:		
Copper produced	$ 5,467,296	
Silver produced	8,268	
		$ 5,475,565
Operating expense:		
Mining and milling	1,992,806	
Freight and treatment	1,455,155	
Selling commission	55,372	
Extinguishment	158,025	
		3,661,359
Net operating profit		$ 1,814,206
Miscellaneous income		296,755
Total income		$ 2,110,961
Interest on bonds, etc.		181,699
Net profit for year		$ 1,929,262

Balance-sheets for the past two years compare as follows:

ASSETS

	Dec. 31, 1912.	Dec. 31, 1911.
Property	$ 8,926,606	$ 7,903,383
Construction and equipment	5,478,429	4,611,440
*Development	3,024,612	2,120,490
Outside investments	1,075,000	1,025,000
Treasury stock	500	500
Prepaid insurance and other expenses	11,818	22,542
Materials and supplies	478,730	435,138
Accounts receivable	63,942	81,643
Copper in transit	770,304	778,256
Cash	560,587	60,013
Total	$20,390,531	$17,038,409

LIABILITIES

Capital stock	$14,473,520	$11,991,750
First-mortgage bonds	3,000,000	3,000,000
Notes payable	.....	950,000
Accounts payable	134,444	168,761
Treatment charges (not yet due)	224,932	294,918
Reserves for insurance, etc.	76,860	75,200
Surplus (from sale of securities)	252,871	259,137
Undivided profits	2,227,902	298,640
Total	$20,390,531	$17,038,409

*After deducting extinguishment charges.

CHINO COPPER COMPANY

This company operates mines and a concentrator in Grant county, New Mexico, and the report covers the year ended December 31, 1912. The report of the president, C. M. MacNeill, shows that when the last statement was made, ore reserves totaled 55,000,000 tons averaging 2.24% copper, while the quantity at the end of the year was 90,000,000 tons containing 1.8% copper. Construction work has almost ceased, and the mill, designed to treat 5000 tons per day, is now dealing with 6000 tons. The gross production of copper was 29,237,966 lb., of which 27,776,088 lb. was sold at an average price of 15.64c. per pound, the total cost being 7.69c. per pound. With present equipment, there should be no difficulty in producing 65,000,000 lb. per year. The general manager, D. C. Jackling, stated that of the tonnage developed in the mine, about 90% will be available for steam-shovel mining, against previous estimates of 60% by that method. Deferred charges for the year, due to stripping operations, amounted to nearly 1c. per pound of copper produced in concentrate, notwithstanding that stripping removed was equivalent to uncovering about 3½ times the amount of ore actually mined. A charge of 30c. per ton of ore produced is now made against operations to cover stripping expenses. Practically all the ore treated was mined by steam-shovel, and no underground work will be necessary for years. There was treated 1,120,375 tons of ore, averaging 2.07% copper, with a recovery of 61.63%, but in 1913 this has been increased to 70%. Average milling costs were 58.57c. per ton, but are now below 50c. per ton.

The income account shows the following:

Operating revenue		$ 4,344,261
Operating expense:		
Mining and milling	$858,108	
Treatment, refining, and freight	942,231	
Selling commission	43,759	
Stripping	287,992	
		2,132,092
Net operating profit		$ 2,212,169
Miscellaneous income		125,133
Total income		$ 2,337,302
Less bond and note interest		160,397
Net income		$ 2,176,904

A comparison of balance-sheets is as follows:

ASSETS

Property and plants:	1912.	1911.
Original purchase price	$ 1,802,795	$ 1,802,795
Additions:		
Construction and development	4,646,930	3,359,061
Mining property purchased	110,921	107,007
Total expenditure for property and equipment	$ 6,560,636	$ 5,268,863
Investments	118,540	112,680
Deferred charges to operation:		
Stripping expense	867,382	541,417
Organization expense, commission to bankers, interest, etc.	.....	293,944
Materials and supplies on hand	375,119	251,827
Accounts receivable	136,688	22,911
Prepaid insurance	3,451	2,029
Value of copper on hand and in transit	1,988,213	131,231
Ore in mill-bins	3,328	2,873
Ore at mine dump	95,518	66,991
Cash	336,979	48,912
Total	$10,485,859	$ 6,743,687

LIABILITIES

Capital stock outstanding	$ 3,887,100	$ 3,500,000
First-mortgage bonds	2,314,500	2,500,000
Notes payable	.....	200,000
Accounts payable, taxes, etc.	241,906	126,609
Freight, treatment and refining charges not yet due	337,899	32,631
Surplus (from securities)	1,243,102	99,000
Profit and loss	2,461,350	284,445
Total	$10,485,859	$ 6,742,687

INSPIRATION CONSOLIDATED COPPER COMPANY

This company was formed in December 1911 to acquire the properties of the Inspiration Copper Co. and Live Oak Development Co. in Gila county, Arizona. The authorized capital is 1,500,000 shares, of a par value of $20 each, of which 722,943 have been issued. On January 6, 1912, the company offered to all stockholders on record on February 1 convertible bonds amounting to $6,000,000, which were entirely subscribed for. The proceeds of this bond issue are being used for mine development and construction of a concentrating plant of 5000-ton daily capacity, which should be in full operation at the end of 1914. A sinking fund has been provided for the bonds as follows: From the beginning of 1916 to the end of 1918 the sum of 10c. and from the beginning of 1919 till the mortgage is fully discharged, the sum of 20c. for each dry ton of ore treated. Details of work at the properties during the year ended December 31, 1912, are discussed in the report of C. E. Mills. The mines secured from the Inspiration and Live Oak companies consist of 972 acres, about 9 miles from Globe, while a group of claims were acquired from the Warrior Copper Co. which were necessary for the mill and tailing dumps. The original estimates of ore reserves in certain parts of the mine have been checked with satisfactory results. Details of technical performance were given last week.

NEVADA CONSOLIDATED COPPER COMPANY

This company owns considerable property at Ely, and operates a mill and smelter at McGill, White Pine county, Nevada. The report recently issued covers work during the year ended December 31, 1912. The technical features of the year's work, as discussed by Pope Yeatman, are reviewed on another page.

The report of S. W. Eccles, the president, states in part that the year's production was 63,063,261 lb. of copper, which was sold at an average of 15.97c. per pound, compared with 12.50c. in the last period. The cost was 8.33c. per pound of electrolytic refined copper f.o.b. Atlantic seaboard, including the amount paid the Steptoe Valley Smelting & Mining Co. for plant depreciation, and all other charges with the exception of ore extinguishment, which latter is a direct charge to undivided profits. Continuing the policy of past years, there has been carried to deferred charges to operation, the amount spent on stripping, namely, $1,077,937, less $457,223, which was absorbed in operating costs. A comparison of results of the past two reports is as follows; that for 1911 covering 15 months:

	1912.	1911.
Sales of copper	$10,076,872	$ 9,818,261
Gold and silver produced	521,277	595,185
Total gross income	$10,598,150	$11,403,447
Operating expenses	7,316,230	7,693,492
Net operating profit	$ 3,281,919	$ 2,719,954
Div. in invest., interest on bonds	1,541,920	1,624,162
Total income	$ 4,823,839	$ 4,344,117
Maintenance Cumberland-Ely property	.....	7,980
Net profits available for dividends	$ 4,823,839	$ 4,336,216
Dividends	2,999,137	3,746,894
Balance	$ 1,824,702	$ 589,322
Undivided profits end previous year	1,828,782	1,872,807
Total	$ 3,653,484	$ 2,462,129
Ore extinguishment	481,306	633,347
Total undivided profits	$ 3,172,178	$ 1,828,782

The combined balance-sheet at December 31, 1912, of the Nevada Consolidated Copper Co., Steptoe Valley S. & M. Co., and Nevada Northern Railway Co., compares with 1911 as follows:

ASSETS

	1912.	1911.
Property, equipment, and construction	$16,748,381	$17,077,330
Deferred charges to mining operations	2,738,075	2,117,361
Material and supplies on hand	684,333	697,963
Accounts collectable, prepaid insurance, etc.	629,531	436,217
Stocks and bonds of other companies	23,000	143,696
Metals on hand and in transit	2,886,660	2,515,808
Cash and cash items	958,780	562,395
Total	$24,668,761	$23,550,774

LIABILITIES

Capital stock outstanding (Nevada Con. only)	$ 9,997,285	$ 9,996,970
Bonds outstanding (Nevada Con. only)	500	500
Surplus (amount realized from securities in excess of par value)	8,071,578	9,070,360
Accounts payable (not due)	658,827	585,781
Unpaid treatment on metals (not due)	334,664	361,791
Deferred accounts	25,499	27,088
Reserve accounts for depreciation	2,102,723	1,376,810
Undivided profits	3,477,683	2,131,471
Total	$24,668,761	$23,550,774

RIO PLATA MINING COMPANY

This company operates in the state of Chihuahua, Mexico, and the report is for the year ended November 30, 1912. The president, H. W. Miller, states that the year's results were satisfactory, considering the conditions under which the company worked. The country was greatly disturbed, labor was scarce, and it was difficult to get supplies to the district. At the beginning of the year the mine was in a poor condition, but production was 291,969 oz. of silver bullion, which gave a net profit of $82,054. A dividend of $37,392 was paid, and at the end of the fiscal year the surplus stood at $192,139. Total production to date is 3,979,479, which gave a profit of $907,853 and dividends of $327,018. The company has had about 12 mines examined by various engineers, and one is now being negotiated for in the United States. The company controls the Trinity Consolidated Hydraulic Mining Co., California, and a report is soon to be issued.

The general manager, D. W. Shanks, reported that work was done on both the Santa Barbara and La Ultima claims. Prospecting in the latter proved that the chlorides and bromides of silver found near the surface were only superficial enrichments, and cut out at depth. Work was discontinued at this property. Development on the Santa Barbara vein between A and La Obra levels opened considerable ore, and sinking from the San Antonio adit, two lenses produced 1600 tons of 60-oz. ore. Two cross-cuts are being driven east and west from this level. Above the San Antonio level, a branch vein was found in the San Gonzalo level, and the drift shows 3 ft. of 10-oz. ore. A winze sunk 150 ft. below La Obra level was disappointing, but from the cross-cut on this level the drift shows 2½ ft. of 10-oz. ore.

The total of all mining costs, including hoisting, sorting, and tramming, amounted to $2.67 per ton. Results were as follows:

Ore treated, tons	6,175
Average value, ounces	52.4
Production from concentrate, ounces	57,531
Production from cyanide, ounces	234,432
Recovery, per cent	90.0
Total cost per ounce recovered, cents	17.5
Total current assets	$205,627
Total current liabilities	24,579

The report contains an exceptionally detailed statement of accounts.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

RAILWAY TUNNELS in New York City have a total length of 78 miles.

ASBESTOS is not mined on a commercial scale in Arizona, though deposits of probable value have been reported.

OIL used by locomotives of the Southern Pacific system in California, Oregon, Nevada, and Utah amounts to 9000 bbl. per day.

EARNINGS from transportation of inhabitants of cities by electric car systems have been found to quadruple as the population doubles.

POTASH SALTS exported from Germany during 1912 amounted to 1,721,079 tons, of which 890,610 tons was sent to the United States.

DEATH RATE per 1000 men employed in Queensland metalliferous mines in 1912 was 2.45; in coal mines, *nil*; and in all departments, 1.92.

OIL used per ton mined at the Copper Queen mines in 1912 was 3.99 gal., and the evaporation of water in the boilers per pound of oil was 15.68 pounds.

GALENA, PbS, has been found to act similarly to other lead salts used in cyanidation, provided the pulp contains enough oxidizer to reduce it to the sulphate form.

PLACER GRAVELS of California are best described in 'Tertiary Gravels of the Pacific Slope,' by Waldemar Lindgren, Monograph 73, of the United States Geological Survey.

SMOKESTACKS for the Calumet & Arizona are to be of steel, and brick lined, 20 ft. diam. by 279 ft. high, and 25 ft. diam. by 305 ft. high, for the roasting and blast-furnace departments, respectively.

TEMPERATURES in quicksilver furnaces vary from 1600° to 2100°F. There is no particular metallurgical harm in maintaining a higher temperature, provided sufficient condensing space is provided. The higher the temperature, however, the more difficult the condensing problem becomes.

AIR-BLASTS in the Kolar goldfield, India, during the year ended June 1912, killed 41 men, the Champion Reef mine reporting 406 blasts which killed 21 miners. Air-blasts have frequently occurred on the Rand, and recently one caused by falling capping at the Miami mine in Arizona resulted in several deaths.

ANALYSES of certain of the Pacific Coast kelps, according to E. G. Parker and J. R. Lindemuth, showed the following salts: potash (K_2O), 3.20 to 31.62%; iodine, 0.13 to 0.30%; nitrogen, 0.54 to 2.72%; soluble salts (Na, K, Cl, SO_4), 13.95 to 63.75%; organic matter, 37.40 to 79.66%; ash, 2.22 to 9.40%; and KCl, 5.06 to 50.05 per cent.

OLD COANISH OR LANCASHIRE BOILERS, with the fire-tubes and one end cut off, the other having the hole plated over, a chute and door fitted on, and the whole placed on end on a framework of suitable height, make excellent storage bins for small mines. Head-frames are generally high enough to allow of a short tramway being laid to the top of such bins. An old boiler, about 6 by 20 ft., should hold nearly 30 tons of broken ore.

EXTENSIVE FIELD of operations does not always mean greater earnings for a corporation over that of one operating in a more limited field, as is to be seen in comparing the annual reports of the American Smelting & Refining Co. and the United States Smelting, Refining & Mining Co. for 1912. The former had a net income of $15,349,966, and the latter $5,497,965. Earnings on common stock were $10.50 and $7.20 per share, respectively, while earnings on the market price of stock were 15 and 18%, respectively.

EFFICIENCY of anthracite coal miners in Pennsylvania, according to the 1911 report of the Department of Mines, is as follows:

	1910.	1911.
Miners employed	43,651	45,324
Days worked	212	234
Total miners' working days	9,254,012	10,605,816
Coal production, tons	74,717,852	81,176,050
Average per miner, tons per day	8.07	7.65

The decrease is attributed to the laxity with which miners' certificates are issued to foreigners who cannot speak or understand English, and with whom intelligent men are unwilling to work. Suspensions and strikes are costly to mine-workers, but this is apparently not considered.

MINING COSTS at the Stewart mine, Idaho, during the six months ended December 31, 1912, were as follows:

	Cost per Ton		
Labor:		Machinery, including drills	$0.06
Superintendent, foremen, surveyor	$0.04	Sundry supplies, freight	0.12
Other labor	1.25	Electric power	0.06
Total labor	$1.29	Total supplies	$0.50
Supplies:		Total mining	$1.79
Candles	$0.01	Development, 100,043 tons	0.36
Explosives	0.06	All mine costs	$2.15
Timber	0.19		

WHETHER the viscosity of a colloidal solution is independent of the size of the colloidal granules is a debatable question. Methods of measuring the size of the particles as described by Victor Henri are as follows: (1) Using the ultra-microscope, which is only applicable on the assumption that the visible colloidal particles contain all the matter precipitated from the solution, which is not often the case; (2) Perrin's method, based on the assumption that the distribution of colloidal particles varies with the depth of the solution, following a logarithmic law; (3) by measuring the Brownian movements, and apply the laws of Stokes and Vant' Hoff; (4) measuring the velocity of falling colloidal particles; (5) measuring the rate of diffusion, which is inversely proportional to the radius of the particles; and (6) by optical methods. Only No. 2 and 6 methods are applicable to exact determinations of size, because only in these cases is there a considerable influence of the size on measurements made. If accurate results are desired, the simultaneous employment of several of these methods is recommended.

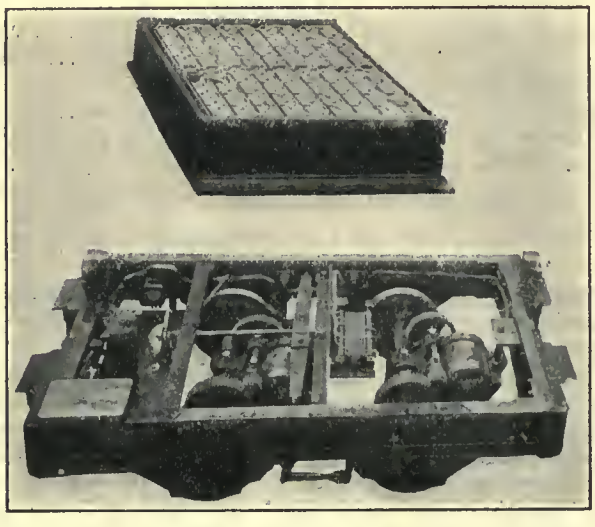
SHAFT-SINKING RECORDS are made occasionally in different mining districts of the world, but in any comparison of time taken to go a certain distance, there are several points to be considered, such as: character of rock, vertical or incline shaft, style and quantity of timbering, water to be handled, size of shaft, hoisting appliances, and hand or machine drills used, and whether ore is being hoisted from the same shaft in which sinking is being done. In sinking two shafts at the Brakpan mine, on the Rand, each 36 by 6½ ft. in the clear, the average speed was 126 and 152 ft. per month. This was beaten at the Modder Deep and the State Mine, where the greatest footage ever attained in a vertical shaft with machine-drills was 168 ft. per month. One mine at Kalgoorlie, direct sinking in greenstone to 1000 ft. depth, a shaft 5 by 14 ft. within timbers, with three machines and 18 men per 24 hours, was sunk about 110 ft. per month including timbering. At Ora Banda, near Kalgoorlie, a shaft 8 by 13 ft., was sunk 330 ft. in kaolin and schistose country at an angle of 27°, in ninety 8-hour shifts, using a 2-ton skip, and no timbering.

Storage-Battery Locomotives in Mines

A novel and at the same time one of the latest applications of the storage-battery electric haulage locomotive is for gathering work in coal mines. One of these machines, manufactured by the General Electric Co., was recently installed in the Glendower colliery of the Philadelphia & Reading Coal & Iron Co. The locomotive is designed specially for the service and built for hauling six trailers, and is described by the builders as follows.

Electric locomotives of both the storage battery and overhead trolley types, designed for carrying the load as well as hauling loaded trailers, have been employed advantageously for industrial service. Comparatively recently a number of machines of the storage-battery haulage type were also introduced and have operated successfully in the work of excavating the Catskill aqueduct tunnel in New York. In general, locomotives of this latter type are designed specifically for short-distance hauls at moderate speeds where it is not feasible to install the overhead trolley system. Under these conditions, the storage-battery machine has proved to be both economical and well adapted for the purpose.

The locomotive for service in the Glendower colliery is equipped with two 85-volt motors and controller. The bat-



THE GLENDOWER LOCOMOTIVE.

teries employed are type A-8 Edison 70-cell, and have a 300-ampere-hour capacity with a discharge rate of 60 amperes for five hours. They provide, at the full rated drawbar pull and speed, for a mileage of nine miles with one charge of the batteries. Under an assumed car and track friction of 30 lb. per ton on level track, this rating is equivalent to 300 ton-miles on one charge. The machine is fitted with the usual ampere-hour meter indicating the amount of charge and discharge, headlight, and gong. The locomotive is built to conform to the following specifications:

	Ft.	In.
Length over all	8	9
Width over all	5	3
Height over platform	2	4
Height over battery compartment	3	9
Wheel base	.	44
Diameter of wheels	.	20
Track gauge	.	44
		Lb.
Rated drawbar pull		1000
Total weight		8000
Speed at rated drawbar pull		3½ m.p.hr.

The batteries are designed for the particular service, are of rugged construction, and the plates are made specially to give the high service efficiency. The cells are grouped in 18 trays and are mounted on top of the locomotive frame in a wooden case. The frame consists of steel channel sides and steel-plate ends carefully fitted at the joints and held together rigidly by bolts and steel angles. The end-plates are faced with wooden bumpers, to which suitable couplers are attached. A seat for the operator is provided in the rear. The cast steel pedestal jaws, which carry the journal boxes, are securely bolted to the lower web of the channel side frames. The cast steel journal boxes are of a special design and are fitted with roller bearings, which assures efficient mechanical transmission of power and consequent economy in battery current consumption. The weight of the car is supported from the journal boxes by two coiled springs.

The wheels are of chilled iron, are pressed on and securely keyed to the axles, which are made from a special grade of steel and are case hardened at the journals. Thus the wear on either the roller bearings or the axles is practically negligible. Brake tension is effected by means of a square-threaded brake spindle. A square-threaded nut travels on the spindle and carries an equalizing bar, to the ends of which are connected chains leading from the brake levers. This device admits of locking the brakes automatically, without the use of pawls or ratchets, in any position left by the operator. The controller is of the drum type and built for this particular class of work. The mechanism is enclosed in a malleable iron case, which is provided with removable sheet steel covers.

The motors are series wound, totally enclosed, and of the familiar automobile type. They are designed especially to operate from batteries and have characteristics that effect the maximum possible economy in the use of battery current. They have high efficiency, large overload capacity, and operate with practically sparkless commutation.

High efficiency is obtained by designing them with a small air gap and running the iron at low densities. By reason of the latter provision, the speed and torque characteristics are steeper than in the ordinary series motor, thereby tending to limit the overload which can be thrown on the batteries. The armature shaft rotates in ball bearings. Friction losses are therefore very slight, and the bearing wear is practically *nil*. Although compactly designed, the motors are nevertheless readily accessible for inspection and repair. Of the enclosed type, they are dust and moisture proof. One motor is mounted on each axle in a cast steel suspension cradle, one side being supported on the axle bearings and the other side spring-suspended from the locomotive frame in accordance with standard locomotive practice.

The motors drive the axles through double reduction gearing, an intermediate shaft, supported in the bearing housing cast integral with the suspension cradle, carrying the intermediate gearing. As slow-speed service is ordinarily required of a storage-battery locomotive, the use of double reduction gearing affords such speeds with minimum rheostatic losses; and, due to the large gear ratio from armature shaft to wheel tread, very high tractive efforts are obtained at comparatively small current inputs to the motors.

Commercial Paragraphs

The MULCONROY CO., INC., 723 Arch street, Philadelphia, Pennsylvania, has recently made several improvements in the Mulconroy coupling and nipple, which are specially designed for hose for high pressure steam, air, water, and rough usage. The new features of the coupling consist of a perfectly smooth stem, rounded and tapered, permitting of easy access into the hose without injury to the tube, and a grooved or channeled lip, at the spud end of the stem, which prevents loss of the washer, a frequent cause of annoyance and lost time. The improved clamps cover the exterior of the hose completely in such manner that when they are tightened they do not injure the cover of the hose, and are not long enough to cause any pressure on the hose at the end of the stem, so the tube is not injured. The projections that clutch over the collar on the stem positively prevent the coupling from blowing off, no matter what the pressure. All couplings are made of malleable iron and threads are iron-pipe standard.

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EDITORIAL STAFF:

San Francisco

H. FOSTER BAIN - - - - - - - Editor
EUGENE H. LESLIE
M. W. VON BERNEWITZ - - - - Assistant Editors

New York

THOMAS T. READ - - - - - Associate Editor

London

T. A. RICKARD - - - - Editorial Contributor
E. W. WALKER - - - - - Correspondent

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

LOCAL sections of the American Institute of Mining Engineers are in process of organization at Los Angeles and San Francisco, and one has just been started at St. Louis.

OREGON has appropriated $40,000 for the first two years work of its geological survey, and under the directorship of Mr. H. M. Parks plans are being laid for a vigorous and systematic study of the mineral resources of the state.

COTTON exports from the United States during the nine months since July 1912 have exceeded in value the gold output of the entire world for last year. Despite the great increase of wealth and luxury, food and clothing remain the prineipal items in the budget of the average man.

CONCENTRATION of low-grade iron ore is becoming more common in the United States and is a form of conservation of which all approve. We print this week the flow-sheet of a mill recently erected in Michigan. It contains several novel features, and the results obtained are of wide significance.

RADICAL amendment of the mining laws is proposed in S. 1364, introduced at Washington by Mr. G. E. Chamberlain, senator from Oregon. Under terms of the proposed bill extralateral rights are abolished as regards future locations, and registration of mining claims in the local land office within a year of staking, and patenting within seven years, is to be required. These proposals are sound and directed toward decreased litigation. Extralateral rights, however, should not be abolished without enlarging the claim area and the bill needs amendment.

CLOSING DOWN of the Bradley process plant at Anaconda after a long period of unsuccessful experiment seems likely to conclude the attempt to place on a working basis the leaching process devised by Mr. C. S. Bradley and exploited by Mr. Thomas W. Lawson in connection with his efforts to develop the Santa Rita mine, which is now worked by the Chino Copper Company. The process, though exhibiting great mechanical and chemical ingenuity, had the drawback that it acquired the simultaneous use of unusual methods of work and unusual types of machinery and the metallurgist familiar with the difficulties incident to the use of either will not be astonished at the outcome. It is stated in Boston that Mr. Lawson, Mr. Burrage, and others interested still have faith in the process, but apparently they stand alone.

BUTTE is already making plans to live up to her reputation as a royal host when the American Institute of Mining Engineers convenes there next August. There are to be luncheons, smokers, banquets, and automobile trips galore. The pedants who want to sit in a stuffy room and listen to scientific perorations will have to fight for a hearing. But, in all seriousness, we can leave the proper apportioning of the time to the capable management of the Institute, and everyone may feel assured that the time spent on this trip to Butte will be well spent.

GENESIS is a vital point in the study of ore deposits. In a most thoughtful and useful address delivered before the Colorado Scientific Society recently by Mr. George Collins, the point is made that despite mistakes and gaps in our knowledge, the engineer who has and tests a hypothesis or a series of them, has an advantage in finding ore over one who merely blocks out ground geometrically. The latter plan is sure in the end to cost more than the profit in the ore found. The former at least eliminates some barren ground from trial. We print this week, notes on the Rand and on Cobalt that indicate how the theory of the origin of a deposit affects the proper plan of development. What is needed is not less theory but more critical testing of theories and of more exact data.

GERMAN steamship lines are to maintain their own coaling station on the Panama canal; a syndicate representing fourteen such lines and the Remisch Westphalische Kohlen-syndicat having secured the necessary space in the projected Government coaling plant. The capital of the company is 3,000,000 marks, contributed by the beneficiary lines in proportion to their tonnage. Westphalian and Welsh coal will be employed and a stock of 16,000 tons will be carried. A touch of humor is injected into the affair by the announcement in the *Wall Street Journal* that the company will be managed by ten directors who are to receive $238 per year and a bonus of 10 per cent after the payment of fixed charges, 5 per cent is to be carried to a reserve fund, and one-third of the profits are to be distributed among the stockholders. This is certainly a high proof of German efficiency.

DISCOVERY of bonanza ore on the 700-foot level of the Beaver mine at Cobalt, following similar discoveries in the Timiskaming, is of large significance in regard to the origin of the deposits and the future of the district. It will be remembered that the late S. F. Emmons regarded the Cobalt veins as the worn-down and re-enriched roots of orebodies that had extended upward through strata since removed through erosion. There has been sharp dissent from this view, and in particular Mr. J. B. Tyrrell has held that the ores are ordinary products of the intrusion of the great diabase sill into the pre-Cambrian sediments. On this basis their distribution is controlled by the contact of the diabase with overlying and underlying beds, and a 'second contact' below the diabase is distinctly probable. Recent developments showing not only the continuation of the veins into the diabase, but the presence of rich ore, strikingly confirm Mr. Tyrrell's views and greatly strengthen the hope of long life for the district.

MANIPULATION of the price of securities is a felony punishable by a fine of not more than $5000, imprisonment for not more than two years, or both, according to the provisions of the Levy bill, which has been enacted in New York State, and was signed by the Governor a few days ago. The law provides that "any person who inflates, depresses, or causes fluctuations in * * * the market prices of stocks, bonds, or evidences of debt of a company or association," or who attempts or conspires to cause them to fluctuate shall be guilty of felony. A pretended purchase whereby no change of ownership or interest is effected is regarded as *prima facie* evidence of violation of the law. The provisions of the statute are stringent enough, but there is at least room for doubt whether such a law can be effectively enforced. Another recent bit of New York legislation, the Goldberg bill, creates the office of Examiner of Securities. Companies wishing to sell securities must file with the examiner certain statements. Upon examination of the statements he is to issue a license permitting the concern to offer securities for sale "if he finds that such company is solvent, that its articles of incorporation, its constitution and by-laws, its proposed plan of business, and proposed contract contain and provide for a fair, just, and equitable plan for the transaction of business, and in his judgment promise a fair return on the stocks, bonds, and other securities by it offered for sale." Wall Street disapproves of this law, on the ground that the arbitrary power thus conferred is dangerous, that only omniscience can infallibly decide whether a company can succeed or not, and that the statement that the security has the approval of the state authorities will be used to further the sale of securities which are just above the margin of doubt. Neither of these pieces of legislation promises, therefore, to adequately meet the problem of safeguarding the investor.

Manganese Ores and Products

Interest in manganese alloys has been greatly stimulated recently by the provision of a 15 per cent duty upon ferromanganese and spiegeleisen in the tariff bill now under discussion at Washington. This is an increase in the import duty, as compared with the present rate, of nearly $5 per ton in the case of ferromanganese. American steel makers, with the exception of the United States Steel Corporation, have heretofore generally preferred to import their supply of these alloys; partly from the American tendency to concentrate upon the main product, and partly from the fact that since the supply of ore comes chiefly from abroad and the quantity, while large in the aggregate, is not individually great, some advantage is derived from importing the alloy rather than the crude ore. The difference in favor of domestic manufacture now becomes worth noticing, and the result of the new schedule will doubtless be to stimulate the development of the production of manganese alloys at

furnaces within the United States.

An important but seldom considered fact in economic geology is the disproportion which exists between the supply of the various metallic elements and their usefulness to man. Aluminum, for example, is more abundant than iron but is much less useful, its principal good quality being its light weight as compared to other structurally useful metals. Manganese is similarly a metal which occurs in abundance, but which is of comparatively limited usefulness. The total production of manganese ores throughout the world does not exceed the iron-ore production of the Marquette range alone. With an abundant supply to draw on, it is natural that only ores of the better quality find a market, and India, Russia, and Brazil, where large deposits of good grade occur at points favorably situated as regards transportation, are, with the United States, the principal producers of manganese ore. Imports of ores into the United States usually amount to about one-quarter of the domestic production, while imports of manganese alloys are about equal to the production at home. For years Russia has held premier position in the production of manganese. In the Caucasus high-grade deposits of pyrolusite and other oxides occur, the phosphorus content being low. On account of high freight rates the output has recently declined, and the production from India, chiefly the Central Provinces, has recently surpassed it. The Indian industry was described in some detail in the *Mining and Scientific Press* of December 30, 1911. In Brazil, also, in the state of Minas Geraes, large deposits of good quality occur, and these contribute about one-tenth of the world's output. All these ores easily meet the trade requirement of a phosphorus content lower than 0.2 per cent; silica being less than 8 per cent. The ore produced in the United States, though considerable in amount, is lower in its manganese content; this being reflected in the fact that imports of spiegeleisen, which contains about 25 per cent manganese, are only one-quarter the domestic production, while imports of ferromanganese, which contains up to 80 per cent manganese, somewhat exceed the domestic yield.

Manganese is used in small quantity in the manufacture of all steel, and in considerable quantities in the manufacture of special alloy steels. It is effective and is added to the charge to remove the oxygen remaining in steel, after the carbon and silicon content has been eliminated. In larger quantities, its presence causes the steel to be brittle. This effect increases until at 5½ per cent it reaches a maximum; further additions of manganese cause the steel to become remarkably tough, while at the same time exhibiting great hardness, a peculiar combination of properties possessed by no other ferroalloys, thus fitting it for use in situations where it has to endure both shock and abrasion. On the other hand, its hardness makes it extremely difficult to work, and its ductility causes it to flow to some extent when subjected to pressure, so that the production of satisfactory objects of this alloy requires a high degree of skill. The interesting announcement has recently been made that one of the leading firms engaged in the production of alloy steels has perfected the drop-forging of manganese steel, so that such objects as the pins of a dredge bucket-line can now be made in this way. The use of such manganese alloys is increasing, but even yet manganese possesses no great attraction for the prospector. The fern-like tracery of its oxides upon rock surfaces may excite wonder and imagination, but it leads to no hidden Golconda, for under present conditions the exploitation of manganese ores, unless of great purity and favorably situated for mining and transportation, offers but little of commercial profit.

Building up the Institute

Commendable efforts are being made to strengthen and broaden the work of the American Institute of Mining Engineers, through making the Institute more serviceable to its members, by awakening a more lively interest among the membership, and by urging all engineers engaged in mining work to support their national society by becoming members and taking part in its activities. The committees which have been appointed to stimulate the work of the Institute in special fields of activity have produced immediate and gratifying results. The papers and discussions at the meeting which was held at Cleveland under the auspices of the Iron and Steel Committee were of an unusually high order of merit and the papers on Western mining and metallurgical topics which have been promised for the coming meeting at Butte are no less remarkable. Discussion is oftentimes more helpful than a formal paper, and this phase of Institute work cannot be over emphasized. It seems unnecessary to point out that any national technical society is perforce a mutual institution and cannot fulfil its mission without the coöperation of all its members. With anything like the full support of its members, the Institute will inevitably take so important a place that no engineer who claims to be well informed can afford not to be a member. Indeed, this is already true, but the fact needs emphasis, so that it may gain more general recognition. A committee has been appointed to secure desirable new members, and application for the first twenty-eight days of April exceeded the total for any previous month. This is good, but the effort ought to be unnecessary. Every engineer should be a member of his national society, just as every voter is a member of some political party. The committee's work should be, therefore, essentially temporary; the Institute should be the magnet to draw every qualified engineer to itself. It is indeed remarkable to find American engineers who are members of foreign scientific societies but not affiliated with their own national society. The most effective propaganda to bring all such into the fold can be carried on by individual members, and if every Institute member will urge his engineer friends to support the work of the national society by first becoming a member and afterward contributing to its proceedings and discussions, the success of the movement to strengthen the Institute will be assured.

The Analysis of Smelter Contracts—I

By Gelasio Caetani

*The smelting industry, like any other commercial industry, has only one object, and that is to derive profit from its operations. The smelters figure on a certain net profit per ton of ore treated, and base their profits on a rather complicated system of discounts and charges. Producers generally claim that the smelters rob them in every possible way; the smelters protest, stating that all they claim is a fair interest on the capital invested in their plant. The truth of the whole matter is that the buying and selling of ores is a commercial transaction in which both of the two parties are supposed to look out for themselves. The smelters have always a clear knowledge of how much profit they are going to make on every transaction, because they know exactly how much of the metals will be recovered and how much it will cost them to smelt the ore. The producers, on the other hand, are in most cases entirely ignorant of this and generally complain of being 'held up' in a shameful manner. I will attempt to analyze this much-debated question and to point out how much can be asked and how much should be expected from the producers' point of view. Smelters will probably find fault with what I am going to say.

The Smelter's View Point

The profits of a smelter are chiefly dependent upon a large volume of business and on low operating costs. The volume of business is instrumental in keeping down overhead charges and capital interest per ton of ore treated; the cost of reduction is minimized by purchasing ores of different kinds in such proportions that their mixture will be self-fluxing; in addition to this, the by-products of one part of the plant can generally be re-treated advantageously in some other part of the plant.

Individual mining companies can but seldom avail themselves of all these advantages. It is infrequent for the ore of any one mine to be self-fluxing, nor is the tonnage available commonly sufficient to operate a smelter with economy. Individual mining companies are therefore unable, in most cases, to compete with local custom smelters, and are obliged to accept the smelter schedules, even if these are excessively onerous.

The smelting companies in purchasing ore must charge the producers with the total costs of smelting, capital interest, metal losses, refining charges, and so forth, in addition to their own profits. At the same time, they must protect themselves against sudden variation in the market price of the metals on account of the large stocks they have to carry on hand either in the form of ore or of bullion. To cover all these charges the smelters could adopt a simple method of discounts and charges; but probably such plain and simple figures would look more distressing to the average producer than they do appear when presented in the form of a complicated network of deductions, discounts, penalties, bonuses, smelting charges, and so forth. It therefore takes some mathematical knowledge and a good business head to see daylight through the wording of a smelter contract.

Smelters are always willing to purchase any ore on the market at moderate prices. However, they cannot depend for continuous operation on the willingness of others to sell; they must be assured of receiving, within reasonable limits, a constant and sure supply of each of the ingredients required to make up the furnace charges, and it is natural, therefore, that more favorable terms are given to such producers as can assure a constant supply of ore and will bind themselves for a considerable length of time.

As the Mine Operator Sees It

On the other hand, the mine operator, while endeavoring to obtain good terms, must take care not to be tied down too closely. He must first of all make provision to share in the increase or decrease of profit resulting from the rise or fall of the market price of metals. Provisions for this are made in most of the contracts, though generally the smelting companies reserve for themselves the lion's share of the good harvest that may come in when metal prices are booming.

A fundamental flaw in many contracts is the absence of any provision by means of which the producer will share the profits that may be derived in the future from improved metallurgical processes, lowered freight rates, or better transportation facilities. In our times, metallurgy is advancing so rapidly that in a few years conditions may have changed completely. Let us suppose that a mine manager has signed a 10-year contract to deliver all the products of his mine to a certain lead smelter. As the mine development progresses the ore becomes more and more zincy, and, according to the terms stipulated in the contract, he is penalized for its zinc content above ten per cent. This zincy ore, let us suppose, could be treated successfully by some new process that would separate the zinc as a merchantable product, but this cannot be done as, according to the smelter contract, all products of the mine must be delivered to the smelter. Provision must also be made for any possible reduction of freight rates when the cost of transporting the ore from the mine to the smelter is included in some general smelter charge; otherwise, when the freight rates are reduced, all the benefit of such reduction goes to the smelting company. It must also be kept in mind that the metallurgical processes may improve so much in a few years, or competition may become so keen, that the smelter is enabled or obliged to offer better rates in the open market, and it is only fair that the old customer, tied down by a long-term contract, should share in these improved conditions.

*A lecture delivered at Harvard University.

In purchasing ore the smelting companies cover themselves by making deductions from the content of the ore, discounts on the market price of the metals, general charges for smelting and refining, and by penalizing any deleterious substance. Bonuses and payments for iron and manganese are given to encourage shipment of low-grade ores and to increase the iron supply to the smelter. I shall now analyze the various items.

Discounts and Deductions

Discounts and deductions are virtually the same thing, and can always be summed into a single discount. A contract may be so framed as to read: "The smelter will pay for 90% of the lead content at 90% of full market quotation." This is exactly the same as if it read "The smelter will pay for 81% of the lead content at full market quotation." Notwithstanding that smelter contracts are always full of such intricacies, it is most important to know when and to what extent discounts are justified, and this subject deserves detailed analysis.

To begin with, the smelting losses in gold are practically *nil*. In many cases, even in pyritic smelting, the smelter recovery on gold is over 100%. The reason of this is that many lead and copper ores contain a few cents in gold per ton of ore; these minute quantities are saved in smelting with no more difficulty than the gold of the high-grade ores, but no account is taken of them in the furnace charge because no payment is made for gold contents below 0.03 or even 0.05 oz. per ton. The value of gold never changes, and there is no risk whatever connected with the fluctuations of metal prices; the smelters therefore rely in great part on the gold and silver discounts as a safe source of profit, and generally put up a hard fight against any reduction in these items. These discounts are generally on a sliding scale; that is, $19 per ounce is paid for low-grade ores; $19.50 for ores containing from 1½ to 3 oz., and generally $20 for gold contents above 3 oz. per ton. Recently some smelting companies have been paying $19.50 for any content above 0.03 oz., per ton, and $20 for contents above 3 oz., and these are to be considered the best terms obtainable under ordinary conditions. At these figures the gold discounts amount to 5.5 and 3.2%. Though these discounts are not heavy, they represent a large source of profit, as in many cases the preponderating value of ores lies in their gold content.

The discount on silver is almost always the same, whatever be the kind of ore under consideration, and as a rule is 5% of the silver content at full market valuation. In lead-smelting the silver loss is generally under 3%, whereas in pyritic and in copper smelting in general it can be at times as high as 10%; for this reason some contracts for copper ores call for a 10% discount on the silver content. High-grade silver ores, like those from Cobalt, are at times heavily discounted, these discounts on the silver taking, to a certain extent, the place of the treatment charge. Zinc, arsenic, and antimony will increase silver losses by volatilization, but provisions are made for this by penalizing the deleterious substances without further discounting the silver.

Many contracts stipulate that no payment be made for silver contents when less than one ounce. The smelter seems to give the impression that this is a negligible quantity. On the other hand, it is by no means a negligible quantity, as fully 95% of it will be recovered in smelting. In some districts, as in the San Juan district in Colorado, the gold and silver are intimately associated with the blende, and therefore zinc concentrates will carry as high as $20 in gold and silver. In the roasting and retorting of the blende there is a notable mechanical and volatilization loss of the precious metals. The zinc smelters take advantage of this and inflict outrageous discounts on the precious metals. A 43% discount on the contents is a common practice. Some zinc-reduction plants offer another arrangement. After the zinc has been distilled from the concentrate the retort residue is held at the disposal of the producer, and is shipped as gold-silver-iron ore, according to his instructions. It is generally stated that the zinc smelter will use "his best efforts to recover the largest possible amount of these values in the residue." In the case I have in mind, these best efforts succeeded in losing 41% of the gold and 35% of the silver. To avoid such losses, every endeavor should be made to recover as much as possible of the precious metals from the zinc concentrate before selling it to the smelter.

Payment for Lead

The discounts on lead vary widely from one district to another, as these discounts are always figured out in connection with the treatment charges; when the treatment charges are low, the discounts on lead are heavy, and vice versa. In the Coeur d'Alenes, for an instance, the total discounts on lead in the high-grade lead concentrates produced in that district will range from 19 to 22%, and the treatment charges range from $8 to $12 per ton. In Colorado, instead, the discounts on lead in the high-grade gold and silver-bearing lead concentrates will vary from 35 to 50%, but at the same time the treatment charges will range from $2 to $3.50 per ton. In this case, as in many other instances, the various items of a smelter contract are so arranged as to balance each other; the sole object of the smelter is to make a certain profit per ton of ore treated, and it is immaterial to the smelter whether this profit be derived from discounting the metals, or raising the treatment charge, or penalizing the silica or some other substance. At times a producer will insist on especially good terms on some particular item; generally the smelters are very accommodating in this; all they do is to raise the charge on some other item. Some of these concealed 'jokers' are mentioned later on.

Calculating the Real Charge

This balancing between the lead discounts and treatment charges makes it difficult to calculate and compare the deductions made on the lead. In the Coeur d'Alene district, where the ores do not carry other values than lead and silver (about 0.6 oz. of silver for every unit of lead), the average total

of charges and deductions is 1.93c. per pound of lead when the market value of lead is $4.25. The producers are therefore paid only for 66% of the gross market value of *all* merchantable metals contained in the ore, and as this gross value for the whole district averages close to $57, it means that the smelters make a total average discount of $19.40 to cover all their metallurgical losses, costs, interest, and profits.

The metallurgical losses of lead will range from 3 to 10% and will average not over 5, so that the customary discount on lead contents alone is more than ample to cover all metallurgical losses. To this must be added the old and time-honored 'joker' of dry assay; that is, a deduction of 1.5 units from the wet assay of lead. For high-grade ore this additional deduction does not amount to much, but in low-grade ores, assaying say 20% lead, this deduction represents an additional discount of 7.5%. Another source of profit for the smelters is the nonpayment for lead contents below 5% lead, dry assay. Ores containing very low percentages of lead are called 'dry' ores and are used as iron or silica fluxes in the making up of the lead-furnace charge. This furnace charge is always figured out to contain a certain percentage of lead varying from 15 to 20, and it is immaterial whether the lead, which is the collecting agent for the gold and silver, be included in the dry ore or added as a high-grade lead concentrate.

Formulae for Making Comparisons

To be able to compare a lead schedule with another is not an easy matter. The following rule of thumb method makes it possible, however, to judge in a general way whether a schedule is favorable or not: Take the lead content of the ore and multiply it by the net unit price paid for by the smelter. Then subtract the treatment charge. The ratio of this difference to the gross market value of the lead content of the concentrate is equal to the percentage of values received from the smelter. Written algebraically it would read:

$$\frac{\text{Pb content} \times \text{net price} - \text{treatment}}{\text{Pb content} \times \text{market price}} = \text{per cent profit}$$

If this percentage is above 65%, the schedule is very good; if around 60%, it is good; and if below 55%, it is a poor one. In using this rule of thumb take care, however, that a 'joker' is not hidden somewhere else.

Payments on copper are almost always based on the content as determined by electrolytic assay less a certain number of units varying from 0.85 to 2, and this price is based on the New York quotation for electrolytic copper less a discount varying from 2 to 8c. per pound. Most contracts for copper ores call for electrolytic assay less 1.3 units at New York quotation less 2.5 to 3c., with an additional treatment charge of $3 to $5 per ton.

Applying to copper ores the same rule of thumb given for the lead ores, it will be found that on an average (when copper is at 15c.) a 10% copper ore is paid for at 56.5% of its gross market value, and a 20% ore is paid for at 68.2% of its gross value. The copper schedules are therefore not much better than the lead schedules. A good 'copper joker' is generally found for the ores that, though containing some copper, are not sold chiefly for their copper content. The smelters try to make you believe in an off-hand way that the small amount of copper in your ore is really not worth mentioning. If the mine operator is aware of the real value of the copper he will generally succeed in getting paid for the electrolytic assay content less 1.3 units at New York quotation less 5 cents. If not aware of this, he may be offered nothing more than electrolytic assay less 2 units at the flat rate of $1 per unit, though at such a price of copper as 17c., 2 units of copper have a gross value of $6.80. Percy E. Barbour, in a valuable article,† gives full information on copper smelter settlements.

Zinc Penalties

The zinc in any ore other than the ores mined especially for their zinc content, is a nuisance. By this I mean that any ore, the leading values of which are gold, silver, lead, or copper, is depreciated by the presence of zinc minerals, even if the zinc minerals are eventually separated and sold as a zinc concentrate. This statement, though not universally true, generally holds good for any ore that will not yield by wet concentration a concentrate assaying above 30% zinc. There are three reasons for this: (1) Some zinc mineral will always pass into the mill products that are not shipped as zinc concentrates and often will cause them to be penalized for excess zinc content; (2) the treatment of the ore becomes more expensive, the cost of separating the zinc by some dry process varying from $1.50 to $2.50; (3) and not least, the value of the gold, silver, lead, and copper contained in the zinc concentrates is very heavily discounted, as stated previously.

Against all these penalties and losses is to be credited the net paid-for value of the zinc, which in most cases amounts to about 40c. per unit when spelter sells at 6c. in St. Louis. On this basis a lead-gold-silver ore containing 5% zinc and which will yield 60% of its zinc as zinc concentrate (this is a high figure) is to be credited with $1.20 per ton crude ore for its zinc content, and the total operating costs, losses, and penalties to be debited against the zinc will most certainly greatly exceed this figure.

Western Base Price

Zinc concentrates are sold on a base-price schedule. A characteristic example for Western ores is as follows: A base price of $22 is paid for a 45% zinc concentrate delivered f.o.b. Oklahoma when spelter sells at 5c. per pound. For every plus or minus variation of one cent in the price of spelter there is added or subtracted $6 to the base price of $22. So also for every unit zinc above or below 45%, there is added or subtracted $1 to the base price. In Missouri schedules are based upon 60% zinc contents.

In all other ores but zinc ores, the presence of this metal is deleterious. A high zinc content in the blast-furnace charge will call for a heavier fuel

†*Eng. & Min. Jour.*, August 12, 1911.

consumption, it will cause a marked loss of lead and silver by volatilization, and the thickening of the slag is a further cause of losses and annoyances. If, however, the zinc content of the slag is kept below 6%, the operation of the blast-furnace is not disturbed to any appreciable extent. In some mining districts the zinc content of the ores is low, and the local smelters are not bothered in the slightest degree by zincy slags. Notwithstanding this, the smelter will never fail to call for a 50% zinc penalty on every unit in excess of 10%. In such a case this is not a penalty, but simply an indirect way of increasing the treatment charge. An operator who is aware of local circumstances and cannot be bluffed by this 'zinc joker' has a good argument for putting up a hard bargain and generally will succeed in reducing the zinc penalty to 25c. for every unit above 12 per cent.

Iron and Silica

Both iron and silica are required for smelting, and they are required in certain definite proportions, and when either the silicious or the iron ores are in preponderance on the market, the smelter is obliged to offer special inducements for the kind of ore which is needed. The supply of silicious ores is stimulated by reducing the treatment charges and that of iron ores by paying for the excess of iron above insoluble. In the Coeur d'Alenes the gangue of the lead concentrates consists chiefly of iron carbonate, and the per cent insoluble is always very low. Notwithstanding this, no payments or bonuses are made for iron, whereas in other districts the smelters will pay anywhere from 5 to 15c. for each unit excess iron. In this case, therefore, as in the one previously mentioned for the zinc, a thorough knowledge of the ore-market condition will enable a mine operator to obtain a better deal. Manganese has the same function as iron in the fluxing of ores, and, though frequently not mentioned in contracts, ought to be always credited to the same extent as iron.

The so-called 'insoluble' is a general term covering everything that will not dissolve in strong concentrated acids and in no way represents the silica content of the ore. Mr. Barbour, in his before-mentioned article, is of the opinion that contracts ought to call for silica determination by fusion. Most smelters would object to this, the reason being that many ores contain basic silicates due to the walls or to intrusions in the vein, and the base radical of these silicates has to be fused without assisting the fluxing of the ore. More so, frequently ores carry barite, which is not only useless but also deleterious.

Lime is advantageous and even necessary in blast-furnace operations unless the charge be very zincy; as lime-bearing ores are comparatively rare, the smelters are usually obliged to obtain barren limestone from some quarry. Therefore, lime is just as valuable to them as iron, and they ought to pay equal prices for both these fluxes. This ought to be kept in mind and payments asked for the lime content of ores.

Zinc, barium, arsenic, and antimony are considered deleterious substances in most ores; sulphur (and frequently also phosphorus) is objectionable in iron ores; lime and magnesia in zinc ores; and even silica, nickel, and other substances may be considered deleterious under special circumstances. The analysis of all these substances would lead too far into the field of fire metallurgy and, being of comparatively rare occurrence and secondary importance, in western ores, can be omitted for the present.

Ores and concentrates, with the exception of iron ores, are settled on the basis of dry ore. The moisture, therefore, does not affect the treatment charge, but only the freight charge, it being taxed by the railroad companies at the same rate as the ore. Each per cent moisture therefore is taxed at the rate of 1% of the freight charge per ton of ore. When freight rates are low and the ore comparatively dry, the charge on moisture is negligible, but in localities where freight rates are high it often pays to dry the concentrates.

In the Lake Superior district, iron ores are sold on the basis of 'natural iron'; that is, on the per cent of iron contained in a wet ton of ore. The unit prices are on a sliding scale; that is, a 50% iron natural ore is paid at 5c. per unit, whereas a 46% iron natural is paid only 3½c. per unit. In this case the drying or draining of an iron ore raises the natural grade of the ore. As an example, if a 46% iron natural containing 9% moisture be dried to 3% moisture, the grade of the ore would be raised to 49.1% iron natural, with a resulting profit of 41c. per ton.

Importance of Moisture Determination

In many cases the smelters will give a flat freight and treatment charge per ton of dry ore. In such case the per cent of moisture in the ore does not affect the shipper, but the smelter is generally willing to lower its flat rate if the shipper guarantees to keep the moisture below a certain limit.

Settlements are generally based on the weight and moisture determinations made by the smelter. These determinations must be controlled by the producer, and it is well to specify this point in the contract, because an incorrect determination of either moisture or weight is just as objectionable, at a financial point of view, as an incorrect assay.

This review of the unit prices and deductions can be taken as a guide in gauging to what extent the terms of a smelter schedule are advantageous to the producer or the smelter. As already mentioned, these terms must not be gauged entirely by themselves, but always in connection with all other factors affecting the final net return per ton of ore. Any bonus or extra charge, the treatment charge, the freight rates to the smelter, all of these items influence one way or the other toward the final economic return, and any especially good term on some specific item must be considered as offsetting to some extent some other item which may appear unduly disadvantageous.

Petroleum production of Mexico in 1912 was 16,500,000 bbl., against 14,051,643 bbl. in the previous year.

THE WATERFRONT AT PARAMARIBO ON SURINAM RIVER.

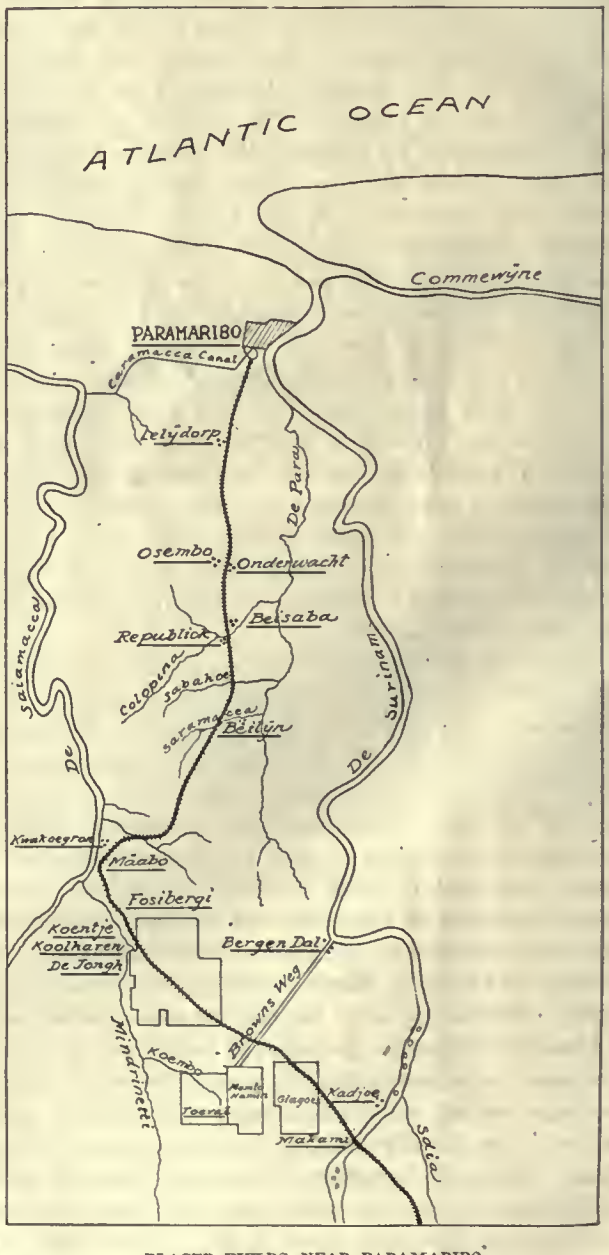
Gold Placer Mining in Dutch Guiana

By J. B. Percival

There is at present an exeellent opportunity for investment of capital in Dutch Guiana. Gold is found in almost every part of this country, from the Corantyne river on the west to the Maronie on the east. As far baek as 1904 the Saramacea company, an Amerieaη eoneern operating on the Saramacea river, produeed in 21 days 5949 gm. by ernde work in 'long toms' manned by 49 negroes. The average produet per man per day was 5.84 gm. The gold produeed was nearly all in nuggets ranging from 1 to 500 gm. Sinee then the eompany has been turning out 40,000 gm. per year. There is a belt, three to ten miles in width, of auriferous material comprising sand, gravel, and clay, running across the entire concession. A small hydraulic plant was erected last year on another property situated on the Sara creek, Surinam river distriet, where the pay-dirt on the hillsides is said to average from $2 to $5 per eu. yd. Previous to the erection of hydraulic plant the mine was operated by hand labor, and for nearly fifteen years an annual product of over 100,000 gm. was secured by washing in the beds of the many creeks on the eoncession. The Sara creek plant working on regolith is shown on the opposite page.

In Surinam the mineral wealth is greater than that of all the other products of the region combined. Capital invested in the placer mines of Surinam is especially safe. Owing to the peculiar character of the region in whieh the gold placers are situated, and the strictness of the governmental supervision, it is impossible for a concession to be made the basis of unhealthy speculation. There are no hardships necessary in getting out the gold in the plaeer mines of Surinam. An efficient manager in Paramaribo (the capital of the eolony) which, notwithstanding its hot climate, is one of the most salubrious cities in the world, can direet all the operations and work the mines successfully. There is no country where property is safer than this. The country is well governed and the mining laws are liberal, though every precaution is taken to prevent the floating of wild-eat properties.

Dutch Guiana needs only an extension of the railroad from 'Dam' on the Sara creek to the Law district on the borders of French Guiana to become famous. In brief, no obstacles present themselves in the goldfields of Duteh Guiana. Here there is eternal summer, easily navigable waterways, a railroad to the goldfields, eheap food, and eheap native labor, and the rich gold deposits.



PLACER FIELDS NEAR PARAMARIBO.

Stoping at the Mammoth Mine

By Charles W. Morse

The ore in part of the Mammoth mine, in Shasta county, California, occurs as solid sulphide masses on either side of a well defined fissure. The largest of these bodies contained 400,000 tons. The ore in places runs 7 cu. ft. to the ton. Robert E. Hanley, superintendent, has adopted the stoping method described below.

Cross-cuts 7 by 9 ft. are run below the orebody or through it, 30 ft. apart, and rises 6 by 12 ft. are put up at 30-ft. intervals. From the top of a rise a cross-cut is run to the edge of the orebody and then widened both ways, working from the edge of the orebody back toward the rise and leaving a protecting pillar near the latter until the last. The floors or stopes are carried 9 ft. high. Sawed timber, 8 by 8 in., is used for posts to support slabs and heavy roof. In most instances these have proved sufficient. The maximum area of a room opened in this way is about 40 ft. square. When this area is excavated tracks are taken up, 6 by 8 sawed timbers are laid on the floor for sills, and 2-in. planking in 5-ft. lengths is nailed to them with 2 or 3 in. between. After the floor is laid, holes are drilled in the roof and bored in the posts and all shot; the charges being fired by electricity.

The country rock keeps slabbing off and follows down, clear to the surface; so that there is no danger of a large chamber being left behind and a heavy fall occurring later with disastrous results. After one room is caved, an adjoining one is started. Several rooms on the same floor and on different floors may be open at the same time. After a cave the floor below is attacked in the same manner, catching up the 6 by 8-in. floor-sills with posts as they are exposed.

Rhodesian Production in January

The value of the mineral output of Southern Rhodesia for January was £236,471, as compared with £260,743 in December. Figures follow:

	December.	January.
Gold	£218,661	£220,776
Silver	1,574	1,401
Lead	731	468
Chrome iron	33,918	8,017
Coal (sales)	5,859	5,809

The month's gold production, 52,455 oz., valued at £220,776, as compared with 51,715 oz. worth £218,661, is, considering the drought and other circumstances, quite satisfactory. The comparatively heavy drop in the total value of production is almost entirely due to the lesser quantity of chrome iron ore shipped. This, however, is necessarily always a varying amount, as the quantity despatched is dependent on the shipping arrangements at Beira.

HYDRAULICKING ON SARA CREEK, SURINAM (DUTCH GUIANA).

Progress in Mining at the Chino Mine

By D. C. Jackling

*The Chino Copper Co. owns 144 mining claims comprising 2643.526 acres. Since the last annual report patents have been received on 36 claims, bringing the total number patented to 131 claims, an area of 2412.385 acres and leaving 13 claims, 231.141 acres, yet to be patented.

In addition, the company owns 160 acres of agricultural land adjacent to its mining properties and has acquired such additional surface rights as are necessary for use in the disposition of waste or overburden stripped from the orebodies. So far as known, the claims cover all of the area containing copper-bearing ores of commercial value.

Millsite, Lands, and Water Rights

The total area owned and controlled, in connection with the mill location at Hurley and the various water rights belonging to the company, is 7996.6 acres. Of this total, 6600 acres is owned outright, the remainder being leased from the state and individuals. Late in the year negotiations were completed for the purchase of a large additional area of land and some important water rights. Some of these have heretofore been controlled and used by the company under long time lease; others are being purchased for the purpose of providing greater storage room for tailing and additional water supply to protect against growing requirements due to the greatly increased tonnage of commercially profitable ore which the work and experience of the past year have shown to be available, and in contemplation of an increase in mill capacity that may in consequence become advisable in the future.

Mine Development

Throughout the year a limited amount of development drilling was continued. The principal purpose of this was to determine the exterior limits and boundaries of the orebodies, in order to demonstrate where it would, or would not, be safe to deposit the overburden stripped from them. Nevertheless, this drilling resulted in substantial extensions of the proved ore-bearing area. The total amount of drilling completed since the beginning of development by this method to the close of 1912 was 195,659 feet.

Ore Reserves

Since the last annual report the ore reserves then shown, as well as the proportion of tonnage which is estimated will be mined by steam-shovel to that which must be mined by underground methods, have been greatly increased. This is due partly to the development of new ore, but in greater measure to a recalculation and reclassification of tonnage upon a basis more nearly consistent with the physical characteristics of the orebodies as a whole and with the methods by which it will be necessary, or at least more economical to mine them. In reports of tonnage heretofore officially rendered, calculations have been based upon vertical planes passing through drill-holes showing thoroughly correlated ore-bearing areas. In these calculations, for determining the tonnage and average copper content of the various orebodies, consideration was given to only a very limited amount of ore containing less than 1½% copper. Neither was account taken of any ore lying outside of the vertical connecting planes above referred to, which material it is necessary to move in establishing practicable slopes required in connection with steam-shovel mining. In analyzing the situation from the viewpoint of experience and costs since the beginning of operations, it became apparent that in order to mine the greatest tonnage in the most economical way, it would not only be necessary, but also desirable, to include a large tonnage of interlying and relatively lower grade bands of ore which contain an average of less than 1½% copper. It was equally apparent, from the same analysis and from further development, that a large tonnage of the material that would have to be moved in making slopes to steam-shovel pits could more profitably be sent to the mill than to the waste dumps. The method upon which the recalculations of ore reserves is based contemplates milling all material shown to be of profitable grade by the experience gained in our operations to date, consideration being given to the fact that it must be moved in any event, and to the further fact that the cost of such mining, or removal, is substantially the same, whether it is sent to the concentrator or to the waste dump.

PITS AND DUMPS AT CHINO.

The last annual report showed 54,970,646 tons of ore containing an average of 2.24% copper. Of this tonnage, about 60% was stated to be available for steam-shovel mining. Calculated upon the basis heretofore used of excluding low-grade material, the ore reserves would be something over 58,000,000 tons. By the application of the modified basis of calculation which has been described, this being the one upon which our engineers agree that the total developed tonnage can be most economically and profitably mined, the ore reserves which may now be

*Annual report of the general manager to the president.

considered as fully developed amount to over 90,000,000 tons, containing an average slightly above 1.8% copper. Neither the tonnage nor the grade of it is stated in specific terms, nor should they be, because it is impossible, pending further experience, to determine exactly what angle of slopes will be necessary and safe in actual mining to greater depths. It is impracticable, therefore, to state definitely just what tonnage will be removed in establishing these slopes, and equally difficult to determine what the average grade of the profitable material derived from these slopes will be. It is certain, however, that the tonnage from the present developed area will be several million tons greater than that stated and that the average grade of it will be within a small fraction of a per cent of the figure given. The average grade for long periods of operation will be above that stated, and further promising areas remain to be developed.

It is estimated that of the tonnage stated, about 80,000,000 tons of average grade, or nearly 90% of the total reserves, will be available for steam-shovel mining. In previous reports it has been estimated that only 60% of the reserves would be mined by steam-shovel. The difference in the percentage of ore that can be mined by open pit methods affects quite materially and favorably the estimated cost of mining the entire ore deposit because of the corresponding reduction in the percentage of ore indicated as necessary to be mined by more expensive underground methods. Furthermore, the consideration of lower-grade but yet profitable material, as ore instead of waste, materially decreases the ratio of overburden to ore, as applying to those portions of the orebody that will be worked by surface methods. On the entire tonnage of ore reserves it is estimated that this basis of operation which permits of mining the stated percentage of the ores by steam-shovel methods will result in a decreased cost of mining alone equivalent to about 1c. per pound of copper produced, as compared to the basis heretofore used and upon which previous estimates of production costs have been founded. This will, however, be offset by the decrease in grade of ore.

Mine Operations

The total amount of material of all classes moved by steam-shovels during the year was 2,850,454 cu. yd. Of this quantity, 2,223,678 cu. yd. was waste, the difference, which was equivalent to 1,301,463 tons, being ore. Of this ore, approximately 200,000 tons was added to stock piles at the mine, the remainder being sent to the mill.

The average cost of steam-shovel work for the year was 29.14c. per cubic yard in place, equivalent to 14.03c. per ton. The above costs include proper proportions of all charges of every nature. The cost of handling waste alone was somewhat lower than the average cost of all yardage, being 27.61c. per yard, equivalent to 13.29c. per ton; while the cost of ore production alone was 16.52c. per ton. The difference in the cost of handling ore, as compared to that of waste, is due mostly to the intermittent operation of shovels working in ore, on account of delays, such as waiting for cars, or to their continuous service not being required for the work in hand.

The total amount of deferred charges for the year due to stripping operations amounted to almost exactly 1c. per pound of copper produced in concentrate, notwithstanding the fact that the amount of stripping removed was equivalent to uncovering between three and four times the amount of ore actually mined. Since the beginning of the second quarter of the year, a charge of 30c. per ton of ore produced has been made against operations, to cover stripping expense, and it is estimated that this rate of charge as applied to the increased tonnage handled, when the mill is in full operation, will be sufficient to nearly, if not quite, cover all current stripping expense and avoid any substantial additions to suspense charges on this account. Practically all of the ore sent to the mill during the year was mined by steam-shovel and no underground mining will be necessary for many years.

During the latter part of the year, 2291 tons of ore produced from the Hearst orebody and containing a little over 12% copper, was shipped direct to the smelter at El Paso. All of the orebodies, and the Hearst in particular, contain large tonnages of ore that can be more profitably shipped direct to the smelter than put through the mill; but while the production of this class of ore will at times have an important bearing on the total production and profits from the company's operations, it will be intermittent and irregular, due to the necessity of extracting these higher-grade orebodies as they are uncovered in the ordinary course of mining the normal grade ore deposits with which they are associated.

Mill Construction and Operation

Additional steam-shovel and accessory equipment purchased during the year, brought the total up to seven shovels, fifteen locomotives, fifty 6-yd. dump cars, and forty-five 12-yd. dump cars. The total amount of trackage in use about the mines at the end of the year was 14.39 miles. Additional trackage is being constructed in the interest of more convenient and economical operation and in connection with the extension of workings, and it is estimated that the increase during the year 1913 will bring the total up to 18.5 miles. Some other surface improvements were made during the year, but the extent of them was of little consequence, the principal ones consisting of additions to living accommodations for employees.

Mill Construction and Operation

Construction and improvements: On April 1 the third and last unit of the originally designed three-unit mill was put in operation. Previous to that time, the rapid increase of ore reserves had indicated the advisability of enlarging the capacity of the plant beyond that of its initial design, and work had been started on two additional units. The first one of these, or the fourth unit of the present plant, was completed and put in operation late in August, and the fifth unit was finished about the beginning of December. No more than four units of the plant were operated continuously for any period during the year. This was due partly to the fact that the

tonnage capacity per unit proved greater than had been calculated, and partly because, for various operating reasons, the mine was not prepared to provide sufficient tonnage for the entire plant. Furthermore, experience gained in the operation of the units earliest started indicated the possibility of some improvements, and advantage was taken of having one idle unit in closing down the earlier completed ones in order to make the desired alterations. These are practically completed at the time of writing this report and the entire plant should be in full operation about the beginning of the second quarter of the year 1913.

The general water-supply system, including a recovery plant designed to conserve such water as it is necessary or desirable to re-use, was completed during the year, and the resultant water supply is more than adequate for all requirements. All construction is now complete as to the mill and its accessories, with the exception of some additions to the coarse-crushing plant, now in progress and made necessary by the increased tonnage, due to the addition of the last two units of the mill, which were not contemplated when the coarse-crushing plant was equipped. A number of dwelling houses were constructed for employees at Hurley during the year and a few more will be required.

Mill Operations

During the first three months of the year, two units of the mill were in operation; for the next five months, three units were operated, and for the last four months, four units were in commission, the average for the year being equivalent to approximately three units in continuous operation. The total tonnage treated for the year was 1,120,375 tons, equivalent to approximately 1000 tons per unit-day. There were many delays during the year, due to various causes usually affecting the starting of a new plant, and as a result of these the average tonnage per unit above stated does not indicate their full capacity. The plant demonstrated a capacity of 1200 tons or more per unit continuously during certain months when regular operations were not seriously disturbed and the entire plant of five units has therefore an economical capacity of 6000 tons per day on normal grade ore. Variations in the grade and characteristics of ore will affect the capacity of the plant somewhat, but it will be able to maintain the tonnage stated regularly under normal conditions.

The average copper content of the ore treated during the year was 2.077% and the average recovery of copper contained in concentrate was 61.63%, equivalent to 25.6 lb. of copper per ton of ore treated. For the first six months of the year, when much of the ore was derived from near the surface where the copper minerals were highly oxidized, the percentage of recovery was only a little over 54%. During the latter half of the year, when a better kind of concentrating ore was available, the recovery was about 65%. During the month of July, when clean ores were available for practically the entire month, the recovery was a fraction under 75%, and at the time of writing this report, and for about two months previously, the recovery has been maintained at 70%. Since the beginning of operations recoveries have been, and continue to be, excellent with respect to all the copper minerals present excepting carbonates, which exist near the surface only, and it has been demonstrated that, with these oxidized ores eliminated, highly satisfactory recoveries can be maintained.

The average milling cost for the year was 58.57c. per ton, but as this includes all of the extraordinary expense incident to starting up the plant and operating on comparatively small tonnages, it cannot be taken as indicating what such cost will be with the full plant in operation. At the beginning of operations the costs of water supply, power, and general charges were heavy, and included in the milling cost for the year are all of the expenses of such alterations and improvements as were made in the first units subsequent to their starting. At the time of writing this report the regular milling cost has been reduced to below 50c. per ton. The mill, power plant, and water-supply system, have all fulfilled every expectation. The cost of water supply is not proving as great as was anticipated and the cost of power is much lower than estimated.

Production and Costs

The total production for the year of copper contained in concentrate was 28,684,208 lb., the average grade of concentrate produced being 21.2%, and the ratio of concentration 16.56 tons into one. This grade of concentrate is lower than it will be normally, because of the excessive amount of carbonates in the ore treated. When operating on ores fairly free from carbonates and representative of the normal ore below the oxidized surface of the deposits, the concentrate has averaged about 25%. This factor has an important bearing on the cost per pound of producing copper as affected by transportation and smelting charges on concentrate.

The production of copper contained in concentrate for the year by quarters was as follows:

	Pounds.
First quarter	3,271,980
Second quarter	4,289,644
Third quarter	10,340,963
Fourth quarter	10,781,621
Total	28,684,208

In addition to the above, there was a production from crude ore shipped direct to the smelter, as previously stated, of 553,758 lb., making the total gross production for the year 29,237,966 pounds.

The average cost of net copper produced from concentrate, after deductions for smelter allowances, was 7.69c. per pound, and the cost of production from crude ore shipments was 6.98c. per pound. These costs include all expenses of every nature in connection with the operation of the property and the smelting, refining, and selling of the metal. It is needless to say that operations at full tonnage capacity and on the ore now available, which permits higher extraction and produces a better grade of concentrate, will result in materially decreased costs of production. Difficulties in securing equipment have interfered somewhat with ore transportation during the year, but the service and facilities in this connection have been rapidly improved.

Origin of the Auriferous Conglomerates on the Witwatersrand

By Richard Beck

*Opinions regarding the origin of these enormous gold ore deposits still differ considerably. Four principal theories have been adduced which are shortly discussed as follows:

1. The theory of the purely mechanical distribution of the gold in its present condition.

According to this theory, the conglomerates are 'fossil' fluviatile placers; formerly loose, now consolidated pebbles and pebble deposits, whose gold particles have floated in purely mechanically. This view is at once negatived by the microscopical examination of the gold in the conglomerates. The gold particles have absolutely no resemblance to mechanically transported placer gold. Its distribution in the reef is also not that usual in placers. Moreover, the conglomerates, in spite of their approximately low gold content, are as a rule richer than placers. Finally, the absence of gold in the quartz of the pebbles is evidence against fluviatile origin, as also the fact that nuggets which are occasionally found in placers never occur in the bankets.

2. The theory of the purely chemical precipitation of the gold and the pyrite in the sea.

According to this precipitation theory, as it may be shortly called, advocated especially by Penning (1888). J. P. Hamilton, De Launay, Stelzner, F. W. Voit, and others, the gold has been precipitated solely chemically from the water at the time of the deposition of the pebbles in a portion of the sea near the coast. This seems unlikely (*a*) because in disturbed water, as in a litoral zone where pebbles could be carried and deposited, such a precipitation is difficult to imagine; (*b*) because it should at least also have occurred during the deposition of the sands from which the quartzite beds are formed; (*c*) because the maximum gold value of the present day sea, as proved by Liversidge and others, does not suffice, and assistance has to be obtained from auriferous mineral springs; and it is further very unlikely that these springs should have ceased to flow whenever sand was deposited to again break out when pebble masses were brought down. Considering the very great distance between the Main Reef and the Black Reef, these hypothetical springs must have flowed in this wonderfully intermittent manner during a very long period of time.

Recently the possibility of a precipitation of such a very small amount of gold as is contained in sea water has, through the experiments of J. R. Don, been seriously questioned. In no wise was he able in his experiments to precipitate gold from sea water with the reagents occurring in nature. Moreover, it may be mentioned that the adherents of this theory seek to explain the precipitation through the occurrence of finely distributed organic substances. They even consider that the strong movement of the water during the deposition of the conglomerate layers has favored precipitation. (F. W. Voit.) But this organic substance is not generally distributed.

3. The theory of former placers in which the gold has subsequently been re-deposited.

This view was propounded by E. Cohen and adopted by F. Posepny, but G. F. Becker has more fully attempted to prove it. Mr. Becker compared the conglomerates with the recent marine placers on the coasts of California, Oregon, and Alaska, the material of which undoubtedly originated from the denudation of gold quartz veins. Gold seldom occurs in the pebbles of such recent marine placers; it also evidently occurs in them re-crystallized, and its distribution is, contrary to that in fluviatile placers, approximately even over its whole width; finally, nuggets are here also absent. He connects the re-crystallization of the gold and of part of the pyrite, which he admits occurs on the Rand on an extended scale, with the eruption of diabase. This theory is certainly fascinating, but it does not attempt to remove a weighty objection, namely, that were it correct, the gold should by rights occur primarily in the quartzite sandstone layers, as the material of recent marine placers are generally principally sandy. J. W. Gregory has recently advanced the theory in a somewhat altered manner. He attempts to explain the auriferous conglomerates as shore deposits which have been subjected to the action of the waves during a long interval of time, being thus enabled to retain the minute gold particles within their interstices, while the light sand and mud was continually removed. Iron oxide grains were originally present, which later were converted into pyrite. But why is ilmenite, so characteristic of marine placer conglomerates, absent?

4. The theory of the subsequent transportation of gold to the conglomerates.

The view, well worthy of consideration, which, rightly described, has also been called the theory of subsequent mineralization and enrichment of the conglomerates, has been specially defended by E. Dorsey, A. R. Sawyer, Gardner F. Williams, J. S. Curtis, J. Kuntz, K. von Kraants, P. Krause, John Hays Hammond, F. H. Hatch, G. S. Corstorphine, and R. B. Young. It can be described as the prevailing view in the circle of Johannesburg mining engineers.

The assumed subsequent penetration of auriferous solutions is connected with the eruption of diabase. The pyrite, according to this theory, is considered as primary and at the same time as a precipitating material of the gold, as actually demonstrated by Johansson and Liversidge, who obtained a precipitation of gold in very dilute solution of chloride of gold through pyrite; or at least the precipitation of pyrite occured a little sooner than that of the gold. It certainly cannot be proved that the amount

*Translated for *Mining and Scientific Press* from 'Science of Ore Deposits,' Vol. II., new edition.

of gold is proportional to that of the pyrite. There are even highly pyritical lodes without gold. Hatch and Corstorphine have therefore suggested organic substances which actually occur in the conglomerates as a precipitation medium. I have already mentioned, however, that these are not generally present. The uneven distribution of the gold within the conglomerates and the occasional enrichment of the lodes in the vicinity of eruptive masses favor the infiltration theory.

The fact that elsewhere in the Transvaal, in the Lydenburg district, undoubted sediments, here dolomite of the Malmain horizon, have been mineralized through solutions which deposited quartz and gold, together with copper, is corroborative of the infiltration theory. The observation that in a much higher geological horizon, that of the Black Reef, the auriferous character of a conglomerate is repeated, also the absence of a constant horizon of ore deposits of this nature, is favorable to the thory.

The principal objection to this theory should certainly not be passed over; namely, that only single layers, not all conglomerate reefs, are found impregnated with gold, that therefore no equal impregnation zones run through all layers of the Witwatersrand along fault planes or dikes.

Against this the originally unequal porosity of such rock layers should be pointed out. Thus it appears that the cement of those beds known as poor, like the Main Reef, Elsburg, Bird, and Kimberley Reef, have become denser through a larger admixture of finest quartz sand than the other richer reefs. When apparently porous layers, such as the breccia-like 'Bastard Reef' below the Main Reef Leader in the New Goch mine (J. W. Gregory) is found poor in gold or with gold absent, this is certainly remarkable. Yet the question is whether this condition has not been occasioned by later removal of cement.

Objections to Infiltration

A statement frequently brought forward against the infiltration theory is the view that channels are absent. J. Kuntz has meanwhile (1908) pointed out that south of Greys Mynpacht on the West Rand auriferous quartz veins were formerly worked, and that possibly such poor reefs have frequently occurred but been little observed. Also an auriferous diabase dike with up to 12 gm. to the ton is known at the Meyer and Charlton and the City and Suburban. I also noted an apophysis in the conglomerate which was projected from a diabase dike which intersected it. This offshoot was full of visible free gold, and even the South Reef was enormously rich at the immediate contact (over 6000 gm. per ton). The diabase mass had in part replaced and filled the interstices between the pebbles. Much more numerous, according to J. Kuntz, are instances in which non-auriferous diabase dikes or faults have exerted a visible enriching influence on the conglomerates in contact on either side. Such an enrichment is known, for instance, in connection with a diabase dike at the Princess Estate and at the fault in the Bird Reef group of the Van Ryn and Chimes mine. In the latter case the enrichment extended for 200 metres on either side.

The most important argument for the infiltration theory is certainly the dependence of the value of the gold in the conglomerates on their dip, as has been lately demonstrated by J. Kuntz, who has practised on the Rand for many years. The steeper the dip of the conglomerates, the stronger have they been compressed and the more faulted they have become. This accounts for their greater gold values in comparison with the undisturbed reefs which are slightly or not at all inclined. "Compare", wrote J. Kuntz (1908), "the gold values in the reefs of the mines lying in relation to depth below one another, Ferreira, Ferreira Deep, Robinson Deep, and Turf mines, in the Central Rand; Champ d'Or, French Rand, and Tudor in the West Rand, or the several Knights mines in the East Rand, or the gold values of the Deep Level mines, with the results obtained in the deepest boreholes, and it will be found how clearly this appears to be the case." The deeper the reefs, the flatter and more undisturbed are they known to occur. That this rule is not without exception is shown in the tables of F. W. Voit and Kessler.

Steam-Shovel Records at Panama

The *Canal Record* states that 1,183,900 cu. yd. was removed by steam-shovels in March from the canal prism and presents the following records of individual performance. Except where noted, monthly reports are computed by place measurement, while the daily reports are based on car measurement. The best record for the month and for one day are shown in the following table, figures being in cubic yards:

BEST RECORDS FOR THE MONTH

CULEBRA DISTRICT

Shovel No.	Earth.	Rock.	Total.	Days.
208	.....	51,128	51,128	25
207	39,350	10,802	50,152	25
224	46,180	.....	46,180	*42

EMPIRE DISTRICT

216	.....	39,412	39,412	25
227	500	38,703	38,703	25
221	1,472	35,478	36,950	24

BEST RECORDS FOR ONE DAY

Shovel No.	Location.	Date.	Material.	Cu. yd.
205	Empire	Mar. 7	rock	2778
229	Empire	Mar. 8	rock	2775
227	Empire	Mar. 8	rock	2473
208	Culebra	Mar. 24	rock	2940
208	Culebra	Mar. 25	rock	2800
208	Culebra	Mar. 10	rock	2760
207	Culebra	Mar. 3	rock	2600

*The excess number of days over and above the actual number of working days in the month of March (25) is due to double shift and night work.

Tin is used to adulterate silk, and the matter has lately been brought to public attention in connection with strike troubles in the silk mills. A manufacturer explains that the tin is used "to weight" the silk and also contributes to its firmness. It is used up to 60% by weight of the material. Sugar is also used as an adulterant, but it is not explained whether sanded sugar or the pure article is needed.

Electric Hoisting at Cananea

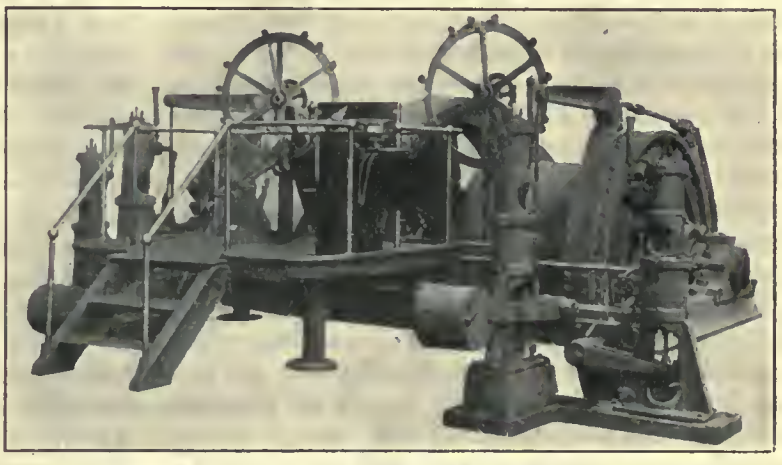
By H. L. Gooding and T. T. Read

The conditions under which the mining operations of the Cananea Consolidated Copper Co. are conducted make the use of electric hoists convenient and economical. In connection with the smelter, at the town of Cananea, there is a central power-house, consisting of waste-heat boilers in connection with reverberatory furnaces and additional oil-fired boilers, using California crude oil heated to 140°F. before being pumped to the burners. The electric-power supply is furnished by a battery of 1875-kva. General Electric high-pressure steam turbines, supplemented by an older set of direct-connected McIntosh, Seymour & Co. vertical engines. As shown in the accompanying diagram, the principal mines operated by the company are from 1 to 7 miles distant from the power-house. At some of these there are several hoists, above and below ground, and the total number now in operation is over 50. The advantage of actuating these from a central power-house, rather than by the use of distributed boiler-plants, is too obvious to need comment. The hoists are of different sizes, but, as shown in the diagram, there are three 375-hp. hoists, rated at 8500-lb. rope pull and 1250 ft. per minute rope speed; two 300-hp. hoists; fifteen 112-hp. hoists, rated at 4500-lb. rope pull and 700 ft. per minute rope speed; and a variety of smaller hoists. All these were built by the Wellman-Seaver-Morgan company.

The 375-hp. hoist at the Cananea-Duluth mine, designed by H. L. Gooding, is the most interesting, since it is the first induction-motor hoist built to be controlled by a positive electric brake. This is actuated by a small fly-wheel motor-generator set, so that the braking is not affected by failure of the line current. This fly-wheel set necessary to accomplish this is placed at one side, to the rear, and consists of a 10-hp. motor, fly-wheel, and a direct-current exciter, furnishing 5 kw. of direct current to the stator of the 375-hp. motor for use during unbalanced lowering of men, timber, and steel. If the line current should fail during the operation of lowering, the fly-wheel would maintain the direct current excitation for a period of 1½ minutes. A separate handle, at the right of the hoist operator, controls an oil switch throwing the direct current into the stator of the motor. This switch is provided with a safety interlock with the master controller, so that both cannot be thrown at the same time.

The capacity of the hoist is 8500 lb., at a rope speed of 1250 ft. per minute, and working to a depth of 1000 ft. The rope drum is driven by single-reduction Falk helical gearing from a 435-r.p.m., 375-hp. intermittent rating, General Electric 3-phase, 60-cycle, induction motor, using the line current through two 3-pole, 2300-volt air-brake reversing contactors. The clutches and brakes are air operated from an elevated platform, as seen in the illustration. The hoist is now being operated on two 8-hour shifts, hoisting about 800 tons of ore from the 600-ft. level, and is not working to its full capacity.

This system of positive electric braking has given excellent satisfaction, several duplicate hoists being under construction at the present time for Western mines where conditions do not warrant the installation of an expensive Ward Leonard system of control. It is independent of contactors, and has given no trouble. For the service the hoist is called upon to perform, this is an excellent arrangement, the control being nearly perfect, and the decreased wear on the brake-blocks, which are only used for holding the drums, does away with the inconvenience,



CANANEA HOIST. THE MOTOR IS HIDDEN BY THE DRUM.

labor cost, and lost time of renewing them. For these reasons the electric brake is immensely popular with the hoist operators. In response to this demand the 55-hp. hoists, which are single-drum machines, are arranged so as to use reverse current

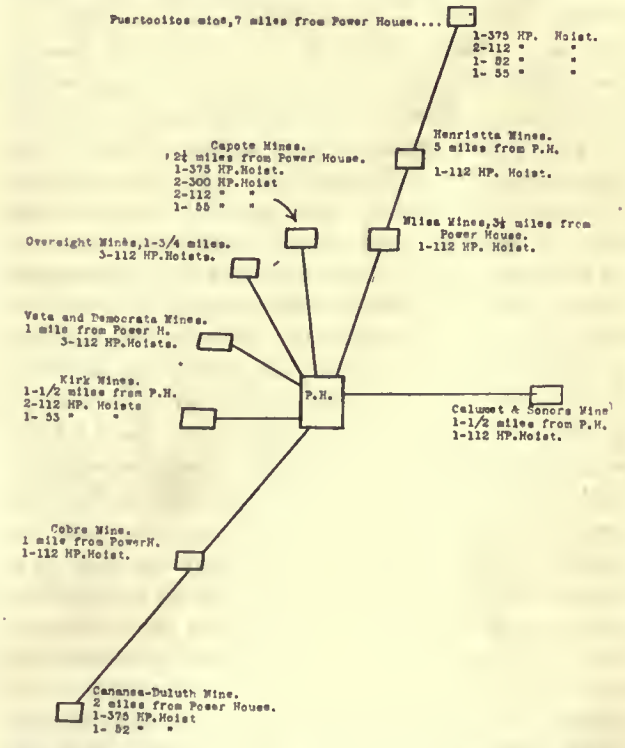


DIAGRAM SHOWING RELATIVE POSITION OF POWER-HOUSE AND HOISTS.

for braking below full speed. A standard drum controller is used and an additional rheostat for cutting down the torque of the hoist motor to the point which permits of it holding its load stationary or overhauling at a proper rope speed in lowering varying loads.

Wolfram in Queensland

*Wolfram mines of Mt. Carbine, Queensland, have recently been examined by L. C. Ball, assistant government geologist, and the following notes are on the treatment of the ore produced by the Irvinebank company:

The Irvinebank company is in the fortunate position of being able to dispense with all preliminary dressing of the ore, the whole of which as broken down is sent to the mill bins, as if any were picked out it would have to be broken up by hand, and that would cost more than crushing by machine. In any case, little of the ore as it comes from the mine is in large blocks, for the cohesiveness of the already friable quartz is further weakened by the disseminated feldspar and wolfram, and blasting reduces it to small fragments, so that quite 40% passes through a ¾-in. screen.

The ore is discharged from the cars at the mouth of the mill adit into a double V-shaped 20-ton bin, originally provided with grizzlies let into the bottom, but these gave so much trouble by clogging, that they have been dispensed with, and all the uncrushed ore now discharges from chutes upon a central platform, whence it is fed by hand into a 16-in. Hadfield crusher. The capacity of the machine, which requires 4 hp., is 20 tons per hour; but the weekly capacity of the mill being from 260 to 315 tons, it is run intermittently and during the day shift only. The crushed stone falls upon a percussion launder, and is fed into a bucket elevator, which carries it to a 70-ton bin above the battery. From this bin the ore is charged, by means of patent percussion chute-form feeders, into the mortar-boxes. The battery, comprising two units of 5 stamps and built by Walkers, Ltd., has a compound frame of steel and timber, the mortar-boxes having single discharge, provided with 8-mesh screens. The stamps, each of which weighs 1200 lb., make 98 drops of 6½ in. per minute; and the duty of each stamp is 5 tons per day of 24 hours. Two other units of 5 stamps each were in course of erection at the end of 1912, and for the filling of the new bin it was proposed to install a horizontal conveyor from the bucket elevator. The management has hopes that this expansion will be followed by reduced costs, as it is not anticipated that any increase in the present battery crew will be needed to attend to the 20 stamps. For the crushing of 1500 tons of fines, produced and sluiced by the company prior to the erection of the battery, a 5-ft. Huntington mill was put in temporarily, but, the whole of the fines having been put through at the rate of 80 tons per week, the machine has now been again dismantled.

The pulp from the two batteries is not mixed, but feeds two separate plants, differing only in the design of the Card tables, and each comprising a Card, baby Krupp, and Krupp table, working 260, 360, and 380 strokes per minute respectively, with two Luhrig vanners, a Wheeler pan, upward-current classifier, and a series of conical settlers. The pulp from the battery screens gravitates into an upward-current classifier, the underflow from which is run to a Card table, producing concentrate, seconds (that are crushed in a Wheeler pan and pumped back to the classifier), and a tailing that goes to waste. The overflow from the classifier passes into a 2-ft. settler, the coarse from which is discharged on the baby Krupp table, producing a concentrate (troughed), seconds (returned to the classifier), and tailing. The overflow from the first settler is run into a second, (2 ft. 6 in. diam.) the pulp from which feeds the large Krupp table (with products as in the case of the baby Krupp). The overflow from the second settler is led to a third and fourth, each 5 ft. diam., and the pulp from these feeds the first and second Luhrig vanners, which yield concentrate, seconds pumped to the classifier, and tailing run to waste. The waste water from the last conical settler is run through a number of settlers of various forms, and then clarified with ash from a boiler prior to being used again. The tailing carries 0.2% wolfram, and the extraction is 87%. Troughs for cleaning the Krupp concentrate are of the usual pattern, about 10 ft. long and 18 inches in cross-section. The dressing tub has special features. It stands 4 ft. high, and is 3 ft. wide at the top; it is fitted with revolving blades to agitate the concentrate, the packing of which below any lighter gangue, is ensured by a mechanical knocker actuated by a spring and cam, worked off the shaft which causes the blades to revolve.

Since 1906, the Irvinebank company has treated 24,745 tons of ore, yielding 666 tons of concentrate worth $300,000. The concentrate averages 71.6% WO_3, with the following composition:

	Per cent.
Insoluble SiO_2, etc.	4.0
Tungstic acid	71.2
Copper	0.2
Bismuth	0.1
Iron oxide	18.0
Manganese oxide	6.0
Undetermined	0.5

*From *Queensland Government Mining Journal.*

Cement-Making Material

According to E. C. Eckel, writing in Bulletin 522 of the U. S. Geological Survey, a barrel of portland cement will consume about 450 lb. of limestone and 150 lb. of clay or shale. A plant making 1000 bbl. per day will therefore use, in the course of an ordinary year, about 66,000 tons of limestone and 22,000 tons of clay or shale. Assuming average density for these materials, a 1000-bbl. plant will use up almost 1,000,000 cu. ft. of limestone per year, together with 250,000 cu. ft. of shale. As the investment in plant is heavy, it would be folly to locate a cement plant, under ordinary circumstances, at a point where less than 20 year's supply of raw materials is in sight. A thousand-barrel plant, therefore, should have 20,000,000 cu. ft. of limestone and 5,000,000 cu. ft. of clay or shale on its properties.

Taxation of Iron Ore Lands in Michigan

By P. B. McDonald

During the past three years, taxation of mineral lands in Michigan has undergone radical changes. The question has proved complex and it is not yet completely solved, but a considerable improvement has been made, and a great deal of information has been brought to light.

The Old Way

In 1909 I happened to talk to a mine manager at Iron River, Michigan, concerning mine taxation. He complained that in a nearby district where he was conducting a small exploration, the property (on which only a handful of iron ore had been found and which consisted of a few tar-paper shacks) had been assessed at $20,000, while a mile or two away a big producing mine of another company was assessed at $30,000. His exploration turned out so discouraging that it was abandoned a few months later, thus proving it to be of no value whatsoever; the nearby mine belonged to a company which was considered the dominant interest in the district; it probably could not have been bought for $500,000. The assessing of iron mines was then done by local assessors who had very little knowledge of correct values of anything bigger than a store or a residence; their figures were supposed to be subject to approval of other officials who probably knew even less of what each mine had. One of the determining factors with such assessors was the general air of prosperity that a mine seemed to have: condition of surface equipment and buildings influence them.

The New Method

In 1911 Chase Osborn, who had lived in the iron-mining districts of Michigan, became governor of the state, and through his efforts J. R. Finlay was engaged to appraise the mines. Only about three months' time was allowed for the work, making personal trips to the individual mines impossible. Mr. Finlay established himself with assistants in Houghton as a headquarters and engaged C. K. Leith, of the University of Wisconsin, as adviser on iron mines. It was previously known that the copper mines were assessed at higher figures proportional to their real value than the iron mines because they were operated for the most part by public stock companies listed in the copper market, while the iron mines were practically all owned by close corporations and it had not been possible to even approximate their value by any method of prevailing stock quotations. When Mr. Finlay's report was published, it was seen that he had in general appraised the copper mines at much less than their prevailing stock values, and had radically raised the iron mines' valuations. This caused a movement in the copper market and aroused disapproval from some of the iron-mine operators whose taxes were increased.

Mr. Finlay's report was put in the hands of the State Tax Commission. His valuation of the iron mines totaled $119,485,000, but the Tax Commission reduced this to $85,637,500. The former valuation by the local assessors had been $19,626,008. Of a total of 101 iron-mining properties, four were reduced; many were raised several hundred per cent. The Newport mine of Ferdinand Sehlesinger, on the Gogebic range, was raised from $1,471,061 to $8,535,000; the Norrie group of the United States Steel Corporation in the same vicinity was raised from $1,800,600 to $14,651,000; a Cleveland-Cliffs Iron Co. tract at Negaunee was raised from $1950 to $474,000; a Breitung-Kaufman property nearby was raised from $12,000 to $560,000; at Iron River, the Caspian and Baltic mines of Pickands, Mather & Co. were raised from $536,000 to $6,469,000; and a Jones & Laughlin property with no equipment was raised from $300 to $450,000. Others were raised in like proportion. The Cleveland-Cliffs Iron Co. paid a quarter of a million dollars in Ishpeming and Negaunee for 1911 taxes; the Newport mine's tax at Ironwood amounted to $100,000. Instead of valuing the iron mines by the amount of paint on the surface plants or by hearsay and rumors, Mr. Finlay adopted a definite system.

Valuing the Plant

Surface plants in these estimates were given no value. Mr. Finlay's remarks on this subject are as follows: "The value of a mine depends wholly upon the ore; that is, the equipment has no value except as applied to the ore. A mine fully equipped is more valuable than a mere orebody without equipment, for dividends can begin sooner, but when a mine's orebody plays out the equipment is mere junk. The equipment of a mine consists very largely of structures that cannot by any possibility be moved; the shafts and other excavations are a part of the equipment. The buildings and machinery may occasionally yield some salvage, but necessarily a small amount. A large part of the expense of installation of machinery consists of labor and materials for housing and erection; this is wholly lost when it is proposed to move the machine." Mr. Finlay's method of appraisal of a mine was by finding the present value of a series of dividends for the term of years the estimated ore would hold out; taking the dividend rate at 5% and reinvestment at 4. Several active copper mines were appraised at zero because no dividends were likely to be forthcoming. The selling prices of the different grades of iron ore were taken as the average of prices for the previous seven years. The costs of mining and the future supply of each mine were estimated from records and blueprints submitted by the operating companies. Unexplored mineral lands were not valued, as no adequate method of appraisal could be devised, although it was admitted that such land is often known to be very valuable. Several of the iron-mining companies made serious protests against the Finlay method of appraisal, and one or two refused to pay the increased taxes. It

is true that in many instances the taxes on the mines looked unduly burdensome, often amounting even at old active mines to 30 or 40c. per ton of ore shipped, which is a large percentage of the total value of such a low-priced material as iron ore. For one entire non-bessemer district on the Menominee range, the cost of 1912 taxes was reported to be 60c. per ton of ore shipped; a high figure, largely due to the district being in a development stage with several heavily assessed mines not yet producing. At one famous old mine on the Marquette range, the manager stated in 1912 that the assessment was over $1 per ton for all available ore in the property. When it is reealled that a ton of iron ore on a stockpile at a Michigan iron mine is worth usually less than $2, it is seen that a tax equal to 30c. per ton on the shipment is relatively high. The objection to the Finlay appraisal by the representatives of the mining companies were briefly as follows: (1) That the average selling price for the previous seven years was too high for future estimates, as those seven years had been 'boom' times; (2) that for the same reason the mines had for several years been producing an unusually large amount of ore, which would probably be lower in the future; (3) 5% was taken to be a fair return on a mining investment, when no investor would consider a mining project that was not reasonably certain of paying 10%; (4) the time allowed for making the appraisal (three months) was too short; (5) other than mining property in Michigan, including manufacturing and farming interests, is assessed at one-third to one-half of its actual cash value, while the mines were now assessed at fully 100% value.

Reductions Have Been Few

Reductions were granted by the state in only three or four instances, when it was proved that the ore was of lower grade than the appraisal figured, or when there had clearly been some misunderstanding. The first objection raised by the companies has so far proved well founded and prices have been lower than the computed schedule. On the other hand, the 1912 shipment was the largest on record and it looks as if next season's would be larger.

After nearly two years of trial, it looks as though the Finlay method of appraisal of Michigan iron mines would continue to serve, and that the value of a mine would be figured as the present worth of a series of dividends calculated for the number of years the orebody can maintain the dividends. Taxation on such a basis is undoubtedly fairer than the tonnage tax system which is usually introduced in the Michigan legislature at every session by some lower peninsular farmer. Such a method calls for a tax of 25c. on every ton of iron ore produced, without regard for the grade of the ore, the cost of producing it, or how large the orebody is; thus a mine which is shipping 50,000 tons of high-grade ore yearly and selling it at $3.50 in Cleveland, making a profit of $1 per ton or $50,000, would pay $12,500 in taxes, while a low-grade mine shipping 200,000 tons selling at $2 and making 10c. per ton, or $20,000, would pay $50,000 in taxes.

Keeping Track of Reserves

The present difficulty in the taxation of the iron mines is to keep an accurate record of changes in size and quality of orebodies due to exhaustion or new explorations, and to adjust the mining companies' assessments to the same basis as other property in the state. To accomplish this first purpose, the State Geologist has been supplied with assistants and given authority to keep a constant record of all new explorations and condition of orebodies. The second difficulty, in regard to treating all property in the state alike, mines, farms, factories, residences, and other property will require some time to overcome. It is proposed to assess all classes of property at their true value, and at a recent meeting of Michigan taxpayers held at Lansing, a resolution was adopted requesting the legislature to authorize the State Tax Commission to remove all assessing officers who do not in their valuation conform to the requirements.

Western Australia Gold Production

The January returns from the state were $2,223,800, and from the principal mines as follows:

Name.	Tonnage.	Value.	Profit.	Div.
Great Boulder	18,133	$245,200	$138,300	.....
Ivanhoe	19,609	194,000	80,000	$225,000
Young Australia	712	56,300	51,000	50,000
Kalgurli	10,560	105,000	45,200	120,000
Yuanmi	10,580	94,500	34,900	.....
Lake View & Star	18,059	102,900	17,000	.....
Fenian	2,800	35,500	15,000	.....
Victorious	9,600	63,900	35,100	.....
Mararoa	2,612	24,500	9,500	.....
Sand Queen	1,014	19,000	8,700	7,500
South Kalgurli	9,820	55,500	7,500	.....
Golden Ridge	2,909	25,700	8,500	.....
Associated	10,895	65,900	6,800	.....
Mountain Queen	3,232	22,100	6,500	.....
Black Range	2,900	31,000	6,500	.....
Ingliston Consols	1,150	11,500	6,000	.....
Menzies Consols	2,008	19,100	4,000	.....
Lake View Consols	9,720	8,600	2,300	.....
Lady Miller	1,600	7,200	2,000	.....
Commodore	1,100	7,500	1,700	.....
Ida H.	1,304	14,500	1,500	.....
Burbank's Main Lode	1,817	20,600	200	.....
Oroya Links	10,230	57,600	5,500	.....
			Loss.	
Sons of Gwalia	13,501	106,800	10,000	.....
Perseverance	21,098	104,200	1,500	.....
Great Fingall	5,926	48,300	30	.....
Hainault	3,942	20,700	800	.....
Golden Horse-Shoe	24,676	150,000	8,400	.....
Marvel Loch	1,718	8,500	1,400	.....
Associated Northern	1,461	38,800	.....	.....
North Kalgurli	522	6,700	.....	.....
Kyarra	609	10,000	.....	.....

The Bullfinch boom, which started in Western Australia toward the end of 1910, will be remembered, and the first return from the new mill of the Bullfinch Proprietary is as follows: From February 15 to March 31, 15 stamps worked 838 hours, treating 5178 tons of ore yielding gold worth $74,000. Mining, transport of ore, treatment, and development totaled $4.64 per short ton, and net profit was $49,000. The grade of ore treated was higher than the average value of the mine, and $43,500 is locked up in the mill circuit.

The Largest Tube-Mill Plant

The treatment-plant of the Waihi-Paeroa Extraction Co., situated at the junction of the Waihou and Ohinemuri rivers, 15 miles from Waihi, claims the distinction now of being the largest tube-mill plant in the world. Its cost totaled $400,000, and its arrangement is interesting. The Waihi-Paeroa company is dredging the Ohinemuri river a couple of miles up from the plant toward Waihi, and the plant was built to treat old battery residue dredged from the river. It may be explained that this river having been gazetted a 'sludge channel' during the past 25 years or so, over 6,000,000 tons of residue has been sluiced into it from the mills of the Waihi, Silverton, Grand Junction, Waitekauri, Crown, Woodstock, Talisman, and other mines near its course. Over 4,000,000 tons was discharged by the Waihi company alone. All the residue has been washed down the 15 miles of river to Paeroa, where the stream is fairly wide and deep, and forms a settling basin. The slime flowed on with the Thames river, the name given after the junction of the two rivers mentioned. The Waihi-Paeroa Extraction Co. estimates that it has fully 2,000,000 tons of sand to treat. The method of recovery is to raise the tailing from the river by means of air-lifts, with water jets at the bottom, into flat-bottomed punts holding 75 tons each, at a cost of 6c. per ton. The large dredge fills a punt in an hour. It is towed by a small oil launch to the plant, a distance of 1½ miles.

Reclaiming Tailing

On the bank of the river there is a movable belt and bucket-elevator which is lowered to the punts, set in operation, and which lifts the sand as it is sluiced to the boot by a man with a hose. It takes about one hour to empty each punt. The elevator discharges into a revolving trommel, the rubbish from the river being mostly eliminated here. The trommel screenings go to a large concrete receiving-tank with a capacity of 3000 tons. This tank is emptied by an air-lift on a traveling platform, the pulp flowing to a second belt-elevator, and from this distributing-launders take it to 10 Union vanners. The river contains a fair amount of fine gravel, organic matter, coal and coke, which have been washed down from time to time. The vanners have to get rid of this and discharge a clean sand with as litle moisture as possible. This they do well, and the vanner is washed clean by jets of cyanide solutions, this being the first contact of the sand with solution. The refuse from the vanners is valueless and is dumped out. The pulp is next lifted by No. 3 belt-elevator to a deep storage-tank, and out of this by an air-lift to a mixing or distributing pan, which supplies the launders to the tube-mills.

There are 20 mills, each 4 by 16 ft., four being driven by belts and gear, the other sixteen being in four rows of four each with shafting between each two rows. Each pair of mills is here driven by one pinion and a Heywood & Bridge patent friction clutch. There is a difference of opinion on this new drive and the old style. The tube-mill discharge is now elevated by two wheels, in stages, to a distributing tank. These wheels handle over 12,000 tons of pulp per day. From the distributing tank the pulp flows to 11 classifier tanks, the underflow returning to the tube-mills. The overflow or slime has about 3 lb. of lime added per ton and cyanide solution made up to 0.8% strength. All the slime flows to four thickening-tanks, 20 by 20 ft., with a bottom conical from 6 ft. down. These act well. The clear overflow is returned to the plant, and the thickened slime is pumped to 15 Brown agitators without central lift, for 48 hr. agitation.

The filter-plant is of interest and consists of three vats, about 20 by 20 ft., conical from 6 ft. down. The central vat is for the slime from the agitators, the others being for washing and discharging. The slime vat has in it four small air-lifts, equidistant around the inside, to keep the pulp from settling, and inside at the bottom there are three water jets and a small agitator. There are two baskets of leaves, which are moved from one tank to another by an overhead electric traveler.

Cycle of Operations and Cost

The cycle of operations is as follows, the cost being about 4c. per ton: forming cake, 5 min.; washing, 15 min.; discharging, 10 min. The discharging takes place in the same tank as the washing; the small agitator stirs the residue, and the water jets thin it down, so that it can flow to the river below the works. The gold solution flows to storage vats, and then through 20 zinc extractors. The roasted precipitate is smelted in kerosene furnaces holding a No. 200 crucible each. The bullion contains little base metal, but is high in silver, as is common throughout the district.

Centrifugal pumps lift the agitated slime to the vacuum plant, but seem to cut out quickly, and another pump will be tried. There are two Babcock boilers fitted with automatic stokers, economizers, and superheaters. The mill engine was made by Hicks, Hargraves & Co., of England, and is fully loaded. There are also vacuum-pumps, an air-compressor, generator, and a complete repair-shop. It must be remembered that the plant, the capacity of which is 500 tons per day, is dealing with a clean sand only, the slime produced by the mills, though fine, containing little or no alumina, which is so troublesome elsewhere. This accounts for the rapid formation of cakes and washing. The river sand is worth about $2 per ton, and costs do not exceed $1. The whole undertaking is of much interest, and despite the large amount of capital spent on an excellent plant, it is proving to be highly profitable. The manager, R. Aitken, described the proposed plant for the *Proceedings* of the Australian Institute of Mining Engineers, when that institution visited the district in 1911. In designing the works he was ably assisted by C. A. Banks, of Waihi, and now of the Jewel mine, British Columbia, who also described the plant in *The Mining Magazine* of August 1912. Two more tube-mills have been since added. During 23 days in January, 11,000 tons of tailing was treated, yielding $16,000, while returns to date total 105,100 tons, yielding $140,000, and a dividend of $30,000 has been paid.

The Trans-Australian Railway

Between the goldfields of Western Australia and the most westerly point of the South Australian railroad system is a gap of 1063 miles. This will be bridged by the Trans-Australian railway, of 4 ft. 8½-in. gauge, and estimated to cost $3,988,000, the building of which has now been inaugurated by the turning of the first sod at both ends. On February 12 a host of federal visitors, including the Rt. Hon. Andrew Fisher, prime minister; Messrs. C. Fraser, postmaster general; George Pearce, minister for defense; T. Bath, acting premier of Western Australia; P. Collier, minister for mines and railways; T. Walker, attorney general; and a number of

THE PRIME MINISTER, MR. FISHER (THIRD FROM RIGHT) AND OTHERS AT THE GREAT BOULDER MINE.

state members of parliament, arrived at Kalgoorlie by special trains, and at midday the first sod of the railway was turned by Mr. Fisher, the prime minister of the Commonwealth, in the presence of about 7000 people. The occasion was marked by a round of festivities and entertainments, and the utmost enthusiasm prevailed. The prime minister was presented with a handsome gold shovel as a souvenir of the occasion, and he announced that the work would be expeditiously pushed on to completion. This railway, it will be remembered, was strongly recommended by Lord Kitchener, and will be of immense advantage to trade and commerce, as well as being of enormous strategic value. On the day following, the federal visitors were taken to several of the mines. The initiation of this line of railway will probably mark an epoch in the annals of the Australian Commonwealth.

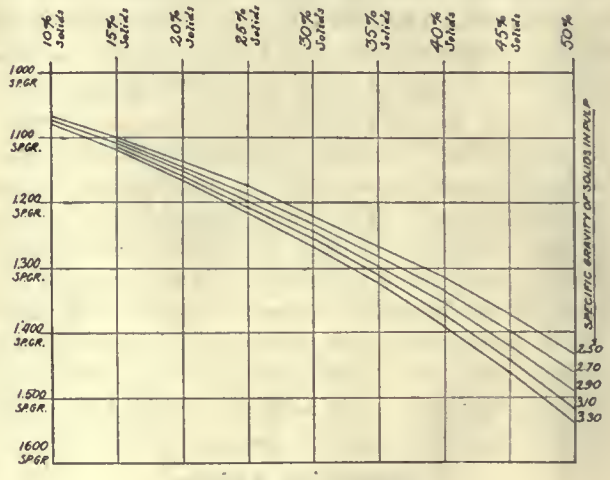
Timbering the Belmont Mine

Timbering the Belmont shaft at Tonopah, commenced on March 14, 1912, and was completed to the 1000-ft. level on June 5. The work was carried on from the collar downward, without disturbing pump columns, air pipes, or power cables. The space between the rock walls and lagging was filled solidly with old shaft timber. Oregon pine, amounting to 275,000 ft., board measure, was used, being dipped in carbolineum preservative, and after nine months' trial, the beneficial results therefrom are as predicted.

Timbering costs, although materially reduced from those of 1911, have been high during 1912. The new method of timbering by triangular sets, adopted a year or two ago, has proved so successful in that it is vastly more resistant to crushing, that it is used almost exclusively in place of the square sets. Mining without timber, by a modification of the shrinkage system, is practised in those stopes of the Belmont vein where this method is feasible. The stopes on the narrower shaft, Mizpah Fault and Lillie Belle veins, have been timbered with stulls.

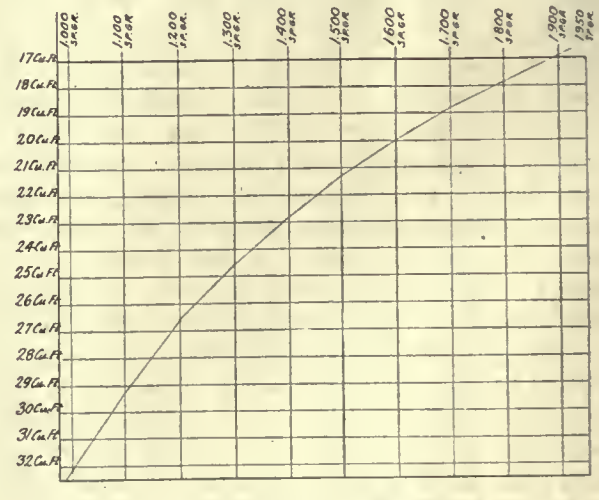
Specific Gravity Curves

Many of the ordinary problems around a cyanide mill may be readily solved by graphical methods, and it is worth while to prepare a few charts covering such cases. Below are two prepared by C. F.



SPECIFIC GRAVITY CURVES.

Spaulding and which are of wide usefulness. By means of the first, having the specific gravity of the pulp and that of the solid matter, the percentage



CURVE SHOWING NUMBER OF CUBIC FEET PER TON OF PULP OF ANY SPECIFIC GRAVITY.

of solids in the pulp may be read direct. By means of the second, the number of cubic feet to the ton may be readily determined for any pulp of which the specific gravity is known.

Charters Towers, Queensland, mines, produced a total of $144,000 during February, from 8423 tons of gold ore and 5476 tons of tailing, 226 tons of smelting ore, 14 tons of lead, and 6 tons copper ore. Dividends paid were $8000, and assessments $13,000.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Mine Administration and Mine Bosses

The Editor:

Sir—During the past six months I have been reading in the *Mining and Scientific Press* a number of articles on Pete, Tom, shift-bosses, foremen, and superintendents, as well as boarding-houses and other similar topics. And I wish to emphasize the fact that all the articles contain a good share of truth. However, I want to add that in the great majority, and, I might well say, all of the cases where there is so much fault to be found by Pete, the remedy is simple. Why doesn't he draw his time and go somewhere else? And if Mr. 'Super' has a crew of 'hogs' working for him, men who do not help him in his struggles for success, it is his own fault for not using the check-book. These arguments only bring out the old saying that a man is known by the company he keeps. There are four very essential things to be considered by any successful 'Super.' The first is, for himself to be at least a good miner; second, he must have a check-book that is always available; third, he needs a good blacksmith; and fourth, but not least, he must have a respectable boarding-house. With these at hand, it is no trouble to do good mining. In my 25 years of mining in the majority of the leading districts of the United States, I have found the mining element made up of human beings, civil, intelligent, and, in the great majority of cases, honorable in every way. Treat them with respect and they will respond; treat them with disdain, and a 'Super' would be a failure with a two-inch vein of solid gold. All miners employed are workingmen, and so is the 'Super,' and because his monthly check happens to be a little larger it makes him personally no better than anybody else, and his job is liable to end just as quick.

ANY OLD JOB.

Modesto, Califorina, April 20.

Extraction Difficulties

The Editor:

Sir—I have read with interest the articles that have been published recently in several of the mining and metallurgical magazines, setting forth the difficulties of arriving at a close valuation of the ore delivered to mills for treatment, and of the trouble experienced by many mill superintendents in checking the extraction from month to month, when the assays of the heads are used as the base from which the recovery statement is calculated. As has been said in several articles, the common practice in the mills of Nevada and of some of the other states, is to base all calculations of extraction on the value of the tailing discharged from the mill, plus the bullion recovered. There are several objections to this method; among them the refinery loss and the loss from leakage of solutions, but as these slight losses are constant, a deduction from the total extraction may be made each month to meet them, if it is thought necessary. Regarding the arguments in favor of the above method, the following experience and notes taken from a mill which is now producing regularly, may prove of interest or value to millmen who may find themselves in 'hot water' concerning their extraction sheets.

As all my work and experience had been gained in mills where the 'tailing plus bullion' method had been used, it was with consternation that I found on taking charge of a new amalgamation and cyanide mill in the Northwest, that I was expected to hold the extraction to a point indicated by tests made on the ore and at the same time check closely with the mine samples and the battery head samples. The ore was found to contain most of the gold in the free state, some of the particles being the size of the head of a pin. I was told on first arriving at the mine that a check nearer than 0.05 oz. was rare, and that an absolute check was impossible. The mill, being a small one, was not equipped with an automatic sampler, and as the feed to the batteries presented the best chance of fair sampling, the head sample was taken there.

At the end of the first month's operation, the difference between the head and tailing samples was far from checking the bullion produced, but as the mill was new, the supposition that leakage and metals in lag would make up for the deficit was entertained. At the end of the second month the same low extraction obtained, though the tailing samples averaged no higher than during the previous month and the indications were that the extraction would be as high as the tests had shown. During this time the head samples had been checked time and again, and the differences on the same sample proved conclusively that it was not possible to check. The tailing samples were then studied, and because of the fineness to which the pulp had been ground, and to its very low grade, it was found that as close a check as could be weighed on an assay-ton sample resulted.

After satisfying myself that the gold was not going out in the tailing, I proposed the 'tailing plus bullion' method of calculating the extraction, but the plan met with decided opposition, the management stating that the chance of a filter-man turning a charge 'down the hill' was too great, and that the refinery loss would not be included in the figures.

I then sampled the tailing pond and found that all the different cuts made checked exactly with the tailing sample from the filter, so the loss through carelessness was eliminated. The management, however, continued to report a low extraction for the mill, and in the recovery statement sent out ignored the tailing samples entirely, reporting the bullion divided by the heads as the extraction and charging the resulting discrepancy to metal losses. The fact that the tailing plus the bullion came to within 0.5% of the extraction given in the tests made no difference.

In a last effort to prove the falsity of the battery-

feed samples, I took half-hour samples of the milling solution which was fed to the batteries, and of the solution after it had been in contact with the ore through the batteries, classifiers, tube-mill, and had gone over the plates, at a point where all the pulp passed into the thickener. The difference in value was credited as value extracted per ton of solution. Specific gravities were also taken at this point and a ratio of solution to pulp found. In this manner the amount extracted from a ton of ore by the solution was reached. A washed sample of the pulp was taken, also, at this point, and the undissolved metal in the ore computed from this. To these two values was added the amalgam. The total, divided by the number of tons milled, gave the theoretical head value. In this way neither the head sample with its free gold content nor the tailing sample with its chance of loss through carelessness entered into the calculations. There was no refinery loss, as the precipitate was not figured.

The following is a table taken during one week's run:

Battery solution value	Slime solution value	Value dissolv. per ton	Moisture in pulp, per cent	Ratio solution to pulp	Dissolv. from 1 ton pulp	Value of washed pulp
$1.80	$2.88	$1.08	81.3	4.4 : 1	4.75	$2.49
1.44	2.40	0.96	81.1	4.7 : 1	4.51	2.00
1.60	2.72	1.12	82.8	4.8 : 1	5.38	2.00
1.20	2.40	1.20	83.2	4.9 : 1	5.88	1.60
1.68	2.60	0.92	83.6	5.0 : 1	4.60	1.60
1.56	2.69	1.12	82.8	4.8 : 1	5.38	1.60
1.68	2.88	1.20	83.2	4.9 : 1	5.88	2.00

Clean amalgam recovered, oz.	Tons of pulp milled	Total val. amalgam, solution, and pulp	Theoretical head value	Assay head value	Diff. per ton	Total difference
44.05	77.01	$771.86	$10.02	$12.00	$1.98	$152.48–
54.525	69.47	726.13	10.45	16.00	5.55	385.54–
50.60	76.39	817.92	10.71	18.40	7.69	587.44–
52.425	70.51	790.74	11.21	10.00	1.21	85.32+
33.05	66.86	580.54	8.68	9.80	1.12	74.88–
31.95	84.22	748.23	8.87	12.80	3.92	330.14–
41.45	71.04	767.99	10.81	10.00	0.81	57.54+

W. M. Dake, Jr.

Rye Valley, Oregon, April 26.

Work of Lidgerwood Unloaders

During the month of March the following Lidgerwood trains and cars were unloaded by the central division of the Panama canal:

Location.	No. of unloaders.	No. of trains.	No. of cars.
Balboa	5*	1,114	23,394
Miraflores	2	270	5,670
Gamboa	4†	1,149	24,110
Total	11	2,533	53,174

*One unloader worked from the 1st to the 25th.
†One unloader worked 23½ days.

The Tigre Mill, Sonora

During 1912 the plants at El Tigre treated 67,832 tons of ore, averaging 0.138 oz. gold, and 28.25 oz. silver per ton; and 14,614 tons of old tailing, producing 2626 tons of concentrate assaying 2.01 oz. gold and 331.7 oz. silver per ton. A new 32-ft. Dorr thickener was installed, enabling clearer water to be sent to the mill feed, and other dewatering equipment was enlarged. Exhaustive experiments were carried out to determine if it were better to crush ore in solution, but results proved that it is advisable to crush in water. A clarifying press is being installed, and will be used to clarify the overflow from the Tigre thickeners before precipitation. The Kelly filters have given better results than during 1911, several minor improvements having been made. All the solution flowing from the residue dam passes through a large zinc-box, and then is pumped to either the mill or tailing ditch as desired. Several air-lifts were installed, two taking the place of Frenier pumps, with good results. A large 3-compartment zinc-box was arranged behind the weak-solution precipitating press to more completely precipitate contents of that solution, and now the solution tailing assays only 0.02 oz. silver per ton. Tube-mill elevators were made higher, and part of the re-ground sand from the tube-mills is sent to 7 concentrating tables in the old mill, which produce a good product. When this plant is shut down, all of the re-ground sand from the tube-mills will be concentrated, making use of the Wilfleys in the old mill. An increase of copper in the ore has given trouble with the cyanide solution, and it has been found that by close concentration, and sulphuric acid used to acidify the solution, and sodium sulphite as a precipitant, will eliminate most of the copper. A high protective alkalinity is necessary in treatment, but the amount of acid required to neutralize and slightly acidify the solution would be expensive. Some process must be devised to deal with the copper in the present ore reserves. An 8-ft. Hardinge mill, 2 classifiers, 4 cone-bottom dewatering tanks, and additional sand and slime concentrating tables have been installed in the stamp-mill, and should be working in May of the current year. A saving of 90c. per ton in cost is expected by this increased capacity and better treatment. Costs in the stamp-mill and cyanide plant were:

Cost per Ton

Crushing	$0.433	Agitation	1.724
Regrinding	0.028	Filtration	$0.284
Concentrating	0.339	Precipitation	0.190
Conveying tailing	0.059	Melting	0.323
Tube-milling	0.610	Alterations	0.382
Classification, elevating, etc	0.234	Experimental	0.014
		Total cost	$4.620

The concentrate shipped overaged 2.01 oz. gold, 331.68 oz. silver, 1.48% copper, and 6.98% lead.

Oil production in Japan in 1912 was 1,454,590 koku, equal to 1,374,900 bbl., valued at $4,218,310. Compared with 1911, there was a decrease of 4.9% in output, and an increase of 25.3% in value.

Special Correspondence

NEW YORK

A. S. & R. and Federal Officials.—The Lead Situation.—Alaska Gold Mines Doing Rapid Driving.—Porphyry Coppers Do Well.—Filtration and Flotation.

Mexican plants of the A. S. & R. Co. are, according to recent reports, all in full operation, with the exception of that at Velardeña, where the interruptions of the train service have brought about a shortage of supplies and fuel. The Chihuahua plant is well supplied with coke and is in little danger of a shut-down. The repeated rumors that an investigation of the 'smelter trust' is to be undertaken by the federal Department of Justice have simmered down to its lead-smelting interests, as the A. S. & R. obviously does not control either the copper or spelter market. It is related that an official of the company, when asked if it controlled the lead market, replied, "No one likes to sell for less and no one can sell for more." The Guggenheim lead-smelting companies control about half of the output of the United States and about a quarter of the world's production of lead. The production figures at present are about as follows: United States, 400,000 tons; Spain, 200,000; Germany, 160,000; Mexico, 140,000; other countries, 300,000 tons. In the United States the A. S. & R. produces 200,000 tons, and in Mexico and British Columbia 100,000 more.

Disregarding lead refined in bond, the United States last year produced 222,000 tons of desilverized lead, 141,000 tons of soft lead, and 29,000 tons of soft desilverized lead, making a total of 392,000 tons. Taking out the 200,000 tons, round figures, made by the A. S. & R. leaves 192,000 tons, divided among eight producers approximately as follows, according to the *Wall Street Journal*:

	Tons.
St. Joseph Lead Co.	60,000
Balbach Refining Co.	36,000
United States Smelting & Refining	27,000
National Lead Co.	22,000
International Smelting Co.	20,000
Desloge Lead Co.	10,000
Southwest Missouri	10,000
Pennsylvania Smelting Co.	7,000
Total	192,000

In most cases the A. S. & R. Co. has clinched its sources of supply by securing long-time contracts. In the instance of the Federal Mining & Smelting Co., which produces approximately 51,000 tons of lead per year, or 43% of the 117,000-ton production of the Coeur d'Alene district, the smelting company has a 21-year contract. It is this contract that is being objected to by minority holders of Federal stock. The contracts in fact are the weak points in the smelting company's armor, and wherever possible it has forestalled their being set aside by the courts by obtaining actual ownership of the companies with which it has them.

Good progress is being made in the development of the Alaska Gold Mines, according to Boston reports. The Sheep Creek adit was advanced 503 ft. during March, and at the same rate of progress should be one-third completed at present. Approximately 70 men are employd in driving, and the work is being done in three shifts. The costs, while not published, are probably proportionately high, but may well be offset by the speed made. Assays in the 2100 and 2300-ft. levels of the Alexander range from $2 to $4.50 per ton. Plans for the big mill have been completed, and it is expected that work on the foundations will be in progress before the end of summer. The experimental mill, which was destroyed by fire recently, has been rebuilt. As a result of this announcement, the stock advanced to 11½ on the Boston Curb. D. C. Jackling has recently made the statement that a recovery of 90% or better has lately been made in the Butte & Superior mill. For the next six weeks the mill will continue to operate at the rate of 600 to 750 tons per day, after which it is hoped to build the tonnage up to 1000 per day.

Good records were made by the porphyry coppers during April. Slightly lower costs were made at the Ray Consolidated, but costs at the Chino remained approximately the same as in March. The average daily tonnage of ore treated at the Utah Copper mills was 18,000, but the copper content is still below normal, and a yield of 9,000,000 lb. of copper during April is indicated by the preliminary figures. The March output of the Calumet & Arizona amounted to 4,250,000 lb., including Pittsburgh & Superior. The East Butte has retired the last installment of the $500,000 borrowed last December to make full payment to the Pittsmont Copper Co. The indebtedness of the company now amounts to about $700,000. The report of the company for the quarter ended April 1, while it shows a decreased tonnage, shows also an increase in the average copper content to 5.21%. The East Butte is fortunate in having an unusually capable and efficient manager, Oscar Rohn, who has reorganized the operations and rebuilt the plant, all the while maintaining operations.

The listing committee of the Curb market has admitted the 550,000 shares of the New Utah Bingham Mining Co., which have a par value of $2.50. The company, which has 397,432 shares outstanding, was listed as a prospect. W. W. Bellows is the president, C. H. Wing, treasurer, and J. M. Donahue, secretary. The Yellow Aster M. & M. Co. has declared a dividend of $5000, bringing the total to date to $1,151,789. The earnings of the Keene Wonder for April are estimated at $35,000. The Beaver Consolidated, according to its annual report, shipped 689,921 oz. of silver, valued at $409,212, and the company has a credit balance in its profit and loss account of $172,511. The Temiskaming, of Cobalt, according to its report for the quarter ended on March 31, showed cash in banks $120,346; due from smelters, $13,400; ore on hand, $15,698; bills and accounts receivable, $26,848; North Dome loan account, $44,031; sundry stocks on hand, $19,981. Liabilities included accounts payable amounting to $23,495. The British Columbia Copper Co. has moved its offices from 31 Nassau street to 42 Broadway. For the first two months of 1913 the company, according to reports from the mines, produced 1,388,572 lb. of copper, 2924 oz. of gold, and 16,703 oz. of silver. January's production was the larger of the two months, 720,260 lb. of copper being produced from the ore treated.

The U. S. District Court for the Southern District of New York has denied the application of the Moore Filter Co. for a preliminary injunction against the Butters Patent Vacuum Filter Co., for infringement of the Moore process patent. The decision apparently hinged upon want of jurisdiction.

It is announced that W. A. Clark has contracted with Minerals Separation Ltd. for use of flotation in the plant he is building at Butte to treat Elm Orlu ore. There has been much speculation as to the process to be adopted in the new plant and the fact that Mr. Clark takes a license from Minerals Separation without waiting for the decision of the Butte & Superior litigation is attracting much comment.

LONDON

Geology of Tinfields.—Globe & Phoenix.

The tin-mining industry of the Malay Peninsula has been developed of recent years largely by English capital, and also to a smaller extent by French capital, and geologists and the public usually refer to it as alluvial mining, and the deposits as tin gravel. In the midst of so much misunderstanding, the opinions now published by J. B. Scrivenor, the government geologist, come as a singularly clarifying exposition. Mr. Scrivenor has had years of opportunity to study these deposits, and is thus in a far more favorable position to form a considered opinion than other geologists who have paid short visits of inspection or made hasty reconnaissances. The report now issued by him deals with the Kinta of Perak, which includes within its borders such celebrated mines as the Tronoh, Gopeng,

and Tekka. He classifies the types of deposits and finds four distinct varieties. There is the recent surface alluvium which is now mainly exhausted, having been worked by the Chinese for centuries. There is also surface soil containing cassiterite, being the weathering products of the adjacent Tertiary granite. Third, there are pipes of granite intruded into the country rock. But the most important at present are the Gondwana clays which constitute the deposits worked by the English companies. These clays have hitherto been supposed to be of recent origin, in that they are easily disintegrated by hydraulicking. Mr. Scrivenor upsets all these suppositions by showing that the clays in fact belong to the Gondwana series which in the geologic scale take their place with Upper Carboniferous and lower Mesozoic. This series is extensively found in India and the East, and corresponds to the Karroo series in South Africa. The Kinta valley is flanked on east and west by ranges of granite hills. On the east side of the

THE MALAY TINFIELDS.

valley and nearer the river there are also lower hills of a precipitous nature consisting of crystalline limestone. The bed of the valley also consists of the limestone, which is overlain by clay and boulder clay, of variable thickness. The clays are in places overlain by phyllites and quartzites also belonging to the Gondwana series. Before the limestone bedrock was thoroughly proved, it was supposed that the limestone of the hills was later than the Gondwana phyllites and quartzites and that the clays were modern deposits. Mr. Scrivenor shows that the clay beds consist of the finest clay mixed with angular sand, and contain a variety of boulders consisting of quartz, schist, corundum, tourmaline-corundum rock, etc., together with cassiterite. These boulders and the cassiterite are not rounded and water-worn, and the beds therefore partake of the nature of a glacial deposit. Under these circumstances, and by the aid of Mr. Scrivenor's advice, the further opportunities for prospecting and discovery are of importance. His work has every appearance of proving an excellent example of the aid given by the scientific geologist to the development of orebodies.

During the past twelve months, the direction and administration of the Globe & Phoenix Gold Mining Co. has been severely arraigned. This company owns the star mine of Rhodesia, the Phoenix, and large dividends have been paid. Since the commencement of operations 18 years ago, gold worth £3,107,000 has been extracted, and about two-thirds of this distributed as dividends. At the present time the ore reserve is sufficient for 2½ years' supply, and averages 33.8 dwt. per ton, and of this, 23,503 tons is exceptionally rich, averaging 116 dwt. per ton. The extraction by amalgamation is comparatively good, and the tailing contains about 4 dwt. The recovery of this residual gold is difficult, owing to the presence of antimony and arsenic, and many modifications have been made from time to time in the cyaniding plant. Details of this work have been given in *The Mining Magazine*, the most important article having been written by the company's consulting metallurgist, H. T. Brett. About a year ago the developments in the bottom levels, the 17th, 18th, and 19th, were none too promising, and much hesitation was felt as to the advisability of commencing the new vertical shaft that was calculated to cut the orebody at the 23rd level, or about 2300 ft. vertical. Since then, conditions have improved, so the work has been begun. No new supply of phenomenally rich ore has recently been exposed, and the orebodies are rather narrower in the deepest workings than they were above. The agitation against the directors has been based on the scarcity of information given to the public, and it is alleged that the directors have been using their position to speculate for themselves on prior information. Meetings of shareholders have been held, in the course of which many accusations have been wildly hurled at the heads of directors. The directors have also had a bad time with regard to the extra remuneration out of profits, allowed by the articles of association. For 1912, no less than £15,000 was distributed in this way, in addition to the ordinary fees. The indications are that this special remuneration will be extinguished. The agitation with regard to privileged speculation is not yet over. During 1912 the tonnage treated was 72,923, and the yield 117,306 oz., worth £495,758. The shareholders received £280,000, being at the rate of 140% on the capital, £200,000. The shares have a par value of 5s., and stand at 30s. on the Stock Exchange.

MIAMI, ARIZONA

INSPIRATION RENEWS DRILLING.—MIAMI STARTS ADDITIONAL MILL UNITS.—SOUTHWESTERN MIAMI AND LIVE OAK DRILLING.

At the Inspiration churn-drilling, which was discontinued during the latter part of 1911, has been renewed. The present intention is to drill between 15 and 20 holes. During the past 229 holes have been drilled, having a total footage of 124,886. Underground connections with the incline have been completed, and the sinking of the two additional compartments was to begin this week. The Colorado orebody is to be mined by the pillar and stope method. Actual operations have proved the practicability of this method to this portion of the orebody. The installation of the electric hoist at the Colorado shaft was completed on April 28, and it is proving highly efficient. At the mill-site operations at present are confined to track laying and construction work on the sand and rock bins. The work of excavating for the foundations of the coarse-crushing plant is about half completed.

At the Miami Copper Co. two of the four idle units of the mill resumed operations on April 26. The management expects to have the mill running again at its normal capacity within the next ten days. The remodeling of the No. 2 shaft into an ore-chute for the stock-pile should be completed within a week and should go far toward furnishing the tonnage necessary to carry the mill operations on at full capacity. The work of removing the surface equipment from the old shaft is being rapidly done. The new timber yard site has been practically completed.

At the Southwestern Miami hole No. 11, in which 100 ft. of commercial ore was found, has been bottomed at a depth of 1208 ft. Work at No. 14 has been temporarily suspended at 905 ft., pending the arrival of a casing spear.

At the South Live Oak property, hole No. 8 is now 175 ft. deep and is reported to be passing through silicified schist carrying considerable silicate of copper.

ST. PETERSBURG, RUSSIA

NEW FEATURES IN URAL GOLD AND PLATINUM INDUSTRY.

The metamorphosis that has characterized the platinum industry for some time back develops apace. The exploitation of the platinum deposits is being gradually taken out of the hands of small people and is being conducted on a large scale by the bigger houses. Councillor Ratkoff-Razhnoff has formed a large company with a capital of 10,000,000 rubles which will be called the Lower Tagil Platinum & Mining Co. It will operate in the Perm Government. Another company is being formed to work platinum deposits of the Lower Tagil mine belonging to Demidoff Successors and Prince San Donato. The lease for these deposits had recently been held by the Platinum company, but has now expired and the property has come back into the hands of the owners. Much more modern methods will be used for exploiting the fields than hitherto. Dredging operations on the gold and platinum fields are beginning later this year than usual because of the late spring. Not a single dredge, it is said, was at work on the gold and platinum fields at the middle of April. It had been intended to start dredging on the Neviansk properties by April 5 on the Byngovsky land, but whether this has taken place is not known.

BOSTON

UTAH METALS.—MEXICAN METALS.—UTAH APEX.—LION HILL.—BUTTE CENTRAL AND ACTIVITY AT BUTTE.

Work is reported to be progressing rapidly on the two-mile tunnel of the Utah Metals Mining Co., extending from Bingham to Tooele. A party of officials expects to go from Boston to Bingham in June; at which time it is thought the tunnel will be open. The company had a contract for the delivery of water from the Tooele side, where it is abundant, to the Bingham side, where it is in demand. Another big source of revenue will be the hauling of waste from Bingham, where space is at a premium, to Tooele. The company has a hydro-electric plant at Tooele which supplies it with all the power needed, it is said. The portal of the tunnel at the Bingham end is within 200 ft. of the Utah Consolidated, Utah-Apex, Yampa, Bingham & New Haven, and other properties. The new president of Utah Metals is E. P. Jennings.

The most sensitive stock on the Boston market to Mexican war developments has been Mexican Metals. This company includes the old Arizpe property, which has a large and scattered estate in Sonora. It is opening two properties, the Palo Seco and the Alacran, is doing deep development, and has a mill. Mill operations have been interfered with by the war from time to time. For a time the war and rumors of war were enough to send the stock off in price, but after awhile this became monotonous and was disregarded. The latest proposal in Mexico is that a heavy tax is to be imposed on all foreign corporations to meet the cost of armed opposition by the revolutionists in Sonora. In the catalogue of 'come-backs' which may have been overlooked must be included Utah-Apex, carelessly passed over by the layman as a copper, but in reality a high-grade lead property. In January, Utah-Apex earned $11,147; February, $5500; and March, $18,579, these figures all being net. From private sources estimates have been received of net earnings of $23,000 for April and $25,000 for May. Two or three years ago, Utah-Apex was apparently worked out. Today it has opened new ore reserves and the management expects to retire the remainder of the bond issue before the end of 1913. Dividends are not yet in sight, as the management wishes to accumulate $250,000 cash on hand. There are 528,000 shares of stock, and with that much money in the treasury a dividend declaration of $200,000, around 40c. per share, could be made, leaving $50,000 for working capital.

An advertisement over the signature of an attorney asking for information from stockholders of the Lion Hill Con. M. Co. here attracted some attention recently, but was without effect as a reflection upon the stock. This company owns a silver-lead property in the Ophir district of Utah and is making excellent headway, it is reported. The financial agents here claim that they are meeting their contracts in supplying the company with money and have no stock out upon loans. Work at the mines, as far as surface operations go, has been retarded by heavy snows, which are expected to last throughout May.

It is understood here that a number of the large interests identified with Butte Central are investigating, with the view of taking the initiative, a large mining and electrical railroad project in the West, not a great distance from Butte. The great activity going on in and around Butte is finding some reflection in market sentiment in Boston, which now talks about the 'outside Buttes.' Market interests are watching the significance of the varied metallurgical experiments in process in Butte in saving the different metals. The activity in optioning and exploring extensions of the district in every direction is also attracting much attention.

HOUGHTON, MICHIGAN

DISSEMINATED COPPER AT NONESUCH AND STAGE CRUSHING.—INTERESTING POSSIBILITIES OF NEW PRODUCTION.

At the Nonesuch mine in Ontonagon county experiments are being conducted in the crushing and concentrating of the peculiar disseminated copper ores occurring in the Nonesuch sandstone and shale. Previous milling methods, using steam stamps had never proved successful because of the flaky and friable nature of these ores as compared to the hard, tough 'rock' stamped at other mines. The experiments in progress include the utilization of rolls in stage crushing. Considerable interest attaches to the experiments, both in Ontonagon county on the southwestern end of the copper-bearing series, and in Keweenaw county on the northeastern end where diamond-drill explorations are being conducted along the old Ashbed lode by the Keweenaw Copper Co. recently organized by T. F. Cole and associates. The copper occurs in the Ashbed lode, although an amygdaloid in much the same manner as in the Nonesuch shale; the rock is soft and easily broken, and the copper is fine and flaky. This flake copper has been very difficult to save in milling, and mines on the Ashbed lode that might have been profitable due to copper contents have failed because so much fine copper was lost in milling. The Ashbed or Arnold lode is an amygdaloid deposit occurring at a relatively high horizon of the Keweenaw Series only a short distance below the 'Great Conglomerate', above which only one copper-bearing bed is found (the Nonesuch). The Ashbed lode outcrops near Eagle river in the extreme northeastern part of the Keweenaw peninsula. Several old mines were worked there in the early days, many Detroit people being interested. The present interests owning lands along the Ashbed lode are the Keweenaw Copper Co., Calumet & Hecla, and St. Mary's Canal Co., besides several smaller companies and individuals. Among the old mines and explorations are the Arnold, Phoenix, Copper Falls, Agate Harbor, Ashbed, Humboldt, and Meadow; much of this ore ran 17 lb. of copper per ton, which is more than many of the dividend-payers of today are producing. In view of the extensive diamond-drill explorations of the Keweenaw Copper Co. and the new milling processes being introduced, it looks as though the prophecies of the old Keewenaw county miners would shortly come true and that the Ashbed mines would once more become important.

JOHANNESBURG, TRANSVAAL

INTERSECTION OF REEF IN SPRINGS IMPROVES CONDITIONS.

The long-looked-for intersection of the Main Reef at the Springs Mines has at last been accomplished at a vertical depth of 3432 ft. from the surface, and although the assays are not as encouraging as those obtained from the

neighboring bore-holes, they are far better than those first rumored on the share market, where the average assay value was stated to be 4 dwt. per ton. For sampling purposes the shaft was divided into north and south parts, and the whole of the shaft perimeter sampled, the north part over a length of 69 ft. only assaying 3.03 dwt. over a width of 32.5 in. The southern part of the shaft, represented by a sampling of a length of 33 ft., however, gave an average assay of 10.9 dwt. over a width of 40 inches, the average of the whole perimeter of the shaft measuring 102 ft., being 5.95 dwt. over a width of 34.9 in. The No. 1 bore-hole, not far from the shaft, gave an assay value of 28.42 dwt. over a width of 18.56 in., so that the shaft results are somewhat below what might have been expected from the bore-hole. It seems fairly well established by the shaft results at the Springs Mines that the reef is somewhat patchy in value. While the results taken on the whole may not be up to expectation, it is impossible in this early stage of the mine to arrive at any reliable estimate of the value of the Springs property. It is the position of the Springs mines that has caused so much interest to be taken in the sinking results, as those indicated by bore-holes are proverbially unreliable on the Rand; and should once the existence of a profitable reef be established at the Springs, it will add many square miles to the possible profitable mining area of the Far East Rand. The splendid results obtained so far at the Brakpan mines have naturally attracted attention to the possibilities of the Springs area, and should similarly good indications be found during the next few months at the Springs, quite a different complexion will be placed on the probable value of the Government ground for which new tenders have just been called. A good deal of light will, however, be thrown on the area between the Springs and the Brakpan, when the two southern shafts of the Modder areas strike the Main Reef Series, an event which cannot be long delayed.

RHODESIA

RAILWAY CONSTRUCTION.—NEW MILL AT MESSINA COPPER.—JANUARY GOLD OUTPUT.—GLOBE & PHOENIX SINKING.

The good progress attained in the Northern Transvaal in construction of the Pietersburg-Messina line railway is being watched in Southern Rhodesia with great interest as this line will reach the Limpopo river (Transvaal-Rhodesian frontier) in the course of the next few months

FOUNDATIONS FOR NEW CONCENTRATOR AT NO. 4 SHAFT AT THE MESSINA COPPER MINE.

and is bound to have a vital effect on the future of Charterland. It will constitute about one-half of the missing link in the chain of the South African railway system between Pietersburg and Gwanda, a missing link which has rendered it necessary for travellers from the Rand to Rhodesia to make an enormous detour to the west and journey through the Bechuanaland Protectorate. For years past the Rhodesian system has had its most southerly rail at the West Nicholson mine and completion of the Pietersburg extension to the Limpopo will probably be followed by connection of a point on the Transvaal side of the river with the west Nicholson terminus. This will mean a saving of 24 hours or more between Johannesburg and Bulawayo. This connecting line will traverse some rich agricultural country which also has good mineral prospects, and it should serve to stimulate interest in mining and farming in the southern portion of Matabeleland. The immediate objective of the Pietersburg-Limpopo line is the Messina Copper mine which is opening up well and now is being equipped with a new 250-ton concentrating plant. In the extreme northern portion of the Transvaal and the extreme southern portion of Southern Rhodesia there are extensive copper deposits in gneiss, and as a result of the railway extension there is likely to be considerable exploitation on the Rhodesian side during the next year or two.

A number of gold mines declared better returns in January, and among the outputs calling for principal mention are those of the Globe & Phoenix 9043 oz., the Eldorado Banket (Lomagunch district) 4424 oz., the Bushtick (a mine under R. R. Hollins' control which has been steadily improving its position for some time past) and the Csardas mines in the Gwelo district, the property of the Wolfshall syndicate, which has for the past seven or eight years contributed regular and satisfactory returns and which must be accounted one of the most valuable of the small mines of Rhodesia. At the Globe & Phoenix mine sinking of the new vertical shaft is in progress. The January output had a value of £37,984, the result of milling 6043 tons and recovering gold from 228 tons of concentrate and 2014 tons of slime. Development continues to expose high-grade ore. On the whole, however, the mine is looking well and the new plant is running satisfactorily.

BUTTE, MONTANA

LEACHING PROCESSES AND COSTS.—BUTTE & SUPERIOR.—CLARK'S CONCENTRATOR.

Patrick Clark of the Bullwhacker company has been in the city for a couple of days, arranging for the enlargement of the leaching plant of the company. He says that it is intended to make the plant large enough to handle 500 tons of ore per day, but for the present the capacity will be but 125 tons. The intention is to have the enlarged plant in operation in about ninety days. The mine is still being worked by lessees, who are sending the ore to the East Butte and the Washoe smelters. Last month the seven lessees netted $35,000 altogether. The ore being taken out averages 4½% copper. The leaching plant people, especially the Butte-Duluth company, has caused to be made so many different statements as to the cost of producing the pure copper direct from the ore that people are puzzled to know just whom to believe. Only a short time ago, J. D. Fields, who installed the plant, was alleged to have made a statement to the effect that the plant was turning out copper at about 5c. per pound, and a short time later there appeared the statement that a carload of pure copper had been cast which was produced at about 6c. Just whom to believe and what the costs are it is hard to tell, but mining men around here are of the opinion that the leaching plant is too expensive to be operated at a cost of less than 8c. per pound. The second section of the Butte & Superior concentrator will not be in operation before the middle of the present month. The management is exceedingly loath to give out information, but as near as can be learned the one section in operation is treating about 600 tons of ore per day and the returns are about 80%. The work on the new concentrator of W. A. Clark is being pushed. Unless something unforseen occurs the structure will be ready for the machinery in the next three months.

The work of making connection with the High Ore mine by the different properties of the Anaconda company on Anaconda hill at a depth of 2800 ft. is being pushed along but it will yet be several months before the work is completed as some of the mines have yet to go from 300 to 400 ft. The Butte-Zenith City company property which is about five miles from the city and which is controlled by Duluth men, will develop into a good paying mine in the next few months or be abandoned. A few days ago a depth of 450 ft. was reached and it was then decided to cross-cut on the different veins.

General Mining News

ALASKA

The marine barracks at Sitka, Alaska, have been abandoned by the Navy department. The people of Alaska have requested that they be turned over to them to be used as a home for indigent prospectors and old men who have spent their years in Alaska and have met with misfortune. This request was made to F. K. Lane, who took the matter up with the Navy Department, and he has received notification that the department is willing to have the barracks used as such a home. Mr. Lane has, therefore, designated the Governor of Alaska to take charge of the property for the purpose.

Cordova

The Bonanza mine at Kennicott is now milling, by wet process, ore that contains 14% copper. It is proposed to test the application of flotation to this ore in order to improve the recovery.

ARIZONA

Cochise County

(Special Correspondence.)—Rich shoots have been opened up for several hundred feet in the drifts on the Halagen vein of the National Gold & Silver Mining Co., four miles south of here. Assays return as high as $815 per ton, but plenty of $100 ore is being prepared for shipment. It is the opinion of those interested that the best of the orebody has not yet been reached.

Stein's Pass, May 1.

A large sawmill is being erected by the Copper Queen company at Don Luis, and will supply the wants of all sections of the properties. Two new boilers are now in commission at the power-plant, making seven in all; and foundations for the 7000-cu. ft. air-compressor have been completed. The lime crystal cave at the Shattuck mine will be filled up.

Gila County

At Hayden, the lead vein opened in the London-Arizona mine continues to develop favorably. This is the first extensive lead ore opened in this district. An electric hoist has been installed at the Kelvin-Sultana mine. The Miami company is making good progress in restoring that part of the mine damaged by the recent cave-in, and about 2000 tons of ore per day is being sent to the mill. The company is building a number of 3 and 4-room houses at Red Springs for accommodation of employees. On the 650-ft. level of the Iron Cap mine, an orebody 5 ft. wide has been opened, 12 in. of which assays 52% copper and 119 oz. silver per ton. The Miami-Arizona Development Co. has been organized to develop 17 claims adjoining the Gibson mine on the southwest. An '8000-ton banquet' was held at the Ray Consolidated boarding-house on April 29, given by W. S. Boyd, the superintendent, to foremen and bosses in various departments, in recognition of the hoisting record made on April 7, when 8000 tons of ore was hoisted from the mine.

The Inspiration company has secured a flow of 1750 gal. of water per minute from a 24-in. well, sunk to 110 ft., at the junction of Pinal creek and the Miami 'wash.' This will obviate the necessity of pumping from the dam below Wheatfields, a distance of 9 miles, over an elevation of 600 ft., to the mill.

Graham County

(Special Correspondence.)—The new smelter being erected by the Arizona Copper Co. is one of the most up-to-date plants in the state. The completion of its construction is going ahead rapidly, and the plant is expected to blow-in early in July.

Clifton, May 1.

Maricopa County

(Special Correspondence.)—David A. Williamson, who owns a promising group of claims near here, has interested some Eastern parties in his property, and is now working a force of 10 men on development. They are already taking out copper ore which will be shipped soon.

Morristown, May 1.

It is reported that a large deposit of cinnabar has been discovered in the Mazatzal mountains, 80 miles northeast of Phoenix.

Mohave County

The suit of F. S. Peachy *v.* the Frisco Gold Mines Co., which owns valuable property 20 miles west of Kingman, has been again decided in favor of the defendant. The plaintiff alleged that there had been an abandonment of the properties when a re-location was made a year or so before he attempted to re-locate them.

The annual meeting of the Tom Reed Gold Mines Co. was held at Kingman on April 28. New directors were elected, and a meeting will be held at Pasadena, California, in a few days. S. S. Jones is superintendent.

Pima County

(Special Correspondence.)—The Olive Mines Co. has completed considerable development work and is installing a reduction and concentrating plant.

Pandora, May 1.

Santa Cruz County

The Three R. mine, in the Patagonia district, is shipping 100 tons of 8 to 12% copper ore per day. The property has recently been inspected by N. L. Amster. The Happy Jack claims in the Wrightson district are producing gray and chalcocite copper-silver ore. There is considerable activity in the Palmilla-Harshaw district. The Duquesne Copper Co. is shipping 50 tons of 14% copper ore per day.

Yavapai County

The Vulture shaft is down 200 ft., and a vein 40 ft. wide, averaging $35 per ton in gold, has been opened. In the vein is a rich streak, and a change-house has been built for miners. The Big Blue mine is shipping rich copper-gold ore. The town of Wickenburg is quite busy at present.

(Special Correspondence.)—At Smith's mill, on the Hassayampa river, an electric gold-recovery plant to treat tailing has been built. Formerly Smith's mill was used to treat the ore from the Vulture mine, and there is a large accumulation of tailing. A group of four or five Eastern capitalists is looking over the Congress mine, and others have been inspecting the tailing dump in anticipation of purchasing or re-working both on royalty. A bond issue of $500,000 is being raised on the Brooklyn mine. The property has had a large amount of money spent upon it. Underground and on the surface, development has been in progress for a number of years, but the mine has not yet arrived at a stage of production.

Wickenburg, May 1.

At the Poverty claim on Slate creek, 150 tons of good copper and gold ore is in the dump. The vein is about 5 ft. wide, averaging $55.40 per ton, half of which is copper. At the Copper Queen 'camp', 15 men are employed. An adit is in 1000 ft., a raise driven to the surface, and a winze is down 400 feet.

The Storm Cloud group of 12 claims has been acquired by M. J. O'Brien, of Canada, and was recently examined by J. B. Woodword. This property has been subject to many lawsuits. Lessees at the Mark Twain have opened silver ore averaging $29.50 per ton. Copper ore has been opened near Zonia. A large shoot has been proved on the 1400-ft. level of the Arkansas and Arizona mine at Jerome.

CALIFORNIA

Alpine County

The Curtz Consolidated Mines Co. is erecting a stamp-mill and concentrating plant at Monitor, to be driven by power from the East Carson river. The property has been under development for four years, and a large tonnage of ore is said to be opened.

Calaveras County

The Lightner mine has not been sold to the Lightner Gold Mining Co. by the Lightner Mining Co. of Stockton, as the former failed to complete payments, and got into difficulties as noted in these pages last week.

Inyo County

The Bishop Creek mill started work on April 21, and

10 stamps are crushing ore from the dump. During the construction of the mill the 300-ft. shaft filled with water

STAMP FOUNDATIONS AT BISHOP CREEK MILL.

to within 50 ft. of the surface, but is being pumped out as fast as possible.

Los Angeles County

(Special Correspondence.)—At a meeting of 24 members of the American Institute of Engineers, held at Los Angeles on April 29, it was decided to organize a local section. Formal application has been made to the directors of the Institute, which will be granted at once, as the president, C. F. Rand, personally suggested the forming of the local section. An organization meeting will be held shortly.

Los Angeles, May 2.

Modoc County

At 200-ft. depth, the Modoc Mines Co., at High Grade, has cut rich gold-bearing ore. The Sunset-Hummer has opened 6 ft. of ore. Los Angeles people are heavily interested in the Sunshine mine, where a rich vein was opened on the Lucky Dutchman claim. Snow is fast disappearing from the hills, and within a month the district will be easily reached.

Nevada County

D. J. Gillespie, of Pittsburgh, who operates the Coan mine at Indian Flat, has bonded 400 acres of mining property. Ore valued at $100 per ton has been cut in the Boston Consolidated mine at Browns Valley, and a wagon-load of ore has been sent to San Francisco. At this mine a shaft is down 200 ft., and an adit is in 500 ft. At the Golden Center property of the Grass Valley Mining Co., recently organized to develop 35 acres in Grass Valley, the Dromedary shaft has been cleaned out and timbered. An electric pump and hoist are to be installed. A 2-ft. vein showing gold has been found as left by the former owners years ago. C. Brockington is in charge.

Plumas County

At the Gold Mountain hydraulic mine, one monitor is operating on a 9-ft. bank of gravel which yields $1 per cubic yard. There is enough water for about two months. A large concrete restraining dam was constructed last season capable of impounding tailing for several years. Nevada men have secured an option on the Cameron placer mine, on the North Fork. The adit, now in over 500 ft., is to be extended, and every 50 ft. a raise will be driven to prospect the gravel and determine the course of the channel.

Shasta County

(Special Correspondence.)—The Bally Gold Mining Co. has been formed by local people to operate the old Bally property, near Whiskeytown. The mine has lain idle about 25 years, but was recently examined, and is considered promising. It is intended to start work immediately. E. N. Eaton is secretary. Porter & Thompson have placed a hydraulic elevator at their placer holdings, near Igo, and are working a portion of the ground by this method. Higher parts of the property are being mined by an electrically-operated steam-shovel. In addition to this work, considerable prospecting is under way at other points. The Midas mine, at Harrison Gulch, is working with a large force; 40 stamps are dropping, and good ore is reported showing in the lower levels. Extensive prospecting of placer ground is going on at several points near Redding. Drilling and prospect shaft-sinking is progressing on the Gibson, Jones, and other ranches below Redding, and arrangements are pending for testing of the gravel on the Shuffleton property. The Oro Water, Light & Power Co. has a bond on several farms, while other strong interests are also devoting attention to gravel deposits along the Sacramento river and tributary creeks. W. D. Egilbert and associates have placed their suction dredge in commission on the Sacramento river, a short distance from Redding. Eastern and local people, headed by H. O. Cummins, have acquired the Mt. Shasta mine, near Shasta. Work has commenced, and the shaft is being sunk 150 ft. It is planned to ship ore to the Kennett smelter. Petitions against the smelting and dredging bills have been forwarded from this county to Sacramento. The local mining interests are making a determined fight against the proposed legislation, as the suggested regulations would particularly affect the mineral activity of this, the leading mining county in California.

Redding, April 28.

At the Dry Slide mine, near Keswick, a 4-ft. vein of $90 ore was opened last week. According to smelter records, this mine is said to have produced about $300,000 in gold.

Sierra County

A new air-compressor is being installed at the Irelan mine, near the Plumbago. An adit will be started, giving 1000 ft. of backs when under present workings. George W. Hegarty is in charge of this property, which is being financed by Mrs. Phoebe Hearst. A wagon-road is being made from Alleghany to the lower adit of the Tightner mine. About $100,000 will be spent on the property during the summer. An electric hoist will be installed in a chamber 2000 ft. in the adit, for sinking a shaft. An aerial tramway is to be erected from the upper part of the mine to the mill on Kanaka creek, to convey ore on the dump at the mouth of the original discovery adit. The mine is developing in an encouraging way and is attracting considerable interest. The owners of the Wyoming, El Dorado, Kenton, Osceola, and King Solomon mines at Alleghany are preparing for a busy season.

Trinity County

Between Trinity Center and Carrville, the Guggenheim interests are operating three Keystone drills, and sinking two shafts on the 4-mile gravel channel. Two other shafts will be sunk, and the number of men employed will be increased from 40 to 60. The drills make a 5-in. hole, and the shafts are to check drill results, they being 5 by 5 ft., sunk to bedrock, which varies from 16 to 55 ft. in depth. Water is troublesome and close timbering is necessary.

Tuolumne County

(Special Correspondence.)—Work has begun on the foundation for a large hoist at the Harvard mine, near Jamestown. It will be capable of handling a 2½-ton skip from a depth of 5000 ft. A head-frame of suitable size and strength is also being erected. The hoist will be operated by a 500-hp. electric motor, and a new 300-hp. motor will replace the smaller one now driving the air-compressor. A bond on the Hazel Dell mine, situated east of Columbia, has been transferred by James Rich, of San Francisco, to a company now being formed. A small force is working on the property, and before long an adit that will be approximately 1200 ft. long, and which will cut the veins at depth, will be started. The property is equipped with a 4-stamp mill, hoist, and other machinery. It is understood that machinery for the operation of the plant by electric instead of water power is to be installed at the Shawmut mine in the near future. The contemplated change would render possible complete operations all the year, whereas interruption is caused almost annually by insufficiency of water. San Francisco men inspected the App and Rawhide mines, during the week, and there is a persistent rumor that the first-named property will resume operations within 60 days. A Hooker centrifugal pump capable of discharg-

ing 1050 gal. per minute has been purchased for the gravel mine near Columbia, operated by the Springfield Tunnel & Development Co., and it is believed by A. L. Horner, who is manager of the property, that the water problem will no longer hinder the progress of work.

Sonora, April 26.

COLORADO

Adams County

Boring for oil will be started three miles northeast of Aurora, and six miles from Denver city, in a few days. It is expected that the drill will have to go 2500 ft. before the oil-sands are reached, and from $8000 to $10,000 will be spent. P. S. Roy and people interested in the Midwest Oil Co. have raised the money.

Eagle County

The Lady Belle claim near Eagle, containing the silver-bearing sandstone discovered last November, and which has been attracting attention to the district, has been leased to a syndicate of New York and London mining men, represented by E. F. Bonnell and John A. Hassell.

Teller County (Cripple Creek)

During the first quarter of 1913 the Mary McKinney Mining Co. earned $68,324 and made a profit of $14,497. A dividend of $26,185 was paid, and the surplus is $69,681. Generally, the position of the mine is satisfactory. The suit of the El Paso Consolidated Gold Mining Co., claiming $1,000,000 from the C. K. & N. Gold Mining Co., has been settled out of court. The latter company agrees to lease to the former all of its ground below No. 10 level down to the Roosevelt drainage tunnel, and also the apex ground which was the cause of the suit. Royalties to be paid range from 15 to 35%. The El Paso company waives all claim to damages for ore mined in the past by the C. K. & N. company, while the former is given an option on control of the latter's stock. M. B. Rapp negotiated the settlement, he holding a lease above No. 5 level of the C. K. & N. mine. The El Paso mine produced 151 cars of ore in April. On the 1600-ft. level of the Vindicator mine, south of the shaft, No. 3 and 4 veins have joined, and at the point there is 15 ft. of ore of high value. On the 1500-ft. level, No. 3 vein was opened 150 ft., and No. 2 for 200 ft. During April the company shipped 55 and the lessees 40 cars of ore.

The April production of the district is reported as follows:

	Tons.	Av. val.	Gross val.
Golden Cycle	31,800	$20.00	$ 626,000
Portland Colorado City mill.	10,000	22.00	220,000
Portland Victor mill	14,100	3.37	47,517
Stratton's Independence	11,384	2.56	29,143
Ajax	4,368	3.05	13,322
Joe Dandy	1,900	2.10	3,990
Dante	1,500	3.00	4,500
Wild Horse	1,300	3.20	4,160
Isabella	800	2.00	1,600
Smelters	3,600	65.00	234,000
Total	80,752		$1,184,232

IDAHO

Idaho County

During the winter, work at the Majestic mines was confined mostly to the Campbell drift in No. 3 adit, where a porphyry vein 20 ft. wide, assaying $7 per ton, was opened. The vein driven on in No. 2 adit is 4 to 6 ft. wide, and is of a promising character. So far 1250 ft. of adits have been driven on the property. A mill will be erected during the summer. The Ironsides mine is opening fairly well.

Shoshone County

The Wisconsin Mining Co. has been formed with a capital of $1,500,000 to work the property of the Gold Leaf Consolidated Mining Co., near Moon creek. This is well equipped, and ore shipments have returned a net value of $45.85 per ton. The new 300-ton mill of the Interstate-Callahan company, at Nine Mile, above Wallace, was tried on May 1. Ninety men are employed. An interesting table in the *Spokesman Review* of Spokane, Washington, gives details of the principal producers of the Coeur d'Alene district in 1912, as filed with the county assessor:

Company.	Ore mined, tons.	Gross yield.	Profits.
Bunker Hill & Sullivan	421,600	$3,435,825	$1,019,020
Hercules	34,195	2,174,045	715,763
Federal Mining & Smelting	807,500	4,645,241	653,876
Stewart	179,505	1,471,556	395,345
Hecla	138,588	1,058,940	335,611
Success	.....	414,025	185,936
Gold Hunter	114,803	263,420	*34,817
Caledonia	.....	39,019	*50,034
Marsh	19,256	168,071	*5,089

*Loss.

MICHIGAN

Houghton County

At the Isle Royale mine 80 machine-drills are working on development and stoping. During 1912 about 20,000 ft. of work was done, while as much as 2300 ft. has been driven in one month this current year. Excepting No. 2, all the shafts are being deepened.

MONTANA

Lincoln County

(Special Correspondence.)—John H. Town, president of the Hazel T. Mining Co., operating the Shaughnessy Hill claims, states that the company has completed a deal whereby the Buzz Saw, one of the main claims in the group, will be purchased by the company, which gives them ownership of all the principal claims on the vein. He states also that the company will probably take steps in the near future toward the erection of a concentrator. Development work has been in progress most of the time since the company became interested in the group, over a year ago, and the vein has been cross-cut by an adit at a depth of 500 ft., and drifts have been driven. Metal values are mostly in silver and lead, and the position is said to be good. The property is situated eight miles south of Libby and is reached by a good wagon-road.

Development work has been in progress during the past winter on the Brick & Branagan property, in the West Fisher district, about 35 miles south of Libby. An adit is being driven to the vein. This property is equipped with a 10-stamp mill, but it has not been operated for several years because of the affairs of the company which has had the mine leased. The ore carries gold. The Kalispell-Lincoln Gold Mining Co. is making arrangements to put in a heavy 5-stamp mill on its property in the West Fisher district to replace the 3-stamp mill which was installed last summer. Several test runs were made with the small mill last year, and the gold returns were so satisfactory that it has been decided to install the heavier and more expensive equipment at once. S. F. Ralston will probably be manager of the property. It is claimed that the ore from this mine will average about $50 per ton, but the vein is not a wide one.

Libby, May 1.

Silverbow County

The coroner's inquiry into the recent hoisting accident at the Leonard shaft found that the breaking of a connecting rod between the hand lever and a steam valve caused the cages to drop to the bottom of the shaft, and the accident was not caused by the hoisting engineer, William Peters.

NEVADA

Churchill County

As mentioned in last week's issue, the Nevada Wonder paid its first dividend of 10c. per share. The company used the proceeds of the bond sale to build a mill which has a capacity of 115 tons per day and which is earning between $25,000 and $35,000 per month. The chief effort of the management at the present time is in the development work. The mine has been opened to the 700-ft. level, and the 3-compartment shaft is being sunk to the 1000-

ft. level and is down about 800 ft. Once the ore is cut on the 1000-ft. level, it will insure the company a large reserve tonnage, and an additional unit to the present mill will probably be ordered, which will double the monthly profits. Like many of the Nevada mining companies, the Nevada Wonder has had a hard struggle to get upon a dividend-paying basis, and much credit is due to the management, headed by C. A. Higbee as president, for the way numerous obstacles have been overcome. The Nevada Wonder is now in its seventh year and its troubles seem to be at an end. If the present dividend may be considered a semi-annual payment, the stock at the present selling price would yield 10%, the present market value being $2 and the par value $1.

ESMERALDA COUNTY

During April the Goldfield Consolidated Mines Co. produced $359,000 from 26,186 tons of ore at a cost of $189,000, leaving a profit of $170,000. This compares with $725,621, 30,005 tons, $255,508, and $470,113, respectively, for March.

HUMBOLDT COUNTY

The monthly pay-roll at Rochester is now about $19,100. The auto-trucks at the Codd lease are giving satisfaction in carrying ore.

OKLAHOMA

OTTAWA COUNTY

The 250-ton mill of the Grey Top Mining Co., the most northern plant in the Miami district, has commenced work. Steam-power, generated by natural gas, will be used. The mill contains 9 sets of rolls, 4 jigs, and 7 tables, and is not an entirely new equipment. The ore, which is mined from 200 ft. depth, carries 10% blende and galena, and an orebody 30 by 150 ft. has been opened. In the Miami district there are 23 concentrating plants in operation, and two other large mills under construction.

OREGON

COOS COUNTY

It is reported that a fairly large deposit of ore carrying 10% nickel has been opened in this county, about 18 miles from the railway.

UTAH

SALT LAKE COUNTY

One day last week the mines of the Utah Copper Co. produced and the Arthur and Magna mills treated 21,000 tons of ore. It is expected that the April copper production will be about 12,000,000 pounds.

On April 10 the Utah Metal Co.'s tunnel had been 9108 ft. from the Tooele side, and 1970 ft. from the Bingham side, making a total of 11,098 ft., leaving 316 ft. to be completed. Present progress is 10 ft. per day, with two shifts. In February the ground was heavy, with a strong flow of water. Since June 1912, 15 different veins have been cut, varying from 3 to 24 in. wide, one showing good ore. The flow of water has been from 600,000 to 800,000 gal. per day, of which most will be sold. Expenditure to date is $365,999.

SUMMIT COUNTY

During April, Park City mines shipped 7200 tons of ore valued at $285,000, making 27,645 tons, worth $1,200,000, for the year. There are 10 active properties in the district. Two drainage tunnels will soon be completed and will drain the water from the lower levels of the mines. The Ontario tunnel is being extended in various directions, and the Snake Creek tunnel has been driven 5700 ft. toward the Daly-Judge.

WISCONSIN

GRANT COUNTY

(Special Correspondence.)—Mining is quiet in the zinc-fields since the drop in the price of spelter. Many of the smaller mines have closed. At Linden only the Optimo and Hinkle are running. Mifflin mines are about ready to quit. The Squirrel has closed, though still far from being worked out. At Livingston the Coker mine is doing well and the Mineral Point Zinc Co. is about to open the Sunrise nearby. The Vinegar Hill Zinc Co. is operating the Vinegar Hill and Wilkinson as well as the Coker. The Empire at Platteville has finally closed, but the Hird, Grotkin, and Baxter are working. At the Black Jack mine, south of Galena, Illinois, the Mineral Point Co. is making preparations for big production. Jesse Smith is in charge of the work.

Platteville, April 30.

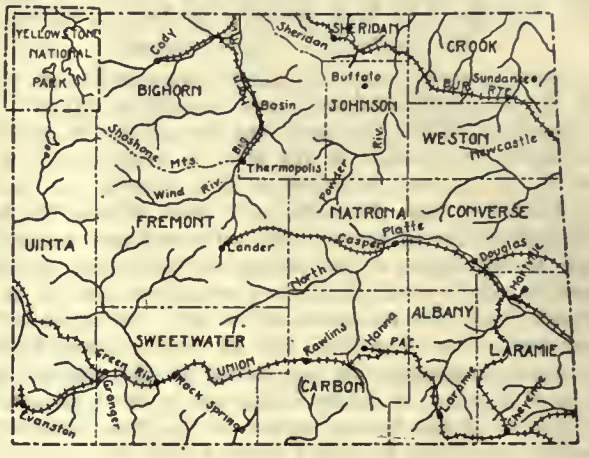
WYOMING

ALBANY COUNTY

The Garfield mine, situated about one mile northwest of Atlantic, has been bonded to Nebraska people. An oil well of about 700-bbl. daily production has been brought in at Caspar. The Dug Out district, six miles west of the Midwest camp, will be actively prospected during the coming summer.

FREMONT COUNTY

(Special Correspondence.)—The Atlantic City Commercial Club has been organized to promote the interests of



MAP OF WYOMING.

the Atlantic-South Pass-Lewiston mining district and furnish reliable general information as to its development.

Atlantic City, April 26.

CANADA

BRITISH COLUMBIA

James P. White, president of the United Mine Workers of America, has given authority to Frank Farrington, of Seattle, Washington, to instruct Robert Foster of Nanaimo to call out on strike all employees of this coal district until the dispute between the miners and owners of the Cumberland and Ladysmith fields has been adjusted. This will affect 2500 men at Nanaimo, Wellington, and Jangiepot collieries. A secret ballot was taken on May 2 as to whether miners would recognize the order of the United Mine Workers.

JAPAN

The Mitsu Bishi company has acquired about 20,000 acres of coal lands at Sorachi-gori, Ishikari, and will spend $1,500,000 in development during the next five years.

MEXICO

SONORA

Owing to the trouble with rebels, several mines near Cumpas and Noria have been forced to shut down. At the Cananea smelter four furnaces and two converters are in operation. Only the Capote, Kirk No. 9, Sierra de Cobre, and Elisa sections of the property are being worked. The Democrata mine and smelter resumed work on April 26. The Mexican Metals Co., in charge of Auguste Fritsche, has worked its mine and mill right through the recent fighting. When trains were not running, a 5-ton Pierce-Arrow truck was used to carry supplies from Bisbee, Arizona. The Calumet & Sonora will resume about May 12, and employ about 120 men. The electrostatic plant has been cleaning zinc and lead concentrate, and about 13 carloads are ready for shipment. W. H. Tangye is in charge.

Schools and Societies

SIXTY-EIGHT STUDENTS from the Colorado School of Mines have been inspecting the mills and smelter at Garfield, Utah. From April 23 to April 26, inclusive, they visited the mines at Bingham Canyon, and during the following week they spent three days at Park City; then some went to Midvale and others to Big Cottonwood canyon. On May 6 they went to Butte, Montana. The students are in charge of F. W. Traphagen, C. A. Allen, G. M. Butler, E. J. Diltus, W. J. Hazard, R. S. Hawley, H. B. Polton, and G. W. Schneider.

MICHIGAN COLLEGE OF MINES students, on April 26, inspected the power-plants at the Baltic and Calumet & Hecla mills, where there are 1250 and 7500-kw. low-pressure turbo-generators at work. A series of extension lectures at the larger towns of the lower Keweenaw peninsula has been undertaken by this college. Elmer D. Grant will lecture on 'Copper Mining in Michigan,' and the subject, illustrated by lantern slides, will include from the history of copper mining to smelting and sociological questions. Of the 640 graduates of the College of Mines between 1888 and 1911, 161 are now in highly responsible positions, their average time out of school being 7.87 years.

PRINCETON UNIVERSITY announces its 1913-14 courses for the Department of Geology. The first term begins on September 24. There are 13 instructors in mineralogy and geology. The graduate courses include chemical geology, stratigraphy and invertebrate paleontology, petrology, mineralogy, geological history of man, economic geology, and physical geography. The Department of Geology is housed in Guyot Hall, which cost $425,000 in 1909, and is fully equipped with a library, power-plant, museum, and necessary apparatus. All graduate students, except Fellows, are to pay $5 per course each term, the total maximum charge not to exceed $20.

MISSOURI AND ILLINOIS MEMBERS of the American Institute of Mining Engineers on April 28 gave a dinner at the St. Louis Club, St. Louis, for the purpose of discussing the question of forming a local section of the Institute. C. F. Rand, the president, Bradley Stoughton, D. R. Francis, Robert W. Hunt, and 36 others were present. D. R. Francis gave an address of welcome, followed by Mr. Rand, who spoke on the present condition and the future of the Institute, and by R. W. Hunt, who related some of the achievements of the past when Dr. R. W. Raymond was at the head of affairs. Several other members and guests made informal addresses, and then every one of the numerous members who were present spoke on the question of the desirability of forming a local section. It was thereupon moved, and unanimously carried, to form such a section, and a committee of arrangements was appointed, consisting of Philip N. Moore, chairman; F. V. Desloge, H. A. Guess, W. E. McCourt, H. H. Stoek, and H. A. Wheeler. Philip N. Moore was toastmaster at the dinner.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY has established a course in industrial physics, which is quite new in educational institutions, and is the outcome of a necessity suggested by Theodore N. Vail, of the American Telephone & Telegraph Co., who said that many business firms find it profitable to undertake research in chemistry and physics, the direct relations of which to their specialties are not always apparent. The Institute has been a pioneer in many lines of technological education, in 1873 starting a course in physics, in 1882 a department of electrical engineering, and in 1901 a course in electro-chemistry. The course in industrial physics requires a less extended study of pure and applied mathematics and a fuller consideration of applied physics in the lecture-room and laboratory. The study of applied optics, heat and electrical measurements is extended, also in theoretical and applied chemistry, mechanical and electrical engineering, electro-chemistry, pure and applied, and metallography. An exceptional equipment of instruments and apparatus of precision is provided. Students taking up this course should possess a knowledge of physical investigation, as well as ability and initiative, and must start at the beginning and complete the four-year course.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

G. H. GARREY is in Mexico.

O. B. PERRY is in San Francisco.

R. A. KINZIE is in San Francisco.

R. B. MCGINNIS is at Angels Camp.

J. C. BRANNER left this week for Brazil.

W. H. SHOCKLEY has arrived from London.

A. C. LUDLUM sailed for Europe last week.

R. S. RAINSFORD was in San Francisco Wednesday.

C. H. MUNRO is in California making an examination.

STEPHEN BIRCH has returned to New York from Chile.

POPE YEATMAN is expected in New York from Chile in July.

H. C. CALLAHAN will leave for Paris the last of this month.

F. K. BAXTER has gone to Ventura county for a couple of months.

R. B. MORAN has returned to San Francisco from Wyoming.

C. V. DREW and LOUIS N. HAGGIN are returning from Peru to New York.

CHARLES T. VAN WINKLE, of Salt Lake City, was in San Francisco this week.

J. A. HOLMES will be at Seattle May 28 and 29 and in San Francisco May 30.

FRANK A. DRURY succeeded A. W. ZIMMERMAN as director of the Batopilas Mining Company.

A. W. GEIGER has been appointed manager for the California Ore Testing Company.

E. M. HAMILTON has gone from Nipissing to London and will remain till the end of July.

H. C. BELLINGER left on the steamer *Ventura* returning to Cobar, N. S. W., last Tuesday.

W. L. WALKER succeeded W. A. WILLIAMS as chief geologist for the Associated Oil Company.

W. G. HAMILTON has been appointed general manager for the Cerro de Pasco Mining Company.

W. A. WILLIAMS has left the Associated Oil Co. to join the staff of the General Petroleum Company.

FRANK M. ESTES has been appointed manager for the Creston-Colorado company at Torres, Sonora, Mexico.

CARMI THOMPSON, formerly U. S. Treasurer, has been appointed general manager of mines for the Great Northern.

STUART RAWLINGS has come up from Mexico and will go to Naples and thence to London, arriving at the latter city in September.

ROSCOE T. ALLEN has left the Dolores Mines Co., to take a position on the staff of the New York & Honduras Rosario Mining Company.

A. P. MAYBERRY has been appointed superintendent at the Central Eureka mine at Tintic, succeeding R. A. BROWN, who retires from active mining.

DAVID DRAPER, a pioneer geologist of the Rand and a diamond expert, is in London on his way to the United States and Mexico, where he proposes to practice hereafter.

LESTER W. STRAUSS returned recently to Lima from a trip into the interior from Chincha. In the course of the journey his companion, MIGUEL BUSTILLO, narrowly escaped drowning.

Institution of Mining and Metallurgy annual awards have been announced as follows: To CHARLES O. BANNISTER, for his paper 'On the Theory of Blast-Roasting Galena,' the Consolidated Gold Fields gold medal; to E. HATSCHEK and A. L. SIMON, for their paper on 'Gels in Relation to Ore Deposition,' the Consolidated Gold Fields premium of 40 guineas; to Arthur Thomas French, for his paper on 'Quick Combination Methods in Smelter Assays,' the Frank Merrick premium of 20 guineas.

The Metal Markets

LOCAL METAL PRICES

San Francisco, May 8.

Antimony	12—12½c	Quicksilver (flask)	$40
Electrolytic Copper	16½—16¾c	Tin	52—53½c
Pig Lead	4.60—5.55c	Spelter	8—8½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES.

(By wire from New York.)

NEW YORK, May 7.—The better political outlook abroad has stimulated European buying, and there was an advance in the London market, reflected as usual in New York. Lead has dropped, a result of price-cutting by outsiders, which influenced the A. S. & R. to announce a reduction, which was accordingly done May 5. Prices quoted here are for New York. Spelter remains quiet and weak. Reports from the field are to the effect that low prices are closing the smaller mines.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
May 1	60.00	April 9	58.50
" 2	60.12	" 16	59.80
" 3	60.25	" 23	59.77
" 4 Sunday		" 30	60.56
" 5	60.00	May 7	60.98
" 6	60.00		
" 7	60.12		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	59.26	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
May 1	4.48	April 9	4.30
" 2	4.48	" 16	4.33
" 3	4.48	" 23	4.39
" 4 Sunday		" 30	4.50
" 5	4.33	May 7	4.40
" 6	4.33		
" 7	4.33		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
May 1	5.33	April 9	5.62
" 2	5.33	" 16	5.50
" 3	5.30	" 23	5.42
" 4 Sunday		" 30	5.36
" 5	5.30	May 7	6.31
" 6	5.30		
" 7	5.30		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
May 1	15.25	April 9	15.17
" 2	15.25	" 16	15.37
" 3	15.25	" 23	16.44
" 4 Sunday		" 30	15.26
" 5	15.33	May 7	15.30
" 6	15.35		
" 7	15.40		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figurea are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
May	1912	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
April	1912	125,694,001	69,513,846	53,252,326
May		126,737,836	72,702,237	69,485,945
June		122,315,240	66,146,229	61,449,650
July		137,161,920	71,093,120	60,121,600
August		145,628,521	78,722,418	70,485,150
September		140,089,819	63,460,810	60,264,796
October		145,405,453	84,104,734	47,621,342
November		134,695,440	69,369,795	55,906,550
December		143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February		130,948,881	59,676,402	72,168,623
March		136,251,849	76,585,471	77,699,306

Stocks of copper in Europe have decreased 1870 tons since April 15, the visible supply having decreased 2464 tons, being 30,467 tons on May 1. Exports from the United States for April amounted to 83,024 tons, as compared with 23,341 tons in April 1912. The strained situation in the Balkans has depressed the European market, while the much talked of May Day strike of the Michigan miners failed to materialize. The American Sheet Steel Co. is carrying on extensive experiments to determine what advantage, if any, will accrue from the use of up to 2% of copper in sheet steel. The consumption of blue vitriol is steadily increasing. Nevertheless the market remains dull, and at the end of April the smaller producers were selling electrolytic copper at ¼ to ⅜c. per pound below 'pegged' price of 15¾c. named by the larger agencies, and the 16c. copper freely prophesied ten days earlier is still in the future. Copper Producers' figures announced Thursday show a decrease of 28,700,000 lb. in the surplus. Details on p. 713.

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
April 9	41	April 23	41
April 16	41	April 30	41
		May 8	40

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.60	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	....	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, May 7.
Associated Oil 5s	101
E. I. du Pont 4½s	93½
Natomas Con. 6s	94¾
Unlisted.	
Associated Oil 1st ref.	90
General Petroleum 6s	59

Unlisted.	Closing prices, May 7.
Natomas Dev. 6s	100
Pac. Port. Cem. 6s	99
Riverside Cem. 6s	77
Standard Cem. 6s	91⅝
Santa Cruz Cem. 6s	85
So. Cal. Cement	78

STOCKS.

Listed.	Closing prices, May 7.
Associated Oil	42⅛
Amalgamated Oil	83
E.I. du Pont Powder pfd.	90
Pac. Coast Borax, pfd.	100½
do com.	80
Pac. Crude Oil	25c.
Sterling O. & D.	1.00
Union Oil of Cal.	91½
West Coast Oil, pfd.	70

Unlisted.	Closing prices, May 7.
Mascot Copper	2
Noble Electric Steel	15
Natomas Consolidated	9
Pac. Coast Borax, old	206
Pac. Portland Cement	59
Riverside Cement	55
Standard Cement	17
Standard Oil of Cal.	187
Santa Cruz Cement	40

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 8.

Atlanta	$ .13	Mizpah Extension	$ .60
Belmont	6.20	Montana-Tonopah	1.60
Big Four	.50	Nevada Hills	1.05
Buckhorn	1.05	North Star	.67
Con. Virginia	.15	Ophir	.17
Florence	.38	Pittsburg Silver Peak	.50
Goldfield Con	1.92	Round Mountain	.57
Halifax	1.20	Sierra Nevada	.22
Jim Butler	.84	Tonopah Extension	2.40
Jumbo Extension	.21	Tonopah Merger	1.02
MacNamara	.19	Tonopah of Nevada	5.65
Manhattan Consolidated	.06	Union	.06
Mexican	.75	West End	1.30
Midway	.50	Yellow Jacket	.24

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	May 8. Bid	Ask		May 8. Bid	Ask
Adventure	$ 1	1⅛	Mohawk	$ 50½	51½
Allouez	32½	33½	North Butte	29	29⅛
Calumet & Arizona	64	64½	Old Dominion	47½	48
Calumet & Hecla	455	465	Osceola	86	87½
Centennial	14½	15½	Quincy	67½	68
Copper Range	43½	44	Shannon	9⅜	10
East Butte	11⅜	12	Superior & Boston	3⅜	3½
Franklin	5⅜	8⅛	Tamarack	27½	28½
Granby	63½	63⅜	U. S. Smelting	39½	40½
Greene Cananea	6⅜	7	Utah Con.	7⅞	7⅜
Hancock	19	19⅛	Victoria	1⅛	1½
Isle-Royale	23	23½	Winona	2⅛	2⅜
Mass Copper	3⅜	4⅛	Wolverine	50	51

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

May 8.

	Bid.	Ask.		Bid.	Ask.
Alaska Mex.	11	12	Mason Valley	6	6¼
Alaska Tread.	40¾	42¾	McKinley-Dar.	1⅞	2
Alaska United.	21⅜	23⅜	Miami 6s	168	173
Alaska G. M.	11½	12	Mines Co. Am.	2⅛	2⅝
Braden Copper.	7⅞	8	Nipissing	8¾	8⅞
B. C. Copper	2⅞	3	Ohio Copper	1¼	1⅞
Davis Daly	2¼	2½	San Toy	19	21
Dolores	1	2	Sioux Con.	2	5
El Rayo	2	4	S. W. Miami	5	7
First Nat.	1¾	2¼	So. Utah	¼	⅜
Giroux	2⅛	2⅜	S. O. Calif.	178	180
Green-Can.	6⅝	6⅞	Tri Bullion	⅛	¼
Hollinger	17	18	Tuolumne	2	2⅛
Inspiration	16⅝	17¼	United Copper	⅝	¾
Iron Blossom	135	145	Wettlaufer	14	15
Kerr Lake	3⅛	3¼	Yukon Gold	2⅝	2⅜
La Rose	2⅜	2⅝			

OIL SHARES

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 7.

Associated Oil	$41.75	Orcutt	$ .55
Caribou	.90	Palmer Union	.18
Claremont	.60	Premier	.28
Coalinga Central	.20	Republic	.15
De Luxe	.40	Sterling	1.00
Maricopa 36	.33	United Oil	.34
Monte Cristo	.50	W K Oil	2.22
New Pa Pet	.45		

BOSTON MARKET NOTES

Nevada-Douglas has recently sold down to $1.25 on the Curb market here, being plainly a case of premature dividend, followed quickly in the wake of which was an unwieldy bond issue. The weakness of the stock has also been attributed to a large block of shares belonging to an estate seeking liquidation. It is now said that this stock has been disposed of and the shares will be made to look better in the market. A. J. Orem says that while a $2,000,000 bond issue was authorized, only $500,000 will be offered at this time. Nevada-Douglas made its annual report public a few days ago, indicating that about 48c. per share was earned in 1912 on its outstanding stock. The shares of the Alaska Gold Mines on the Curb here have been manifesting weakness of late, increasing with the nearer approach of July 1, when the second $5 per share will be payable on the stock. There was a statement to the effect that the payment will be deferred, but this is not likely. Another reason for the decline is that holders of Alaska Gold have been selling out in order to support their holdings in Butte & Superior and the Pond Creek and Island Creek coal issues on the Exchange.

Butte Central, since the sudden slump in the stock a few weeks ago, have been selling around $2.50 per share, and the active manipulation which formerly prevailed has practically ceased. The market condition of Wolverine continues deplorable. The stock around $50 per share has touched the lowest level in over ten years. Everything seems to point out that Wolverine is now nothing but a liquidating proposition and that J. R. Finlay in his mild-mannered report really sounded its death knell. The Wolverine management, for reasons which have never been explained, seems unwilling to follow the example of Calumet & Hecla, Copper Range, and Quincy, and buy more territory, although it is immediately surrounded by promising ground which it could have obtained cheaply two years ago and which would have given it a new prospective lease upon life. A historic property of the Stantons, at one time holding the world's record for low-cost copper production, Wolverine in another decade or so will, barring the unexpected, be only a memory. The copper list here has troubles of its own, with North Butte selling at only one-fourth of its high price, but the market is also disturbed by the unfortunate controversy and embroglio between attorney and publicist Louis Brandeis and Charles S. Mellen over our New England transportation monopoly. New England railroad stocks have been selling at the lowest figures in their history.

COPPER PRODUCERS' ASSOCIATION REPORT

The Copper Producers' Association statement, May 8, shows a decreased surplus. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, April 1, 1913	104,269,270
Production of marketable copper in the United States from all domestic and foreign sources during April	135,333,402
Deliveries for consumption, April	78,158,837
Deliveries for export, April	85,894,727
Stock of marketable copper of all kinds on hand and at all points in the U. S., May 1	75,549,108

Recent changes in surplus have been as follows, in pounds:

	Increase.	Decrease.
April 1912	2,927,829	.....
May	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....
October	13,679,380	.....
November	9,419,095	.....
December	19,148,523	.....
January 1913	17,885,770	.....
February	.....	896,134
March	.....	18,032,928
April	.....	28,720,162

Estimated Copper Production and Earnings

(Compiled by Thompson, Towle & Co.)

The production, estimated earnings, and dividends of the important copper mines of the United States, Mexico, and Canada are shewn below, as compiled by Thompsen, Towle & Co., and republished by permiasion.

Mine and Location.	Control and General Office.	No. shares issued.	Par val.	1912[2] Production copper, pounds.	1912[2] Cost per lb., cents.	1912[2] Earn. per share.	1913[3] Estimated production.	1913[3] Cost per lb., cents.
Amalg. Copper,[4] Butte, Mont.	Standard Oil, New York	1,538,879	$100	219,764,392	....	....	202,027,281	....
Ahmeek, Calumet, Mich.	Calumet & Hecla, Boston	50,000	25	16,455,769	7.85	$29.30	16,500,000	7.85
Allouez, Calumet, Mich.	Calumet & Hecla, Boston	100,000	25	5,525,455	13.52	1.71	7,000,000	11.00
Anaconda Cop.,[5] Butte, Mont.	Amalgamated, New York	4,332,500	25	294,700,000	10.00	3.80	270,000,000	9.75
Arizona Cop.,[6] Clifton, Ariz.	Scotch interests, Scotland	2,946,016	5s.	36,150,000	9.75	.....	37,000,000	9.50
Boleo Copper, Mexico	Rothschilds, Paris	120,000	100	27,880,600	....	.....	27,800,000	....
Braden Copper,[7] Chile, S. A.	Guggenheims, New York	2,600,000[1]	5	9,500,000	....	.....	25,000,000	7.50
British Col., Greenwood, B. C.	Newman Erb, New York	591,709	5	11,146,000	12.86	0.72	12,000,000	10.00
Butte-Ballaklava, Butte, Mont.	Duluth, Duluth	250,000	10	.....	....	.....	.....	....
Cal. & Hecla, Calumet, Mich.	Agassiz-Shaw, Boston	100,000	25	67,856,429	9.86	45.00	68,000,000	9.50
Calumet & Ariz.,[8] Bisbee, Ariz.	Calumet & Pitts., Calumet	628,552	10	53,108,628	7.02	7.50	55,000,000	7.00
Centennial, Houghton, Mich.	Calumet & Hecla, Boston	90,000	25	1,742,338	13.46	0.56	3,000,000	13.00
Cerro de Pasco, Peru, S. A.	Haggin-Hearst-Morgan, N. Y.	100,000	100	45,000,000	....	.....	45,000,000	....
Chino Copper,[9] New Mexico	Hayden, Stone, New York	870,000[1]	5	27,776,067	....	.....	55,000,000	7.50
Cop. Range, Houghton, Mich.	W. A. Paine, Boston	393,709	100	30,000,000	7.50	2.70	30,000,000	9.25
East Butte, Butte, Mont.	W. A. Paine, Boston	411,000	10	14,709,460	9.70	2.39	15,000,000	9.50
First Natl., Shasta Co., Cal.	Guggenheims, New York	600,000	5	.....	9.70	2.50	Closed	....
Franklin, Houghton, Mich.	Edwards-U. S. Smelt., Boston	166,666	25	1,710,651	....	.....	.....	....
Giroux Con.,[10] Ely, Nevada	Cele-Ryan, Duluth	1,500,000[1]	5	3,817,083	10.80	.....	9,000,000	11.00
Granby Con.,[11] Phoenix, B. C.	Nichels-Luther, New York	149,648	100	22,630,000	9.50	10.60	22,000,000	9.50
Greene-Can., Cananea, Mex.	Cole-Ryan, New York	2,427,739	20	48,346,000	10.50	0.95	55,000,000	10.25
Inspiration Con.,[12] Globe, Ariz.	Thompson-Ryan, New York	965,024[1]	20	.....	....	.....	.....	....
Isle Royale, Houghton, Mich.	Calmet & Hecla, Boston	150,000	25	8,186,957	11.89	2.83	10,000,000	11.50
Lake Cop., Ont'n'gon Co., Mich.	W. A. Paine, Boston	100,000	25	.....	....	.....	.....	....
Mason Valley, Mason, Nev.	Gunn-Thompson, New York	254,000[1]	5	16,058,493	....	1.45[13]	16,000,000	....
Miami Copper, Globe, Ariz.	General Dev. Co., New York	748,236[1]	5	32,832,609	9.58	2.90	38,000,000	9.50
Mohawk Cop., Calumet, Mich.	Stanton, New York	100,000	25	11,995,598	10.61	6.56	12,500,000	10.50
Nevada Con.,[13] Ely, Nevada	Utah Copper Co., New York	1,999,457	5	63,063,261	7.75	2.40	60,000,000	7.75
Nevada-Douglas, Mason, Nev.	A. J. Orem, Boston	1,000,000[1]	5	9,250,000	10.00	0.55	6,000,000	10.00
North Butte, Butte, Mont.	Cole-Ryan, New York	410,000	15	26,000,000	9.75	4.00	27,000,000	9.50
Ohio Copper, Bingham, Utah.	F. Aug. Heinze, New York	1,300,000[1]	5	6,554,015	13.00	0.15	8,000,000	10.50
Old Dominion, Globe, Ariz.	Phelps-Dodge, Boston	293,353	25	27,343,243	10.34	5.50	30,000,000	10.00
Osceola, Calumet, Mich.	Calumet & Hecla, Boston	96,150	25	18,413,387	10.36	12.60	18,000,000	10.50
Phelps-Dodge, Ariz. and Mex.	Phelps-Dodge, New York	450,000	100	148,678,889	8.50	23.40	148,000,000	8.50
Quincy, Houghton, Mich.	Todd, New York	110,000	25	20,654,800	11.60	8.80	20,000,000	11.50
Ray Con.,[14] Kelvin, Ariz.	Aldrich-McNeill, New York	1,587,500[1]	10	34,068,421	9.85	1.37	60,000,000	9.00
Shannon Copper, Clifton, Ariz.	N. L. Amster, Boston	300,000	10	16,509,000	12.00	2.20	15,000,000	12.00
Shattuck-Ariz., Bisbee, Ariz.	Duluth, Duluth	350,000	10	.....	....	.....	15,000,000	9.00
Se. Utah M. & S., Newhouse, Ut.	Samuel Newhouse, New York	860,000[1]	5	2,400,000	15.40	.....	1,600,000	15.40
Sup. & Boston, Globe, Ariz.	Houghton, Houghton	283,827	10	.....	....	.....	.....	....
Sup. Copper, Houghton, Mich.	Calumet & Hecla, Boston	100,000	25	3,921,974	12.75	1.72	4,500,000	12.50
Tamarack, Calumet, Mich.	Calumet & Hecla, Boston	60,000	25	7,908,745	13.15	4.50	9,000,000	12.75
Tenn. Cop.,[15] Ducktown, Tenn.	Jas. Phillips, Jr., New York	200,000	25	13,252,634	11.00	5.50	13,000,000	10.50
Tez.C.M.&S.Co., Teziutlan, Mex.	Robt. S. Towne, New York	100,000	100	.....	....	.....	Cloaed	....
Tuolumne, Butte, Mont.	Butte, Butte	800,000	1	4,716,047	12.80	0.17	6,000,000	12.50
United Verde, Jerome, Ariz.	W. A. Clark, New York	300,000	10	31,565,539	....	.....	31,500,000	....
Utah Cop.,[16] Bingham, Utah.	Guggenheims, New York	1,625,000[1]	10	93,514,413	8.85	5.20	120,000,000	7.50
Utah Con., Bingham, Utah.	Standard Oil, New York	299,980	5	6,506,814	7.10[20]	2.01	6,000,000	....
U. S. Smelting, Ariz., Utah, Cal., Mexico, Nevada	Boston, Boston	*351,105 †486,320	50	21,152,620	....	7.22	21,000,000	....
Wolverine, Calumet, Mich.	Stanton, New York	60,000	25	9,120,485	7.75	12.60	9,250,000	7.75

*Common. †Preferred.

Mine.	Earn. per share 15c.	Earn. each 1c. change	Amt. and date of last dividend.	EST. PRODUCTION, COST, AND EARNINGS PER SHARE at 12, 13, 14, 15, 16, and 17c. copper when reduction plants have been brought up to capacity. General remarks also given in this col.
Amalgamated Copper[4]	$7.66	$1.31	$1.50 q. Feb.24,'13.	224,073,030 lb.—$5.13, $6.58, $8.03, $9.41, $10.95, $12.40.
Ahmeek	23.60	3.30	$7 q. Apr. 10, '13.	Inc. cost 1912 due const. This work should be completed after 1913.
Allouez	2.80	0.70	.....	Cost 13.52c. Includes high construction cost of 1.6 per lb.
Anaconda Copper[5]	3.27	0.62	75c. q. Apr. 16, '13.	300,000,000 lb., 9c., $2.08, $2.77, $3.46, $4.15, $4.85, $5.54.
Arizona Copper[6]	0.69	0.12½	.....	43,000,000 lb., 8½c., 0.51, 0.66, 0.80, 0.95, $1.10, $1.24.
Boleo Copper	....	....	.....	Second largest copper producer in Mexico.
Braden Copper[7]	0.72	0.10	.....	75,000,000 lb., 7c., $1.44, $1.73, $2.02, $2.31, $2.60, $2.88.
British Columbia	1.01	0.20	15c. q. Jan. 15, '13.	Cost 1912 inc. due principally to lower grade ore treated.
Butte-Ballaklava	....	....	50c. Aug. 1, '10.	Practically shut down, due to litigation with Anaconda.
Calumet & Hecla	37.40	6.80	$10 q. Mar. 20, '13.	1913 earnings do not include subsidiary div. $855,000 in 1912.
Calumet & Arizona[8]	7.00	0.88	$1.25 q. Mar.24,'13.	65,000,000 lb., 7c., $5.17, $6.20, $7.24, $8.27, $9.31, $10.34.
Centennial	0.67	0.33	.....	Increased cost 1912 due lower grade rock. Tendency toward reduc.
Cerro de Pasco	....	....	.....	Production and earnings not available. Figures given merely est.
Chino Copper[9]	4.74	0.63	.....	66,000,000 lb., 7c., $3.79, $4.55, $5.32, $6.08, $6.84, $7.59.
Copper Range	4.38	0.76	75c. q. Apr. 1, '13.	Finer crushing should result greater extraction.
East Butte	2.00	0.36	.....	Greater prod. made possible from inc. cap. mill and smelter.
First National	....	....	.....	Est. normal 10,000,000 lb., 10½c., 25c., 42c., 58c., 75c., 92c., $1.09.
Franklin	....	....	.....	A loss of $81,393 was sustained during 1912.
Giroux Con.[10]	0.24	0.06	.....	1912 figures on 6 mo. operations; 1913, on basis 1000 tons per day.
Granby Con.[11]	8.09	1.47	$1.50 Mar. 1, '13.	45,000,000 lb., 9½c., $6.84, $9.58, $12.31, $15.05, $17.78, $20.52.
Greene-Cananea	1.07	0.22	25c. q. Mar. 1, '13.	Cost increased 1912 owing to inefficiency and increased cost labor.
Inspiration Con.[12]	....	....	.....	70,000,000 lb., 8½c., $2.54, $3.27, $4, $4.73, $5.45, $6.18.
Isle Royale	2.33	0.67	$1 Mar. 31, '13.	Dev. mine 1912 good. Outlook encouraging.
Lake Copper	....	....	.....	Operation far behind schedule, due labor shortage.
Mason Valley	....	....	.....	Does custom smelting business.
Miami Copper	2.79	0.51	50c. q. Feb. 15,'13.	40,000,000 lb., 9½c., $1.34, $1.87, $2.40, $2.94, $3.47, $4.01.
Mohawk	5.62	1.25	$3 s. a. Feb. 1, '13.	Finer crushing-mill should result greater extraction.
Nevada Con.[13]	2.18	0.30	37½c.q.Mar.31,'13.	65,000,000 lb., 7¾c., $1.38, $1.71, $2.03, $2.36, $2.68, $3.01.
Nevada-Douglas	0.30	0.06	12½c. Feb. 1, '13.	Ore treated at Mason Valley smelter.
North Butte	3.62	0.66	50c. q. Apr. 19, '13.	1912 dev. good. Should result increased ore reserves.
Ohio Copper	0.28	0.06	.....	Net earnings after exp., Aug. 1, '12, Dec. 31, '12, $57,030.
Old Dominion	5.11	1.02	$1.25 q. Apr. 7, '13.	Concentrator now being enlarged, should inc. prod. and earnings.
Osceola	8.42	1.87	$3 q. Apr. 30, '13.	Increased wages and const. responsible higher cost 1912.
Phelps-Dodge	21.38	3.29	$2.50 q. Mar.28,'13.	Nacozari operations 1912 handicapped by Mexican revolution.
Quincy	6.36	1.82	$1.50 q. Mar.24,'13.	Increased cost 1912 due to higher wages labor.
Ray Con.[14]	2.27	0.38	.....	90,000,000 lb., 8½c., $1.98, $2.55, $3.12, $3.68, $4.25, $4.82.
Shannon Copper	1.50	0.50	50c. q. Jan. 30, '13.	1912 costs increased due to certain inc. charges and difficulties.
Shattuck-Arizona	2.57	0.43	50c. Jan. 20, '13.	Ore treated at Calumet & Arizona smelter.
South Utah M. & S.	....	0.02	.....	Operated 9 mo. 1912. Up to Apr. 1913 property shut down.
Superior & Boston	....	....	.....	Shut down 1910. Mine now being developed. Shipments being made.
Superior Copper	1.13	0.45	.....	Operation 1912 showed great improvement. Cost per lb. 1911, 15.31c.
Tamarack	3.38	1.50	$4 July 23, '07.	Increased revenue expected from fine grinding in mill.
Tennessee Copper[15]	4.68	0.65	$1.50 Jan. 20, '13.	Earning 1912 largest in history of company.
Teziutlan Cop. M. & S.	....	....	.....	Operation 1912 interfered with due Mexican revolution.
Tuolumne	0.19	0.07	10c. May 15, '13.	Ore treated at Anaconda reduction plants.
United Verde	....	....	75c. m. Mar. 5, '13.	New smelter building. Ult. production 40,000,000 lb.
Utah Copper[16]	6.88	0.92	75c. q. Mar. 31,'13.	140,000,000 lb., 7½c., $4.73, $5.79, $6.85, $7.91, $8.97, $10.03.
Utah Con.	1.60	0.20	50c. Apr. 12, '13.	1912 operation interfered with due labor strike.
U. S. Smelting, com.[17]	....	....	75c. q. Apr. 15,'13.	Profit 1912 amounted to $4,232,965 after heavy depreciation charges.
U. S. Smelting, pfd.[18]	....	....	87½c.q.Apr.15,'13.	Earnings per share shewn allow dividends pfd. Copper but small proportion of company's output.
Wolverine	11.18	1.54	$5 s. a. Apr. 1, '13.	Increased cost over 1911 due to higher wages of labor.

[1]Stock issued when all honds have been converted.
[2]Where actual figures were not available, estimates have been used.
[3]It should be berne in mind 1913 estimates were made early in the year, and are necessarily contingent upon numerous conditions which may exist at the properties.
[4]Amalgamated's income derived from 3,185,802 shares Anaconda, 154,000 Greene-Cananea, entire United Metals Selling Co., which owns 43,000 shares International S. & R. Co.'s stock. Figures shewn for Amalgamated are based on pro-

portionate earnings and not upon income and dividends. On April 30, 1912, company had cash assets $15,681,578. Company has $12,500,000 5% notes.

[5]1912 cost increased owing to labor wages resulting from higher copper prices.

[6]Conatruction of new smelter will make possible increased production and decreased cost.

[7]Mine development 1912 good. Large increase in ore reaerves expected. Management contemplating doubling mill.

[8]Merged with Superior & Pittsburgh 1911. Constructing $2,000,000 smelter increasing production and earning.

[9]Large inc. reserves 1912. Further addition concentrator probably be made, increasing production beyond figures shown in 'Remarks.' Net profits 1912, $2,352,822, with only part of concentrator in commission.

[10]Six months' profit $150,000. Ore treated at Nevada Consolidated reduction plant.

[11]Company owns Hidden Creek property. Smelter under construction. See 'Remarks' for ultimate production and earning. Has $1,500,000 convertible bonds.

[12]Consolidation of properties of Inspiration Copper Co. and Live Oak Development Co. Erecting 7500-ton concentrator. Should be producing in 1914.

[13]Low production 1912 result labor strike.

[14]Operations behind schedule. Ore treated to date below average. Improvement being shown. Estimate entire plant in commission before close 1913.

[15]Company makes sulphuric acid as by-product copper smelting. Acid output 1912, 195,000 tons. Profit acid $1.75 per ton.

[16]Company owns one-half Nevada Consolidated stock. Profits shown include proportionate earnings Nevada net income. Annual dividend $1,500,000 received from Nevada Con. Low production 1912 result labor strike.

[17]On 6% dividend basis.

[18]On 7% dividend basis.

[19]Gross operating profit 1912 was $403,122. There was charged off depreciation $102,269, deficiency charges, $14,577, and bond interest $59,379, leaving net profit $226,896.

[20]Credit earnings from lead, silver, and gold production. Based on assumption copper metal sold at average price for year.

ORE RESERVES PORPHYRY MINES

(Last official estimate.)

	Tons.	Copper, %.	Years life on plants built or contemplated.
Utah Copper	301,500,000	1.53	39
Ray Consolidated	84,000,000	2.20	24
Chino	90,000,000	1.80	35
Inspiration Consolidated	45,000,000	2.00	17
Nevada Consolidated	40,000,000	1.70	14
Miami	20,800,000	2.48	17
Braden	23,000,000	2.50	11

Company Reports

NEVADA CONSOLIDATED

The quarterly report of the Nevada Consolidated contains the following:

Ore treated, tons	729,115
Average copper content, per cent	1.54
Copper production, pounds	14,523,565
Deficit	$222,118
Ore extinguishment	119,520
Actual stripping expense	216,606

Production was curtailed owing to extraordinarily cold weather, which affected mining operations in the Liberty Pit, and the 12-in. North creek pipe-line froze, necessitating digging up and thawing 4000 ft. of the line, while ore froze in the cars between the mines and concentrator.

NEVADA-DOUGLAS

The annual report of the Nevada-Douglas Copper Co. for 1912 shows the following:

Ore sales	$738,070
Other revenue	6,140
Total revenue	$744,210
Operating expenses	367,684
Net operating revenue	$376,526
Other deductions	6,161
Net operating income	$370,364
Deductions from income	51,627
Total income account	$318,736
Final ore settlement	82,073
Total	$400,809
Depreciation, mine redemption	48,345

The Nevada Copper Belt Railroad had an income of $215,378 and net profit of $45,364.

AMALGAMATED ZINC (DE BAVAY'S), LTD.

This company operates a large flotation plant at Broken Hill, New South Wales, which is supplied by tailing bought from several mines in that district, and has the right to use the De Bavay, Potter, or Minerals Separation processes as desired. Operations during the six months ended December 31, 1912, were as follows:

Tailing treated, tons	278,634
Zinc concentrate produced, tons	76,517
Lead concentrate produced, tons	1,061
Contents of zinc concentrate:	
Zinc, per cent	49.1
Lead, per cent	6.1
Silver, ounces	8.8
Operating profit	$410,000
Settlement of concentrate in suspense	330,000
Total profit	$740,000
Dividend and bonus paid	360,000
Equalization reserve fund	610,000
Reserve tailing to be treated, tons	559,569

VULCAN TIN MINING COMPANY, N. L.

This company's property is situated at Irvinebank, Herberton district, Queensland, and has been an important producer of tin for many years, the yield being 11,036 tons of black tin (about 66% metallic), worth $2,529,000, from 137,085 tons of ore, to which the forty-third half-year to February 10, 1913, contributed 92 tons from 3926 tons of ore. Dividends to date total $860,000.

During the period under review, a rich shoot has been raised on for 50 ft. above the 600-ft. level stope. No. 3 winze from the 750-ft. level was connected with the level below, and a shoot 30 by 30 ft. of low-grade ore was stoped out. The raise above the 750-ft. level was driven 45 ft., but metal contents were low. On the 900-ft. level, the southeast cross-cut on the downward extension of the 750-ft. level orebody was extended 66 ft., and at 53 ft. the shoot was opened out to 13-ft. width, averaging 3% black tin. Generally, this level is encouraging. From the 1050-ft. level stope, 1380 tons of ore was mined, but the reserves here are small. The main shaft has been retimbered from 600 to 915 ft., and is now in good order.

NORTH BUTTE MINING COMPANY

This company's property is situated at Butte, Montana, and the report is for the year ended December 31, 1912. Development work covered a total of 18,140 ft. The Granite Mountain shaft was sunk 868 ft., making the present depth 2250 ft., and stations have been cut on the 1800, 2000, and 2200-ft. levels, while connections were made with the 1800 and 2000-ft. levels of the Speculator shaft. A large modern hoist was installed at the Granite shaft, which is to be sunk to 2800 ft. The Adirondack vein was developed on the 1800, 2000, 2200, and 2400-ft. levels. On the 2000-ft. level the ore averaged 3 ft. wide, assaying 5% copper and 7 oz. silver per ton. Five feet of 6% copper and 4 oz. silver ore was opened for 160 ft. on the 2200-ft. level, while 12 ft. of 5.25% and 3 oz. silver ore was opened for 300 ft. on the 2400-ft. level. The vein was cut on the 2600-ft. level, showing 7 ft. worth 3.5% copper and 2 oz. silver; and this ore has been connected with the 2400-ft. level by a raise. The Edna May vein on the 2400-ft. level, has proved to be 15 to 25 ft. wide, assaying 4.5% copper over a length of 75 ft., and is more regular than in the 2000 and 2200-ft. levels. A cross-cut is being driven on the 2600-ft. level, to prove this vein at depth, and has passed through 4 ft. of ore, worth 6.4% copper and 2.8 oz. silver, the foot-wall not being reached. Faults have disturbed the Jessie vein on the 2600 and 2800-ft. levels, but on the former level 4 ft. of 3% copper and 6.8 oz. silver ore was cut. On the 1800, 2200, 2600, and 2800-ft. levels the Gem vein has been opened to a small extent, the bottom level showing 12 ft. of 5.3% copper and 2.2 oz. silver ore. Generally this vein has been irregular in size and metal contents. A large quantity of ore has been opened in the North Croesus vein between

the 1600 and 2000-ft. levels. On the 2400-ft. level, 2 ft. of 3% ore has been opened 300 ft. east of the shoot mentioned. The Snowball vein was opened 576 ft. on the 2000-ft. level west drift averaging 5 ft. wide of 7.3% copper and 8.8 oz. silver, while the east drift opened 300 ft. of 3 ft. width, containing 6% copper and 8 oz. silver. The west drift on the 2200-ft. level was extended 725 ft., opening 5 ft. of 5.5% copper and 9 oz. silver ore; and while the east drift was in faulted ground, 500 ft. of 7% copper and 10 oz. silver ore was developed. At 2400-ft. depth drifts have been driven 800 ft., opening 4¼ ft. of 5.5% copper and 9 oz. silver ore. Ore reserves, which were 710,920 tons at the end of 1911, have increased largely during 1912, and the average content is 4.5% copper and 4.5 oz. silver per ton.

During the year the mine was in operation 342 days, employing 902 men, and results were as follows:

Ore mined, wet, tons	434,854
Copper precipitate from mine water, tons	78
Ore shipped to Washoe smelter, dry tons	425,248
Copper produced, pounds	24,480,123
Silver produced, ounces	1,377,468
Gold produced, ounces	1,367
Average price received for copper, cents per pound	16.37
Net earnings	$1,670,719
Dividends	697,000
Surplus	973,719
Cash on hand	293,254
Copper, silver, and supplies on hand	1,355,871
Accounts payable	600,506
Surplus	2,800,779

UTAH COPPER COMPANY

This company operates extensive copper properties at Bingham Canyon, and two large concentrating and one smelting plant at Garfield, Utah. The report of the president, C. M. MacNeill, for the year 1912, gives the following information:

Ore development can be summarized as follows: fully developed ore, 257,584,500 tons, averaging 1.6% copper; partly developed ore, 80,116,342 tons, averaging 1.16% copper, making a total of 337,700,842 tons, averaging 1.5% copper. During the whole period of operation of the property in past years, there have been mined and treated 21,200,842 tons of an average copper content of 1.542%. The remaining tonnage of developed and partly developed ore now in reserve amounts to 316,500,000 tons, averaging 1.495% copper. The average grade of the ore handled during the year was 1.3642% copper. In the last annual report it was estimated that during the year 1912 the output would be 120,000,000 lb. of copper. This prediction would have been realized had it not been for the interruption occasionad during the last quarter of the year following labor difficulties. It is expected that the current year will show a production of approximately 120,000,000 lb. The operation of the Bingham & Garfield Railway Co. has been in every way satisfactory, both from a physical and financial standpoint. The result of operations verifies the statements hertofore made, that the financial return upon this investment will result in approximately three-fourths of one cent per pound reduction in the cost of producing copper.

The production of copper, gold, and silver and price received for the year ended December 31, 1912, compares as follows:

	1912		1911	
	Product'n.	Price rec'd.	Product'n.	Price rec'd.
Copper, lb.	91,366,337	15.839c.	93,514,419	12.646c.
Gold, oz.	34,255	$20	40,202	$20
Silver, oz.	311,391	60.6c.	366,906	53.3c.

The net cost per pound of copper produced for the year was 8.781c. after deducting miscellaneous income; no deductions being made, however, on account of dividends received upon the Nevada Consolidated stock owned by the company. Dividends paid during the year 1912 amounted to $4,729,747. The total amount of dividends paid up to date, aggregates $16,242,220. On December 31, 1912, the outstanding shares were 1,579,640. During the year there were 4640 shares of stock issued in exchange for $232,000 par value of Bingham & Garfield Railway Co.'s bonds. Since December 31 there have been issued 2530 shares of your company's stock for $126,500 par value of Bingham & Garfield Railway Co.'s bonds, which makes a total exchanged to date of $358,500 par value, leaving $2,141,500 par value of these bonds outstanding, which, under the terms of the mortgage, are convertible until July 1, 1914, but not thereafter, into stock on the basis of $50 per share.

The revenue account shows the following:

	1912.	1911.
Operating revenue	$15,345,953	$12,825,953
Operating expenses	9,038,711	8,324,053
Net operating revenue	$6,307,242	$4,501,900
Dividends on investments	2,176,000	1,720,750
Interest and rent	46,562	46,248
Total income	$8,529,804	$6,268,895
Interest	80,532	30,966
Net profits	$8,449,272*	$6,237,928
Dividends	4,729,747	4,703,022
Surplus	$3,719,525	$1,534,906

*Equal to $5.35 per share on 1,579,640 shares outstanding as compared with $3.96 per share on 1,575,000 shares outstanding in the previous year.

The undivided profits account follows:

Undivided profits December 31, 1911	$2,731,445
Surplus for year ended December 31, 1912	3,719,525
Undivided profits December 31, 1912	6,450,970

The balance sheet of the Bingham & Garfield Railway Co., as of December 31, 1912, shows assets as follows: Road and equipment, $5,567,312; current assets, $231,754; total, $5,799,066. Liabilities: capital stock, $2,500,000; bonds, $2,500,000; current liabilities, $422,865; sinking fund, $375,924; profit and loss surplus, $277; total, $5,799,066.

BUNKER HILL & SULLIVAN MINING & CONCENTRATING COMPANY

This important company operates a large silver-lead producing property of 2748 acres, besides millsites, water rights, and concentrating plants at Kellogg, in the Coeur d'Alene district, Idaho, and the report of the manager, Stanly A. Easton, covers a period of 19 months, from June 1, 1911, to December 31, 1912.

The results for this period show an average monthly operating profit of $96,624, approximately the same as for the period covered by the last report. The metal market during the 19 months also showed an average price of closely the same low tenor as during the preceding period. During the months of October, November, and December 1912 the output was reduced because of repairs made necessary to the main shaft and station, following a mine fire on October 7, 1912. Concrete, reinforced by steel where necessary, has been used in making these repairs. No. 2 unit of the West mill went into service in April 1912, and the changes to the milling practice because of this new unit, and other improvements, resulted in an increased lead extraction of 5%, and silver 6.3%, and an increased economic extraction of 3.4, the latter being the ratio of the net smelter value of the product to the total value of the lead and silver in the feed, and its increase being due to an improvement in the grade of the product from the mill as well as to improved extraction.

New ore has been developed on No. 11, 12, and 13 levels of the Bunker Hill mine, in the upper portions of the Stemwinder mine, and in the Saxon claim. In the upper portions of the old Tyler mine, where no mining had formerly been done for some 15 years, lessees discovered an important orebody, from which production has been regularly made during the past 10 months. Ore has also been opened in the Scorpion, Combination, and Spokane claims, so that there has been exposed for mining a tonnage equalling in

grade and quantity that exposed when last reported, with normal geological conditions in new ground wherever opened.

Last summer, it was found that the Caledonia Mining Co. was extending its mining operations in ore beneath the Spokane and other claims, and upon application to the Federal Court in July, an injunction issued against the Caledonia company. Trial of this matter is expected during the current year. During September 1912 it was discovered that the Stewart Mining Co. was mining ore from beneath the Saxon claim. The District Court granted an injunction against the Stewart company, and suit to quiet title will be tried this year. The same issues were tried out during January 1913, Stewart Mining Co. *v.* Ontario Mining Co., and the Stewart Mining Co. was denied the right by the trial court to mine southerly beyond its surface boundaries. Generally the condition of the properties of the Bunker Hill & Sullivan company are in a sound condition. The year's results may be summarized as follows:

Development work done, feet	11,050
Ore mined, tons	702,520
Cost of mining	$1,125,695
Ore concentrated, tons	697,560
Cost of milling	$262,584
Concentrate produced, tons	96,267
Crude ore shipped, tons	3,431
Total value of all products	$5,396,915
Freight and treatment, lead and silver discounts	1,980,231
Operating costs at Wardner	1,580,814
Operating profit	$1,835,870
Sundry receipts	112,155
Total	$1,948,025
Other expenses at Wardner	501,040
Total net receipts	$1,446,984
Dividends paid	1,209,900
Ore reserves:	
Bunker Hill mine, tons	2,854,010
Sullivan mine, tons	842,992
Stemwinder mine, tons	85,668
Total, tons	3,782,670
Operation to date:	
Ore mined, tons	5,585,988
Gross value	$52,978,904
Net smelter returns	31,480,914
Operating profit	17,747,667
Dividends paid	13,911,750

The report is accompanied by a map of the property, and a plan and longitudinal section of the mines, besides details of various expenditures and the balance sheet.

LUCKY TIGER-COMBINATION GOLD MINING CO.

This company is incorporated in Arizona, has a general office in Kansas City, Missouri, and operates the mine and mills of the Tigre Mining Co., at Yzabal, Sonora, Mexico. The report is for the year 1912. The consulting engineer, James W. Malcolmson, states that 69,595 tons of ore was mined, worth $1,689,097; while 14,615 tons of old tailing was cyanided, yielding $114,270; shipping ore yielded $288,194; concentrate, $671,429; and cyanide bullion, $716,471, a total of $1,676,096. Total cost of operation was $964,414, and profits $711,681. Extraction averaged 91%. To date, results have totaled 253,790 tons of ore, yielding $6,977,256, and dividends $1,603,809. Nine miles of development has been done. In the new mill costs are 98c. per ton less than the old plant, and all the ore will be treated in the former. A Hardinge mill is being installed for intermediate grinding between the stamps and tube-mills.

The manager, L. R. Budrow, reported as follows:

Ore milled, tons	68,443
Ore shipped, tons	1,152
Current tailing treated, tons	63,994
Old tailing treated, tons	14,615
Gross proceeds	$1,676,096
Costs per ton:	
Mining	$2.541
Development	0.715
Transport to mill	0.112
Milling	4.809
General, management, taxes, cost of recovering bullion stolen by rebels	0.738
Marketing and taxes, ore and concentrate	3.287
Marketing and taxes, bullion	0.784
Total	$12.986
Less sundry profit	0.516
Net cost	$12.470
Cyaniding old tailing	3.486
Marketing, taxes, bullion, and old tailing	0.708
Total	$4.194

The ore shipped assayed: gold, 1.01 oz.; silver, 348.9 oz.; copper, 2.6%; and lead, 12.5%. The main vein, on six levels, produced 40,113 tons of ore; the Sooy vein, on five levels, 6639 tons; and from development generally, 2728 tons. Remaining in the stopes and on dumps is 59,896 tons, a decrease of 18,684 tons compared with the end of 1911. Mine work covered 4413 ft., an increase of 314 ft., and a total of 49,220 ft. to date. Diamond-drilling is now under way in country east of the main vein. At the south, on No. 4 level in Gold Hill, an orebody over 300 ft. long was opened, but the value was erratic. The sulphide ore cut is of good shipping grade. On No. 3½ level, the south drift on the main vein, was advanced 596 ft., 175 ft. being in ore assaying gold, 0.12 oz., and silver, 35 oz. per ton. No. 4 level was driven 757 ft. south, 364 ft. being in gold 0.08 oz., and silver 49.7 oz. ore. Raises and winzes driven opened only fair ore. No. 5 level was advanced to 854 ft. south in low-grade rock. The south drift, No. 4 level, on the Sooy vein, was advanced 110 ft., 10 ft. assaying gold 0.03 oz., and silver 52.5 oz. per ton; and on No. 5 level the advance was 164 ft., 45 ft. assaying gold 0.04 oz., and silver 43.7 oz., the balance being low-grade. No. 7 shaft was sunk 101 ft., 15 ft. being worth: gold, 0.04 oz., and silver, 50.4 oz. In the Combination claim, 326 ft. of work was done, and samples gave as high as 500 oz. silver per ton.

Ore reserves are as follows:

	Tons.	Gold, oz.	Silver, oz.
Ore developed	92,515	0.11	36.6
Ore broken in stopes	54,892	0.11	23.3
Ore on dumps	5,004	0.13	28.0
Total	152,411	0.11	31.6
Old tailing	66,000	0.08	13.5

The report contains a map, details of the mill, and costs, which will appear in another issue of this journal.

TREATMENT COSTS at the San Francisco mill, Pachuca, which deals with a mixed ore containing silver sulphides, manganese, galena, blende, and pyrites, with 92.4% and 94.5% extraction of the silver and gold, are as below:

	Cost per metric ton.		Cost per metric ton.
Rock-crusher	₱0.11	Precipitation and clean-up	₱0.41
Stamping	0.24	Sampling and assaying	0.13
Concentration	0.04	Surface expenses	0.05
Tube-mills and classifiers	0.29	General repairs	0.17
Agitation	1.05	Power	0.81
Filtration	0.16	General expenses	0.31
Pumping	0.09	Total	₱3.86

TAILING from several Cornish tin mines is being treated, and during March 1913, 7506 tons was concentrated, yielding 29.25 tons of black tin, SnO_2, equal to 8.72 lb. per ton. This was sold for $15,070, or $2 per ton treated, at a cost of $1 per ton.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

PLOD is a term used by miners in certain countries for a notebook, or any message or instructions left for the following shift to remember.

HEADQUARTERS of the American Mining Congress are maintained at Denver, Colorado, 725 Majestic building. The Secretary is J. F. Calibreath, Jr.

FREIGHT RATE on 'raw' gold exported from mines in the South African Union by steamer to London has been reduced from 5s. per cent to 4s. 3d. per cent.

TUBE-MILLS or grinding pans are not used at Broken Hill to grind the ore to a slime, but just fine enough to liberate the fine galena, which is mixed with blende, rhodonite, and garnet.

NATURAL CEMENTS set more rapidly than portland cement, but do not attain so high tensile strength. From 1870 to the end of 1911 the United States has produced 507,752,834 bbl. of portland cement, worth $495,225,971.

SORTING ORE on the Rand is decreasing rapidly, and although the average was 12.57% during 1912, at present, according to the *South African Mining Journal*, there is no sorting at the Knight's Deep mine: Consolidated Langlaagte, 0.94%; Simmer & Jack, 3.86%; Jumpers-Treasury, 1.73%; Jupiter, 4.52%; Langlaagte Estate, 4.93%; and the New Primrose, 4.23 per cent.

LIME in an ore interferes with flotation as usually practiced, since it reacts with the acid. At the Braden one of the initial difficulties in flotation was traced to a lime-bearing cement used in setting the lining of the Hardinge mills in use. At the Bonanza mine at Kennicott, Alaska, where flotation is to be tried, the ore occurs in limestone, so it will be necessary to operate without acid, which may be done under proper conditions.

LEAD, in the form of an alloy of 2 to 3% with zinc dust, has been found to be more effective than the same amount of lead precipitated from the acetate on the surface of pure zinc filings of equal fineness. Solutions of lead salts have been widely used in connection with precipitation by means of zinc dust, and incidentally it may be noted that lead nitrate is a little more advantageous than acetate for this purpose, as it is cheaper, and contains a larger percentage of lead.

MINE SURVEYORS are valuable and necessary officials, and any attempt to operate a large mine without one is, sooner or later, attended with disaster. If a survey department of a company is disparaged because it costs, say, 0.5%, then on the same grounds, the management with its 1.5% cost should take second place in importance of the labor bill. At small mines, the combination of sampler, surveyor, and assayer is an excellent one, but when the unit grows large, the surveyor should attempt nothing but his own work.

MINERAL PRODUCTION strongly affects the budget of the South African Union. This for the year 1912-13 shows that the actual revenue was £17,314,000 and expenditure £17,196,000, and the net surplus £75,000. Exports during the term totaled £64,262,000, of which £48,804,000 was diamonds, gold, and specie; wool, £800,000; and ostrich feathers, £336,000. The general revenue from gold mines was likely to remain at £210,000 for the next three or four years, as the mines seemed to have reached high-water mark; and, until new government areas were opened, four or five years hence, there was not likely to be any increase of revenue from them, unless working costs were reduced. The production of coal was 8,170,000 tons, worth £2,000,000. The total mineral production of South Africa to date was: gold, £363,250,000; diamonds, £170,000,000; coal, £25,000,000; copper, £9,500,000; and tin, £1,250,000.

A VACUUM-FILTER at the San Francisco mill, Pachuca, treats, with only one basket of 40 leaves in use, 220 tons of ore per 24 hours. Cakes are discharged by water under a 20-ft. head. The cycle of operations is as follows:

	Minutes.
Forming 1¼-in. cake	20
Transfer to barren solution tank	3
Barren-solution wash	40
Transfer to water and discharge tank	3
Water wash	15
Discharging cake	5
Total time	86

CONCENTRATE at the Liberty Bell mill, consisting chiefly of iron pyrite, hematite, and rhodonite, is to be treated by a slightly different method from the present practice, although no great change is made. The concentrate pulp will flow by gravity to a low point in the mill, be dewatered, and ground fine in a small tube-mill, from which the pulp will be elevated to a shallow 20-ft. diameter Dorr thickener, where solution for special zinc-boxes will be decanted. From the thickener the slime will go, after dilution, to small Pachuca agitators in series, and then to two more Dorr thickeners, in series, and discharge into the present mill circuit, at a point just above the present agitators. Solution overflowing from the thickeners will be decanted in a counter-current system and finally go to the zinc-boxes mentioned. The tests on which this system was designed were on a 10% scale.

RAWHIDE, paper, and other materials have been extensively used for gear pinions with a certain measure of success, but cloth pinions, made by the General Electric Co., are now said to be superior to those mentioned. They are strong, are not damaged by oil, are unaffected by atmospheric changes, are vermin proof, and have elasticity of tooth. These pinions consist of a cloth or cotton filler, compressed under hydraulic pressure of several tons per square inch of side surface, and are held in compression by steel shrouds or side plates, and threaded studs passing entirely through both shrouds and the filler. Beveled pinions are not made of this composition. Graphite, applied as a flake, or a stiff paste made of that material and vaseline, or good machine-oil, is a suitable lubricant. Cloth pinions should not be operated against uncut cast teeth, or teeth which have become badly worn.

IF TWO SYNCHRONOUS MACHINES, such as converters, are connected slightly out of step, or are thrown somewhat out of step by some other means, the machine in which the rotor is ahead of the position of mean rotation, that is, the 'leading machine,' gives more power and so slows down, while the 'lagging machine,' gives less power and so speeds up, and the machines thus come nearer together. However, when they are in step, according to C. P. Steinmetz, the machine which was formerly leading, being slower in speed, still loses, and thereby drops behind, while the machine which was formerly lagging, gains, due to its higher speed, and thus runs ahead, and the machines again fall apart, this time in the opposite direction. This goes on until the increased load on the leading machine retards it, and once more causes it to drop back; while the decrease of load on the lagging machine causes it to speed up and gain. In this manner, by a number of successive oscillations the machines settle down into step. If there were no losses, at every swing, the machines would pull apart again as much as they were apart in the preceding swing; but, owing to the energy losses caused by the oscillations, the swings decrease the more, as more energy is dissipated by them, and the oscillation thus is damped out. This is not 'hunting,' but the natural and inherent adjustment into step by a decaying oscillation.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

RESERVATION OF MINERALS IN DEED—CONSTRUCTION

A reservation in a deed to land of "all mineral and mining rights and the incidents thereto whatever", is not a reservation of petroleum and natural gas in the absence of a clear intent by the parties to so include them.

Preston *v.* South Penn. Oil Co. (Pennsylvania), 86 Atlantic, 203. Jan. 6, 1913.

DEED TO MINERAL RIGHTS—CONSTRUCTION

Where a deed conveyed an equal undivided one-half of the coal mines situated on a certain tract of land, the words "coal mines" should be constructed to mean coal deposits underlying the land; it appearing that no mines had actually been opened, but that such deposits had been discovered by excavation. Such a deed carries with the coal deposits the right to use so much of the surface estate as may be reasonably necessary for the proper use of the mineral estate.

Gordon *v.* Million (Missouri), 154 Southwestern, 99. Feb. 28, 1913.

COAL MINE—UNINTENTIONAL TRESPASS

Where one, without the consent of the owner, makes improvements upon another's property, he does so at his peril, and, except under extraordinary circumstances, will be allowed neither to remove the improvements nor receive compensation therefor. However, where in mistake of a boundary line, tracks were laid within the mine of another and coal extracted without knowledge by the trespasser that he was within the mine of the other, the tracks might be removed by him if it could be done without injury to the mine and a reasonable royalty paid on the coal taken or destroyed.

Bennett Jellico Coal Co. *v.* East Jellico Coal Co. (Kentucky), 154 Southwestern, 922. March 18, 1913.

MINER'S LIENS—EMPLOYMENT BY OPTION HOLDER

An option contract to purchase mining stock, which authorized the prospective purchaser to go upon the corporations' claims for the purposes stated in the contract and to repair flumes, etc., was sufficient to put the corporate officers on notice that such purchaser would hire laborers to work on the claims for the purposes stated and that said laborers would be entitled to a lien for their services. The option holder became the owner's statutory agent for the employment of labor. Laborers employed by such option holder to construct a flume on the claim are entitled to a lien thereon for their services, upon compliance with statutory requirements.

McLung *v.* Paradise Gold Mining Co. (California), 129 Pacific, 774. Jan. 15, 1913.

MINING CONTRACT—REPAYMENT OF PURCHASE PRICE

Where the contract for sale of mining property provided that if the purchaser became dissatisfied he might demand and receive a return of the purchase money at the end of three years, "he keeping up his share of the assessment work during that time," and the claims lapsed during vendor's absence in the third year after the contract was made, for non-performance of assessment work, it was held that the purchaser, having made a demand for repayment on vendor upon his return, was entitled to receive his money back, less an amount equal to his share of the last year's assessment work.

McDougall *v.* O'Connell (Washington), 130 Pacific, 362. March 4, 1913.

Concentration of Low-Grade Iron Ores

The American-Boston Mining Co., one of the important interests of the M. A. Hanna & Co., Cleveland, Ohio, has recently erected a concentrating mill for the treatment of low-grade iron ores from the mine situated at Diorite, Michigan. J. R. Thompson, local manager for the company, and James D. Ireland, general manager for M. A. Hanna & Co., after a number of preliminary tests, arranged for the mill, which has a rated capacity of 500 tons in 24 hours.

Before erection of the mill it was necessary to select ore with a sufficient percentage of iron to bear shipment to the market. Along with the high-grade ores were those of lower grade. Constant assays and special mining methods were necessary to determine the shipping ores and the waste to be left in the mine. With the mill in operation, the necessity for careful sorting underground is overcome and the bodies of low-grade ores are made available. This not only reduces considerably the cost of underground mining, but converts a former waste into a profitable product.

The company had erected and in operation a coarse-crushing plant consisting of gyratory crushers and revolving screens used in connection with their loading bins at the railroad tracks. From this coarse-crushing plant the low-grade ores are elevated to the concentrating mill by means of a belt-conveyor delivering the feed to the mill ore-bin. Fig. 2 shows the flow-sheet of the mill. The

FIG. 1. AMERICAN BOSTON MILL.

ore-bin. Fig. 1 shows the flow-sheet of the mill. The two trains of revolving screens which separate it into four jig sizes as follows: 10 to 7 mm., 7 to 4 mm., 4 to 2 mm., and –2 mm. Each grade of ore is treated on a separate group of Richards pulsator jigs, there being a total of 15 in the mill system, 9 on the upper floor and 6 on the lower. The jigs on the upper and lower floors deliver coarse concentrate from the side gates above the screens and fine concentrate from open spigots in the hutches. The tailing from the jigs on the upper floor is dewatered and re-treated in jigs on the lower floor, thus giving double concentration. The tailing from the –2-mm. jigs on the upper floor is dewatered and the thickened pulp delivered to one 24-in. duplex Callow screen with 20-mesh screen cloth. It is found that the oversize from this screen is sufficiently low in iron to deliver directly to the tailing. The –20-mesh pulp passing through the screen is elevated to a Richards pulsator classifier of the launder type, the bottom spigot of which delivers coarse pulp to one Deister concentrating table, No. 4, while the overflow is thickened in an 8-ft. diameter pulp-thickening cone and the fine thickened pulp is delivered to the second concentrating table.

The concentrate from the jigs and concentrating tables is dewatered by means of suitable dewatering boxes and an Avoca spiral dewaterer, which deliver the concentrate to the concentrating elevator with about 15% moisture. The concentrate in discharging to the storage-bin is sampled by an automatic bucket sampler operating continuously. The bottom of the concentrate bin is provided with a filter

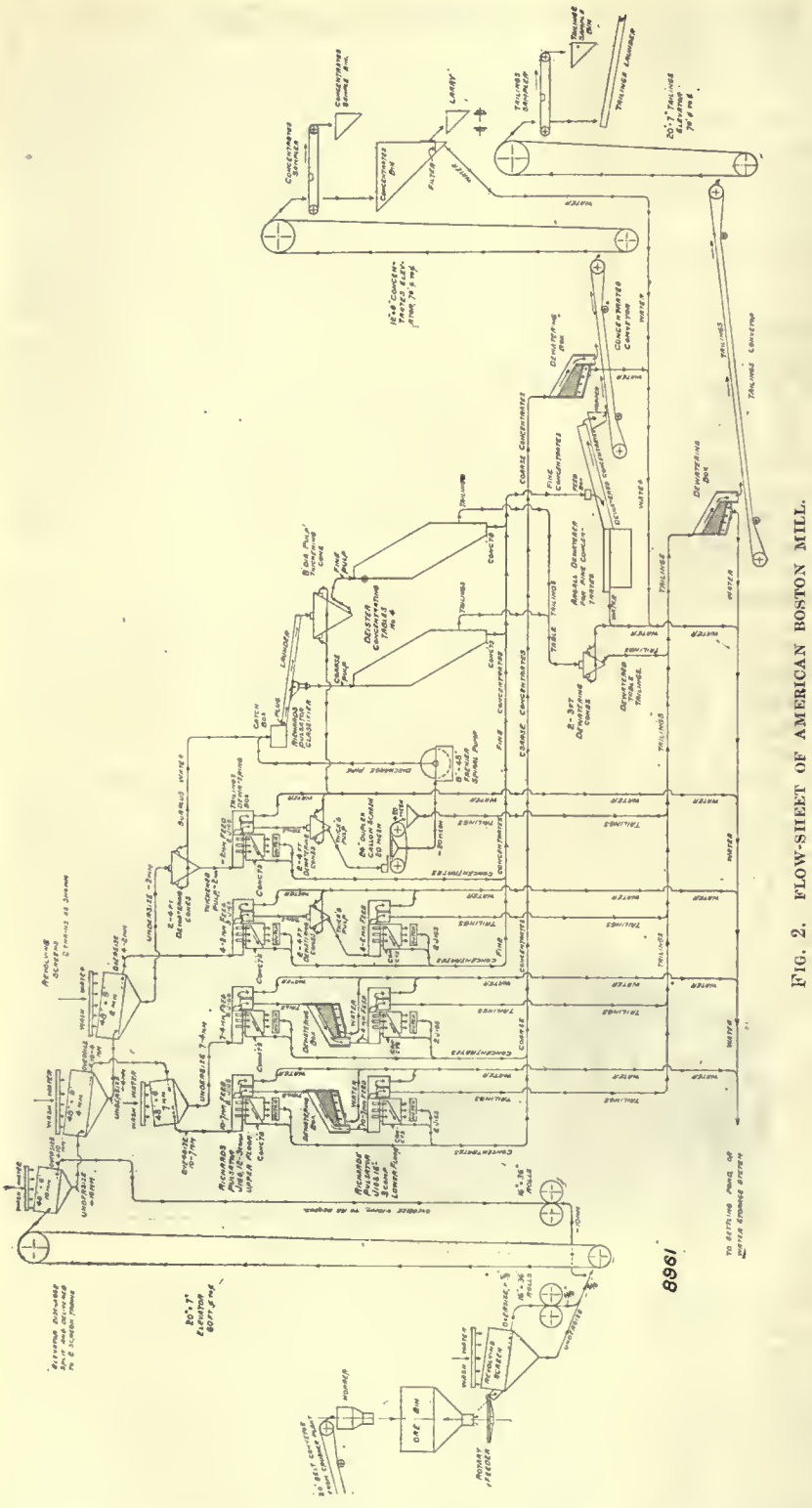


FIG. 2. FLOW-SHEET OF AMERICAN BOSTON MILL.

consisting of a board grating and coarse matting which allows the surplus water to filter through the bottom of the bin and leave the concentrate well dewatered for shipment. The concentrate bin is at a height sufficient to discharge by gravity into an electric larry which runs on a track 30 ft. above the ground; allowing the delivery of the concentrate to the railroad loading bins or to the stock piles.

The principal point of interest in this mill system is the use of the Richards pulsator jigs for the concentration of these low-grade ores. The American-Boston mine ships a large tonnage of high-grade ore directly to the market without further treatment. The mine has also areas of low-grade iron ore comprising both hard and soft varieties. The hematite occurs in the form of thin bands interbedded in the gangue material. In crushing, the mineral breaks into thin flat pieces, making a difficult jigging operation; but the Richards jigs concentrate this ore successfully, although such a feed is a severe test for any jig system.

While the mill is designed for a rated capacity of 500 tons during 24 hours, there is sufficient space for additional capacity. The mill operates daily throughout 24 hours except Sundays. But four men are required on each shift. This evidences the 'automatic' character of the mill system and demonstrates that the Richards jig requires the minimum of attention and adjustment. An important point with reference to the jigs in this mill is the large proportion of hutch concentrate produced. Previously, it had been supposed that the Richards jigs were not adapted for hutch work, but this mill shows the richest and greatest amount of carbonate to be produced from the hutch spigots.

Great interest is found among the engineers of the Michigan iron district in the operation of this mill, as it demonstrates the possibility of treating extensive areas of similar low-grade ores in the iron district. In Minnesota large mills have been constructed for the concentration of iron ores occurring in the form of sands, but the American-Boston mill is the first operated for concentration of low-grade iron ores in Michigan.

To meet the additional power requirements in the mine and mill, the American-Boston Mining Co. installed a large Curtis steam turbine with General Electric generator. The water for the mill is taken from a small lake near the mill. One pumping station at the lake delivers water to a flume which carries the water by gravity to a pump adjacent to the mill. A second centrifugal pump raises the water from the sump to the water-storage tank inside the mill building. A large proportion of the water used in the mill is discharged to a settling pond near the mill, which settles out the solids, and the surplus water flows by gravity to the sump of the pumping plant adjacent to the mill for use again in the mill system.

After a few days devoted to preliminary adjustments, the mill ran steadily, and within two weeks from the start was shipping 60% iron concentrate at the rate of seven standard-gauge ore-cars per day. The plant was designed with surplus space for increasing the capacity, and the management expects with a few additional jigs to increase the capacity to 900 tons in 24 hours. James H. Christy is the mill superintendent and the milling machinery was manufactured by the Denver Engineering Works, which also designed and erected the mill.

The F. MAYER BOOT & SHOE CO., Milwaukee, Wisconsin, manufacturers of miners' and prospectors' boots and other footwear, has just completed another large factory building consisting of seven stories and basement 50 by 150 ft., which is to be used exclusively in the manufacture of Martha Washington Comfort shoes. It is claimed to be the largest single factory in the country devoted entirely to the manufacture of one type of shoes. Including the new Mayer Martha Washington building, the Mayer factories now have facilities for manufacturing 20,000 shoes per day. This company has built up an excellent reputation on its Mayer Honorbuilt shoes, and specializes on boots for miner's use.

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EDITORIAL STAFF:

San Francisco

H. FOSTER BAIN - - - - - - - Editor
EUGENE H. LESLIE } - - - Assistant Editors
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A. W. Allen. — Charles Janin.
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Gelasio Cactani — C. W. Purington.
Courtenay De Kalb. — C. F. Tolman, Jr.
F. Lynwood Garrison. — Horace V. Winchell.

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EDITORIAL

MINING men of northern California and southern Oregon have been meeting this week at Redding in the annual conference that has become a feature of the year in this region. An account of the meeting will be printed next week.

ABANDONMENT of the Clancy process in the Ajax mill at Cripple Creek marks the probable end of another interesting attempt in metallurgy. Theoretically the proposed set of reactions were sound. Practically the complications incident to most regenerative processes defeated the metallurgists engaged. Without regeneration tailing loss of reagents would have made the cost prohibitive.

SULPHUR may now be imported from Japan free of duty, regardless of its purity, if it has not been artificially refined. The Customs Court of Appeals announced a decision to that effect May 6, reversing the decision of the local appraiser to the effect that the Bungo sulphur, being 99 per cent pure, was in effect refined sulphur though collected in that state of purity from a volcano. The duty was at first $8 and later $4 per ton. It is expected that the new decision will permit extensive imports.

VALUING the good will of the business of J. P. Morgan & Company has been furnishing a topic for discussion in financial circles in New York, but, according to a recent decision of the Court of Appeals, the good will of any concern is to be determined, not by the market value of shares of stock, but by the book value of the stock. The difficulty of appraisal of so intangible an asset is illustrated by the fact that good will is carried upon the books by the General Electric Company at $1, and at $30,000,000 by F. W. Woolworth & Company.

MANUFACTURERS of caps and fuse, particularly on the Pacific coast, will be hard hit by foreign competition if the tariff reduction proposed in the House bill goes through without change. Fuse and caps can undoubtedly be made cheaper in Germany and Belgium than in the United States, but this is one of the places where low cost is not the sole desideratum. Where safety is so important, it is not wise to have manufacturing conditions determined by price competition. Foreign fuse is made largely in small factories. In certain parts of Germany fuse-making is almost a household industry, and the fuse is exported, not by the manufacturer, but by middle men. Under these conditions adequate inspection and the all important uniformity of grade is simply impossible. The possible saving to the ultimate consumer is small, in any event, and may be wiped out by a single accident.

Safety first, in this industry, means quality first; and it is impossible to make sure of the latter unless a reasonable price be assured manufacturers.

ILLINOIS has a state university to which is appropriated something over $2,000,000 per year. The amount of money that the state makes available each year has been rapidly growing, and the prime reason for this lies in the fact that the university is devoted to the work of the state in the largest and most direct sense. Every facility of plant and faculty is placed freely at the service of the state and its citizens. One of the characteristic features of the institution is the holding of frequent conferences to which are invited representatives of all interests concerned. In 1909 the first fuel conference was held at this university. It was attended by miners, operators, inspectors, engineers, railway officials, manufacturers, officers of the Geological Survey, and others, and proved immensely stimulating and helpful. A second such conference has just been held. A glance at the list of papers and discussions, given on another page, will show that this, too, must have been a meeting of great technical and practical interest.

IF REPORTS coming from the other side of the Rio Grande are to be given any credence, it would seem that Sr. Emeterio de la Garza, Jr., diplomatic representative of the Huerta administration, will have considerable difficulty in convincing Washington that armed resistance to the Federal Government of Mexico exists in only two states. Just what the solution of Mexico's difficulties will be is so deeply shrouded in mystery that the ordinary layman is not in position even to venture a guess. It was predicted and believed with every degree of certainty that the new administration would be supported by the people and that the disturbing element which was the cause of so much trouble to the Madera administration would unite with the victors for the establishment of peace and the restoration of prosperity. However, as is *la custumbre de la pais*, the reverse has proved true, and instead of peace, which was the sole war-cry of the followers of Sr. Felix Diaz in the revolt against Madera, revolutions and uprisings have increased and multiplied, until there is scarcely a state in the Republic which has not been affected. Before the administration of Sr. Porfirio Diaz, Mexico was in a continual state of revolution for fifty years, and after thirty-five years of peace it is to be hoped that the country is not to be again plunged into a similar state of revolution and anarchy which could only result in Mexico ultimately losing her identity as a nation. Latest reports indicate that conditions are growing worse rather than better as optimistic writers on the situation would like to believe. With Sonora and Coahuila in open rebellion against the Huerta government, and the proved inability of the federal troops to handle the situation in these states, and with a state of anarchy prevailing in Guerrero and uprisings in Durango, Sinaloa, Tepic, Zacatecas, Tamaulipas, and Puebla, it is hard to believe that any immediate solution is in sight.

IN an open letter to the President published in the *Boston Transcript*, Mr. Courtenay De Kalb suggests an ingenious solution of the difficulty with England over Panama canal tolls. Mr. De Kalb points out that the coasting trade has been restricted to United States vessels since the early days of the Republic, and that it could hardly have been anticipated that exemption of canal tolls in its favor would have been thought to be an infraction of the rule requiring equal treatment for the vessels of all nations. However, if it be so held, the easy solution is to allow any other nation finding it convenient to use the canal for its own coasting vessels to do so on the same terms as are given to those of the United States. Since a vessel is only a coasting vessel when it touches at no foreign port, this would only open the canal free to German vessels, for example, sailing exclusively between German ports, or British vessels that touch at nothing but British ports. It is hardly likely that many lines would avail themselves of their privilege under these rules, since normally the business to be won from intermediate stops at foreign ports would be worth more than the saving in canal tolls. The plan, we understand, has been taken up by the State Department, and is being given the careful study that it merits.

Copper Surplus and Prices

Share quotations, copper stocks, and the price of the metal move in a mysterious way their wonders to perform. Upon the declaration of an unexpectedly large decrease in surplus copper stocks on May 8, Amalgamated Copper share quotations scored a sharp advance upon the New York Stock Exchange, while prophesies that copper would soon thereafter sell at 16 cents were freely ventured. The commercial rating of a man having an income of $14,000 per year, and who normally maintained a bank balance of $700, would not be in the least affected by the discovery that his balance had shrunk to $500 or risen to $1000. Copper production last year amounted to 600,000 tons, in round figures; the stock on hand on April 1 amounted to 50,000 tons, shrinking to 36,000 tons May 1. Some eyes may detect profound significance, from a market standpoint, in these figures, but we can claim no such clairvoyance. Production of copper at the mines goes on, subject to interruptions and irregularities that are as varied as they are transitory. Consumption of copper by the brass foundries, wire mills, and their ilk varies no less with the fluctuating conditions of trade. Sometimes the consumer, eager to avoid the possibility of a lack of raw material when profits are good, will bid up prices in order to obtain a supply of metal; sometimes the producer, anxious to exchange metal on which banks will only advance a fraction of its total value for coin, will offer copper freely and lower prices. These are normal phenomena of trade; sudden and extensive changes are typical of speculative manipulation. At any given moment there exists a 'normal' price of copper, none the less real because it defies detection. Analysis of all the factors that enter

into its makeup would not, we venture, exhibit any vital dependence upon the stock of copper then available, providing it be enough to tide over consumers until increase of production at the mines could meet trade demands. In the case of electrolytic copper, three months will usually cover the period between pouring from the converter and casting wire bars at the refinery. A retail house which carried a stock equivalent to nearly a month's sales of a product requiring three months to manufacture would certainly not exhibit any nervousness if the sales during one month were one-third larger than normal. Thus it may be inferred that nervousness over copper stocks is rather "a consummation devoutly to be wished" in the share market, than a fundamental and necessary psychologic phenomenon. Deductions from technologic conditions would indicate that the average price of copper may be expected to decline slightly during this year, but prophecies in regard to copper prices must take account of more than technologic conditions.

Hoisting Accidents

Deep mining and large ore production led to the development of the modern hoisting engine, with its high speed, great power, and intricate machinery. The recent accident at the Leonard shaft, at Butte, Montana, emphasizes the fact that even the most perfect of these modern engines does not give entire freedom from danger. Accidents are caused by brakes failing, by clutches coming out of gear because of unexplained causes, by reversing gear getting out of order, by ropes breaking, by cages and skips being hung up in shafts, by skips in inclined shafts running away and safety catches not acting, by overwinding, and by various failures of the human element. In hoisting, there are three distinct phases of motion—acceleration, maximum velocity, and retardation. In passing from one of these stages to another, important adjustments of the engine must be made, and these depend upon the judgment of the engineer. If the first period is passed through too quickly, there are various strains set up that are especially bad for ropes and skips. The second period may involve winding so fast as to start ropes swaying badly, and to cause the skips to strike and loosen the guides. A large engine, hauling a total load of five to ten tons, vibrates to an astonishing degree, and the centre bearing of a drum shaft of 16 inches in diameter has been known to break as a result of too fast winding. At Kimberley, on the other hand, Mr. Alfred Williams found it possible to stop the swaying by running faster. Apparently for a given load and given conditions there is a certain favorable speed which must be found in order to accomplish the best results. In the third period, the engineer judges the position of the load in the shaft by indicators, and if the retardation is not begun soon enough, or the rate is too slow, an overwind may well result.

The modern hoist is a magnificent piece of machinery, with its direct motion, post and disc brakes, its reversing gear, its air or steam-operated clutches, its indicators, overwinding gear, and signal system, and would appear to be safe in the hands of a level-headed man. But at times even the best men fail, and this human factor, usually not studied, comes into play. Unless an engine has too great a speed, the brakes should hold when it runs away; but brakes do fail. Recently there was an accident at Kalgoorlie, and it was said that a clutch came out as the result of some extraordinary cause. If the machinery is not regularly and carefully inspected, this is entirely possible. As a matter of fact, it rarely occurs, especially where the engine is operated by steam. Several years ago in the same district, the quadrant which held the reversing lever of an engine in place allowed it to slip, and two timbering 'gigs' with five men were dropped several hundred feet. Ropes attached to skips frequently break, but owing to safety appliances fatalities from this source are infrequent. Skips in inclined shafts seem to be prone to disaster. A recent accident in Idaho, and one in Western Australia about two years ago, appear to have been due to the skips suddenly getting away when the speed was too great to allow engine brakes or safety appliances to act in time. It too frequently happens that the hoisting engineer has not a full and clear view of the shaft and skip. This is a bad arrangement, and accidents are due to this cause. It is too much to expect him to guess the correct position of the skips, even with indicators on the engine. Besides having a clear view, the engineer should have keen eyesight, and be on the alert for every signal. At the Treadwell mines, signals are both by bell and colored lights, and no engineer is allowed to hoist men except when an assistant is present. This is an excellent rule. In Queensland during 1912 special regulations were made regarding hoisting engineers, and a license must now be obtained before operating such machinery. Similar laws are in effect in a number of American states. Many accidents have happened to men being lowered or hoisted too rapidly, especially when coming off shift tired and perhaps dazed with powder fumes. Powder smoke makes men 'light-headed' and fast hoisting adds to the feeling, so that they occasionally collapse and are killed by striking between shaft and cage. Accidents during sinking are especially common where cross-heads and buckets are used, and this point requires attention, as fatalities have been too frequent. With electric hoisting there does not seem to have been so many accidents, due perhaps to the slower speed, the gear-driven drums, and the better control.

Hoisting from great depths has been studied by many noted engineers. One of the finest contributions on this subject was prepared by Mr. Hans C. Behr, at Johannesburg in 1902. His studies of African, European, and American hoists, with the discussion of other engineers, forms a volume of 434 pages, supplemented by an atlas of 79 plates illustrating every suggested type for deep, economical, and safe work. With all the ingenious appliances fitted to hoists and the general care taken, the hoisting engineer remains the person to be most studied and to be watched and helped. If he fails, an accident results which nullifies the best efforts of the mechanics.

The Analysis of Smelter Contracts—II

By Gelasio Caetani

*The object of bonuses is to offset some charges which would be too severe on some ores if applied indiscriminately to all ores. They also stimulate the production of certain especially desirable kinds of products. As an example: smelters will often grant bonuses on ore assaying below a certain value, and thereby induce the producer to ship low-grade material (as, may be, the concentrate of a canvas plant) which otherwise would necessarily have been thrown to waste. The bonuses or reduced treatment charges, on the other hand, are also used to stimulate the production of very high-grade concentrates which, owing to their high metal content, can be shipped to some distant point at a less cost per pound of metal than otherwise would be possible. More generally, however, the smelters take special pains to increase rapidly the percentage of their profit as the value of the ore increases, relying on the basic principle that the larger the melon, the less bashful you must be in helping yourself. In this the railroad companies are close seconds. Sometimes these progressive charges are discontinuous; a $20 ore will pay $5 treatment charge per ton, a $30 ore $6, and so forth, the other charges and per cent discounts remaining the same.

Typical Smelting Contracts

On lead concentrates a very usual progressive unit price schedule is as follows: 90% of the lead is paid at 90% of the New York quotation if said quotation is less than $4.10; if the quotation is above $4.10, then the smelter will pay 90% of the lead at 90% of $4.10 plus one-half the difference between $4.10 and the market quotation. This schedule makes a progressive charge as the price of lead increases, reserving to the smelter the lion's share when metal prices are booming. Figured out on this basis the total lead deductions are:

Price per 100 lb.	Per cent.
$4 total deduction	19.0
5 total deduction	25.5
6 total deduction	30.3

On copper ores the per cent of deduction varies in the opposite direction, becoming smaller as the market price increases. This condition exists notwithstanding that the market fluctuations of the price of copper are more capricious than those of lead. It may be one way of making the lead producers pay for tariff protection.

All these various aspects of the smelter contract question are so disparate, so complex, and often so contradictory that it is quite possible you may understand them less now than you thought you did before I started. This happens quite often when you go deeply into a subject.

It may help to resort to graphical representation, and it is quite remarkable to note of how much assistance diagrams are, in comparing the relative value of various smelter schedules, in disclosing the hidden jokers, and in conveying definite suggestion as to how to modify mill operation in view of realizing the maximum economic efficiency.

Graphical Studies

As an example of graphic representation I have prepared here two sets of diagrams. In the first one (Fig. 1) are drawn the diagrams of three smelter contracts for lead ores which are actually in force in Western states. In figuring out these diagrams I have omitted payments for gold, silver, copper, and iron, as the addition of these payments would complicate matters. The diagram therefore simply gives the net value per ton of ore f.o.b. the mine for varying lead contents of the ore. The value per ton of ore will also vary according to the market value of lead, and therefore there are three variables to be represented on the diagram, that is: value per ton, grade of ore, and market value of lead. To represent these three variables, families of curves may be used as shown on Fig. 1. The diagrams represent a schedule reading as follows:

No. 1. The smelter will pay for 90% of the lead at full New York quotations less 1¼c. per pound of lead; the treatment charge to be 10c. for every unit of lead below 60%, and there will be a bonus of 10c. for every unit of lead above 60 per cent.

No. 2. The second schedule reads as follows: The smelter will pay for 90% of the lead content at 90% of the New York quotation if this quotation is less than $4.10, and if above $4.10 it will pay at the rate of $3.69 per 100 lb. plus one-half the difference between the New York quotation and $4.10. Treatment charges to be $12.25 per ton.

No. 3. The third schedule calls for payment on 90% of lead content at full New York quotations less $15.75 per ton.

In Fig. 2, I have reproduced the lines representing the value of the ore under the three schedules when the price is $4 per 100 lb., omitting all the other lines which at first glance make the diagram somewhat confusing.

Relative Advantages of Each Contract

Looking at these diagrams, it will be seen that the No. 1 contract is more advantageous to the producer than either of the two others as long as the grade of the ore is below 63% lead. For ore higher than 63% the third schedule is more advantageous than the first one because though the treatment charge is heavier the price per unit of lead is highest. The second schedule is more advantageous than the third one for ores assaying less than 52% lead; it is less advantageous than either of the other two for ores ranging from 52 to 63%, and again becomes more advantageous than schedule No. 1 for concentrates assaying above 73% lead. This means that if we can divide by concentration the ore into two classes, that is, into a concentrate assaying less than

*A lecture delivered at Harvard University, continued from p. 687.

63% lead and one above this grade, it will pay to do so, as by selling each product under the most favorable contract more profit will result than if the whole product were sold under any one single schedule.

To make this clearer, I must point out the fact that whenever a schedule is a linear function of the lead content, that is, when it is represented by a straight line on the diagram, there is no advantage whatsoever in producing concentrates of different grades. This is easily demonstrated by algebra. If, however, a schedule, or a combination of two or more schedules, represented graphically, appears as a curve or a polygonal line, concave on its upper side, then it is always profitable to divide the concentrate in two or more products of different grade. Vice versa, if a schedule appears on the diagram as a curve convex on the upper side, then there is always a possibility of determining a certain grade of concentrate at which the maximum price is obtained for every unit of lead.

Another important observation brought out by these diagrams is the minimum grade of the concentrate that can be shipped under any of the three schedules. Looking at Fig. 2, it will be noted that the schedule lines cross the zero line of the ordinates, respectively, at 12, at 19, and at 22. This means that any pound of material contained in the concentrate and which assays less than 12% lead is shipped at a loss if sold under schedule No. 1. To be sold under schedule No. 2 no part of any concentrate must assay less than 19% lead, and in the case of schedule No. 3, this limit is 22% lead.

I will illustrate this further. Suppose that all mill products must be sold under schedule No. 3, and

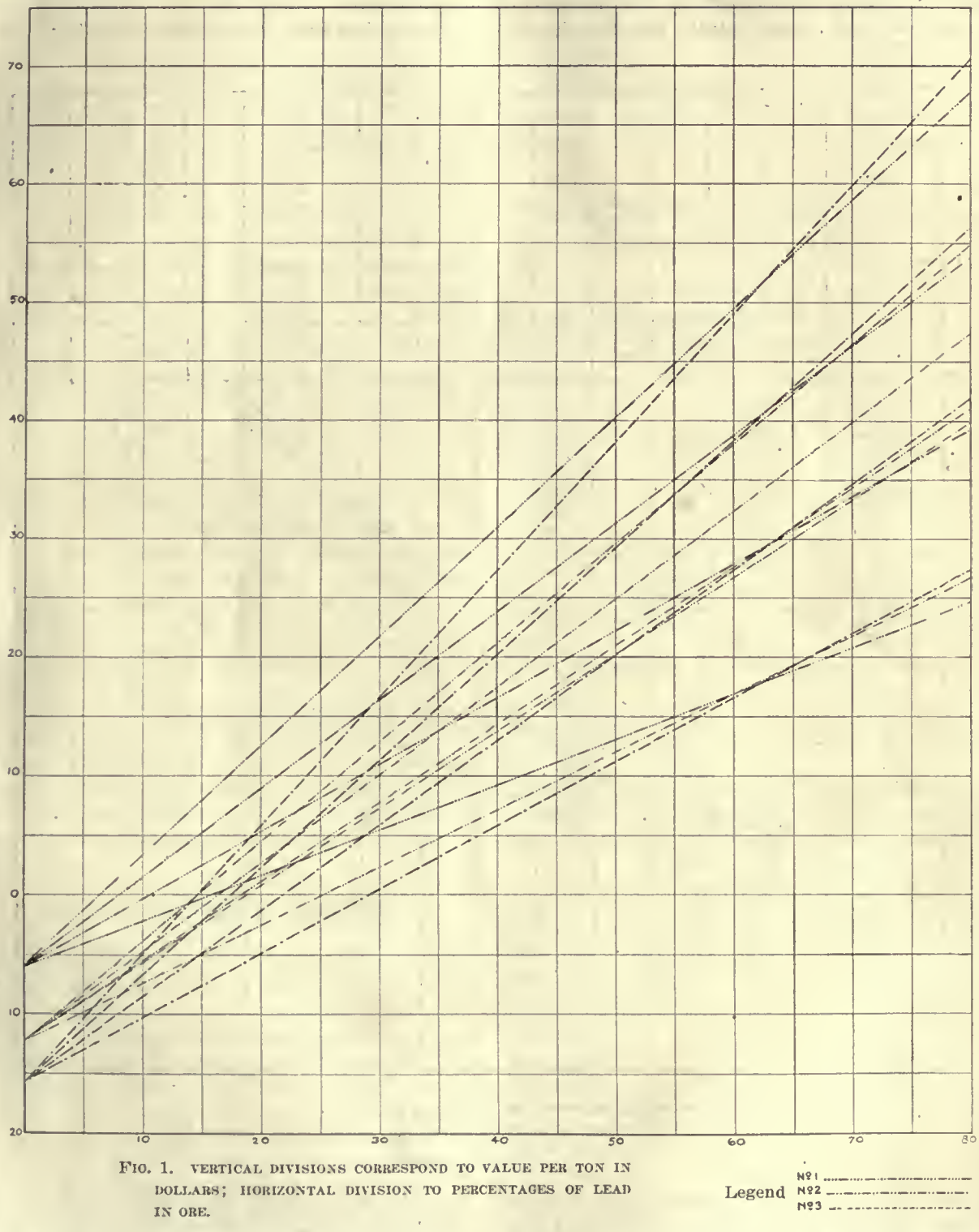


FIG. 1. VERTICAL DIVISIONS CORRESPOND TO VALUE PER TON IN DOLLARS; HORIZONTAL DIVISION TO PERCENTAGES OF LEAD IN ORE.

that 100 tons of table concentrate assaying 50% lead is to be sold. From the diagram it may be seen that this is worth $20 per ton net. By running this concentrate over a cleaning table, 10 tons of tailing assaying 15% lead may be eliminated, giving at the same time 85 tons of a refined concentrate assaying 53.9% lead. The diagram shows that this 15% lead tailing, if shipped with the concentrate, would have represented a loss of $2.50 per ton. The operation of cleaning 100 tons of concentrate therefore has resulted in a net profit of $25. It may seem a shame to throw away 15% lead tailing, but if it pays to do so it must be done. If instead of selling under schedule No. 3 the concentrate was sold under schedule No. 1, the diagram shows that the 15% lead tailing is worth $2.50 per ton. It is useless to attempt to refine the concentrate unless it is possible to eliminate a tailing assaying not more than 12% lead.

The diagram also gives the net loss suffered in shipping barren material mixed with the concentrate. This loss is represented by the negative ordinate of the origin of the family of curves and is minus $6 for the No. 1 schedule, $12.25 for the second, and $15.75 for the third schedule. Suppose that the ore contains some barren barite which finds its way into the concentrate. If by some process, say the flotation process, it is possible to eliminate this barite there would be a profit corresponding to the figures given above.

Now going back to the diagram of Fig. 1, it appears that for schedules No. 1 and No. 3 the increase in value of the ore is directly proportional to the increase of the market price. For schedule No. 2 the case is different because, on account of the unit price being based on one half of the difference between $4.10 and the New York quotation, the rate of increase becomes about one half as soon as the market price of lead passes beyond $4.10. In fact, for lead $4 per hundred pounds, the difference between schedule No. 1 and No. 2 is only $2 for a 50% concentrate, whereas when lead is $6 this same dif-

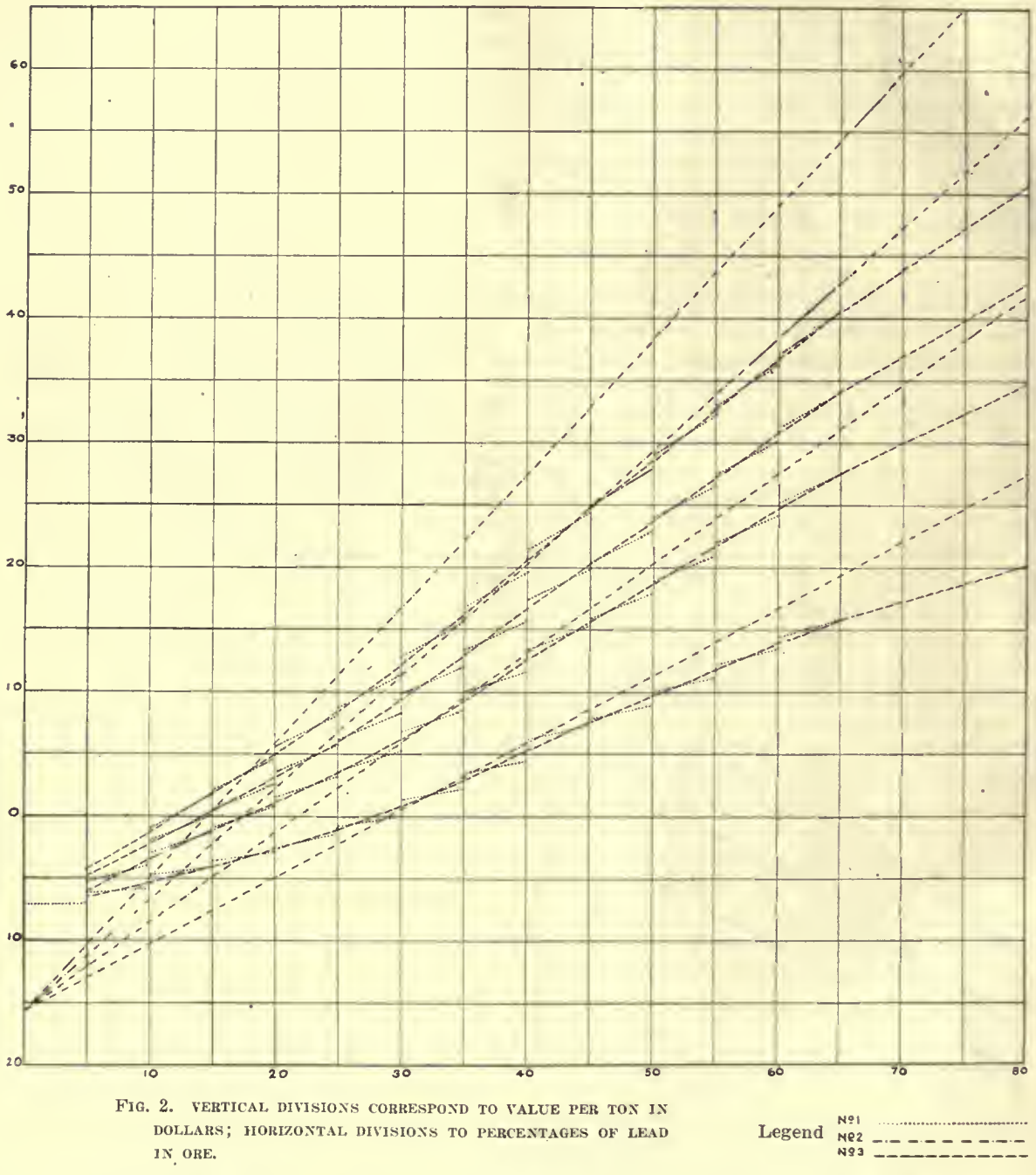


FIG. 2. VERTICAL DIVISIONS CORRESPOND TO VALUE PER TON IN DOLLARS; HORIZONTAL DIVISIONS TO PERCENTAGES OF LEAD IN ORE.

ference is over $10. Therefore, schedule No. 2 is especially disadvantageous when the price of lead is high.

Colorado and Idaho Schedules

The smelter schedules so far considered are represented by straight lines. In Fig. 3 is given the diagram of a lead schedule for gold-silver-lead ores, which is actually in use, in Colorado. The wording of the contract is too complicated to be given here, and it suffices to say that the unit price for each grade of ore is determined by adding or deducting one cent from a base unit price for every cent variation plus or minus a nominal market quotation which is obtained by discounting in a complicated way the true New York quotation for lead. The schedule being discontinuous, the diagrams are represented by a series of steps. The curves shown in Fig. 2 give an idea of the average value of the schedule. For comparison I have superposed on these curves the straight line diagrams of the same schedule, No. 3 which has been previously analyzed. This goes to show how far less advantageous the Colorado schedule is when compared with No. 3 schedule.

This is true for any high-grade ore. If, however, the ore or the concentrate produced were to be classed as 'dry,' that is, ores very low in lead, the Colorado schedule would be more advantageous, especially when the market price of lead is low. The difference is about $5 for ores assaying 10% lead in favor of the Colorado schedule, whereas the difference is about $7 in favor of the No. 3 schedule for concentrate assaying 60% lead and when the market price is $5 per 100 lb. This goes to prove how circumstances may change the relative value of two smelter schedules.

A further and more detailed analysis of smelter contracts would lead too far. The general review made will suffice to give an idea of the general plan on which are based the smelter contracts and of the great importance attached to the real understanding and to the mathematical analysis of this intricate subject.

Growth of Cement Industry

The recent growth of the American portland cement industry has been so rapid that its present relative standing among our great industries is realized by few, even of those directly interested. Its importance, both commercially and financially, is perhaps best brought out by comparison with the American iron industry, whose standing is everywhere fully understood. The following table, compiled by E. C. Eckel of the U. S. Geological Survey, gives the output of pig iron and portland cement in long tons during every fifth year from 1880 to 1910, inclusive:

Year.	Pig iron, long tons.	Portland cement, long tons.	Percentage of cement to pig iron.
1880	7,749,233	7,000	0.1
1885	7,415,469	25,000	0.3
1890	9,202,703	56,000	0.6
1895	9,446,308	165,000	1.7
1900	13,789,242	1,414,000	10.3
1905	22,992,380	5,874,469	24.3
1910	26,674,123	12,986,152	48.7

Costs at the Bunker Hill & Sullivan Mine, Idaho

During the 19 months ended December 31, 1912, 702,520 tons of ore was mined, and 697,560 tons concentrated at a cost of $1,580,815, divided as follows:

	Total cost.	Cost per ton mined.
Stoping	$1,125,695	$1.602
Tramming	51,995	0.074
Concentrating	262,584	0.374
Shipping	23,939	0.034
Superintendence and office	51,473	0.073
Contingent expense	60,378	0.086
Legal	4,750	0.007
Total	$1,580,814	$2.250

Stoping costs were as follows, covering the mining of 699,160 tons of concentrating ore:

Details of labor and supplies.	Total for the period.	Av. cost per ton.
Foremen, bosses, blacksmiths, machinists, nippers, and supply men	$ 122,830	$0.177
Timbermen and carpenters	60,063	0.086
Miners	255,012	0.367
Carmen	36,168	0.052
Shovelers	254,197	0.366
Power labor	18,918	0.027
Repair labor	17,884	0.026
Explosives	52,172	0.075
Illuminants	13,555	0.020
Lubricants	2,264	0.003
Iron and steel	8,508	0.012
Miscellaneous supplies	24,159	0.035
Timber and lagging	149,486	0.215
Power supplies	31,563	0.045
Wood	23,888	0.034
Stable and stock	445	0.001
Total	$1,071,113	$1.541

Shipments of crude ore brought the total to $1.602 per ton.

The mills concentrated 697,560 tons of ore, equal to 1256 tons per 24 hours of actual operation, at the following cost:

Details of labor and supplies.	Total for the period.	Av. cost per ton.
General labor	$ 24,339	$0.035
Millmen	84,498	0.121
Laborers	5,210	0.007
Power labor	2,596	0.004
Crusher labor	2,245	0.003
Repair labor	13,221	0.019
Explosives	7	
Illuminants	1,702	0.002
Lubricants	3,213	0.004
Iron and steel	1,205	0.001
Miscellaneous supplies	36,708	0.053
Timber lagging	3,728	0.006
Roll shells	2,823	0.004
Trammel screens	4,152	0.006
Crusher supplies	3,256	0.004
Power supplies	56,597	0.081
Wood	5,487	0.009
Total	$250,987	$0.359

Operation of the tailing mill brought the total to 37.4c. per ton.

Gold exports from the Federated Malay States in 1912 totaled 12,533 oz., on which duty amounting to $330 was paid.

A North Carolina Mining Enterprise

By Claud Hafer

According to G. F. Becker, the gold produced in the United States from 1804 to 1825 came from North Carolina, and the total recorded was $110,000. Before 1825, placers were the only source of metal, but in that year Mathias Barringer mined quartz successfully in Montgomery county. So to this county is to be credited the first vein-mining in the South, and here today, nearly a century later, is in operation the most successful gold mine and reduction plant on the Atlantic slope. This mine, the Iola, was discovered in 1900 in a part of the county little prospected previously, and its success gave rise to a mild boom in the Candor district, which resulted in the discovery of other veins that are, or have been, in course of development.

The district in which the mine lies is near the junction of the Piedmont plateau and the Coastal plain. It is a region of little relief, and as far as mining operations are concerned may be called flat. It is essentially an agricultural country, well timbered and well watered. Railroads give easy access to the coalfields, and hydro-electric power is close at hand. Mining labor is not plentiful, and is paid from $1.25 to $2.50 for a 10-hour shift. The country rock, as far as excavations made to date reveal, is schist thinly laminated for the most part, though graduating into a more massive rock, having the appearance of andesite.

Character of the Ore

The ore deposits in this mine occur (1) as narrow veins, trending northeast and southwest, and dipping steeply to the northwest, conforming generally to the dip and strike of the enclosing schist; (2) as silicious pyrite zones in the schist; (3) as aggregations of stringers and lenses with unaltered schist between them. The veins have been crossed by dikes of diabase and other basic rock, and are faulted. The Iola vein varies from one to eight feet in width and has been developed for 2000 ft. along its strike by the Iola and Montgomery mines, and to 650 ft. on the dip. A parallel vein on the hanging wall side 180 ft. distant and a branch vein have also been productive.

Shortly after the discovery of the vein a mill was put up consisting of three slow-speed, stone, Chilean mills and a 10-stamp battery. It was fed by hand, with no rock breaker. The ore was rich and the returns were remarkable for North Carolina, though nearly as much went with the tailing as was caught by the mercury. At one time 69 lb. of amalgam was obtained from an 8-day run. The plant was close to an incline shaft sunk near a stream crossing the property, an ill-chosen position, as the water-soaked schist requires careful timbering to hold any excavation intact. This shaft became unsafe, and a vertical one was started to cut the vein at 250 ft. The mill was moved to higher ground on the opposite side of the branch, where 10 stamps were added. At this time the mine enjoyed great prosperity, and everybody in the neighborhood who could was prospecting. Mining prospects in the Candor field were in great demand among mining promoters. It is doubtful if there has ever been a parallel case in Southern mining history, unless it was at the time of the discovery of the gold-bearing saprolite at Dahlonega, Georgia.

Early Milling Experience

The next improvement that was made was a cyanide annex, an out of door plant on the slope across the branch from the mill, at a higher level. A launder received the pulp from the plates and discharged into a boot of a belt and bucket elevator, that elevated it 35 ft. to another launder that discharged into collecting boxes, each holding 8 tons. The boxes were provided with filter bottoms and the sand was partly dried before being loaded into the leaching vats, three in number, of 25 tons capacity each. The slime overflowed at the end of the settling boxes and was led to one of three agitating tanks, 20 ft. diameter, with 12-ft. staves provided with mechanical stirrers, and connected with the intake of a 4-in. centrifugal pump. As the tank filled, the clear water was decanted, and when a charge of approximately 20 tons was in the tank the pulp was shifted. All of the water was then decanted, and cyanide solution was run on in its place. The charge then received the combined or alternate treatment of compressed air, stirrers, and centrifugal pump. The solutions were precipitated on zinc shavings in two zinc-boxes under cover near by. The gold slime was treated with sulphuric acid, and smelted in a little wind-furnace in an adjoining building. The plant operated almost continuously with profitable results for four years.

Handling the Ore

In the meantime the stamp-mill was burned and shortly after reconstructed with improvements, the latter including rock-breaker, ore-bin with belt-elevator from breaker to bin, feeders, and an automatic dump car for delivering the ore from the shaft 150 ft. away. This car was an unnecessary refinement for the small tonnage handled, never over 25 tons per 24 hours, and unfortunately the car was somewhat erratic in action. At times it would stick in the middle of its flight, or would run to the terminus, double back half way, and carefully drop its load in the branch. Eventually it gave way to a cable-drawn car that delivered at the top of the ore-bin, thus doing away with the belt-elevator. The mine had now reached a depth of 350 ft. and was in hard ore, which cut down the capacity of the stamps. A mill of 40 stamps was built on higher ground, and development commenced on the southwest extension of the vein. An incline shaft was sunk, which is the present working shaft of the mine, now 450 ft. deep. A Cornish pump was installed and a 200-hp. boiler added. The cyanide plant, now in bad condition, was torn down and the best of the material used in

its reconstruction in the building formerly occupied by the stamps. The new mill operated but a short time dropping 40 stamps, and a little longer with 20, when the mine was placed in the hands of a receiver and sold, which wound up the affairs of the Iola Mining Company.

Another Mill

During its life the mine produced nearly a half million dollars. The new owner, the Candor Mines Co., immediately commenced active development, and 10 months after buying the mine started construction on a modern mill. It was a dry-crushing plant and was completed and in operation six and one-half months when destroyed by fire. It was situated on the slope just back of the incline shaft. The ore was brought by a belt-conveyor to a 50-ton bin, from which it was fed by a Challenge feeder to a dryer consisting of a revolving cylinder that received the flame from a fire-box at one extremity. After being dried the ore was elevated 35 ft. by a chain-belt elevator to a steel bin that fed a 42-in. Lehigh Fuller mill. This mill was supposed to grind to 200 mesh and was fitted with 30-mesh screens, which were frequently and easily broken, according to the statement of the management, and allowed coarse material to pass. The finished product was collected in a dry-ore bin of 50 tons capacity. This had a hopper bottom, and in turn discharged to a screw-conveyor leading to an elevator that lifted to a pulp tank on top of a 35-ft. high Parral vat. The pulp tank was 4 by 5 ft., and had an ordinary rotary agitator mounted in the centre. The pulp overflowed into either of two Parral vats, through a 5-in. pipe. The Parrals were 13 by 35 ft. in size, and discharged from the bottom upon a revolving filter. The solutions were precipitated on zinc shavings as in the old plants.

THE CANDOR MILL.

The plant was not exactly suited to the conditions; wear and tear were excessive, and shut-downs frequent. It produced its share of bullion, however, and was lost by fire in December 1910. The loss was a blessing in disguise, for it led to the construction of the present efficient mill. Profiting by previous experience, in effect if not in fact, this plant leaves little to be desired for its intended purpose. The ore coming from the shaft in a self-dumping skip drops on a grizzly with 1¾-in. openings. The oversize is washed crudely by pouring water on it by the bucketful, and a portion of the clean waste is eliminated before crushing. Passing through a 9 by 15-in. Blake crusher to the crude-ore bin below the grizzly, the ore is drawn as required upon an 18-in. picking belt. This is of 81-ft. flight and has a rise of 28 ft. In the course of its passage along this belt, the ore is washed by the spray of an ordinary garden hose nozzle, and about the same quantity of waste is removed as is on the crusher floor. In order to get the required 50 tons per day, something over 12 tons of waste is picked from the mine product. The cleaned ore is stored in a 100-ton bin, and fed through a suspended Challenge feeder to five stamps, each weighing 1750 lb. and having a daily duty of from 10.5 to 14 tons per stamp, through a ¼-in. screen. Crushing is done in cyanide solution, and the pulp is reground in a 4 by 20-ft. Allis-Chalmers tube-mill, the slime first being removed by a Dorr classifier. The tube-mill product is returned to the classifier by a Frenier pump, and the overflow from the classifier is thickened in an 8 by 18-ft. Dorr thickener. The thick pulp is discharged intermittently to the boot of a bucket elevator, which elevates to the top of the first of a series of three Parral vats. These vats are 18 ft. in diameter and 29 ft. high, each holding pulp equivalent to 55 tons of dry ore. The first two are arranged for continuous treatment, and the third is a storage-tank for the filter. Being provided with an air-lift, it serves as an agitator also. Of the total extraction, 90% occurs in the first vat. A Kelly pressure-filter, No. 1-B, is used, and handles the entire product on the day shift of 12 hours. Zinc-boxes are still used for precipitation. They are three in number, each containing 6 compartments, 24 by 36 by 20 in. The zinc-box product is acid treated and smelted into fine bullion on the premises. Treatment cost totals $1.64 per ton and an extraction of 95.5% is made. The mill has been in operation since August 1911, and has given remarkable service. If its success can be followed by that of others, North Carolina may not only be of historic but of economic interest in its relation to the gold-mining industry.

Figures on results of operations of railroads of the United States in January, furnished by the Interstate Commerce Commission, are strikingly favorable. It is shown that revenues from operation were 13.3% larger than in the previous corresponding month, that net revenues were 52.5% larger than in January of last year; that transportation costs took up only 39.1% of gross returns, against 42.9% for January 1912, and the statement also shows that railroads generally were better maintained in January last than in the previous corresponding month. These figures do much to belittle the current popular cry that railroads are being pauperized by labor unions and adverse legislation.

Operation of the Tonopah Belmont Mine, Nevada

By Frederick Bradshaw

*During the year 1912, the mine has been in constant operation excepting when work was discontinued by reason of stoppage of power. For the first six months of the year the Desert Queen shaft was used for hoisting, since which time work has been carried on entirely through the Belmont shaft, which has been operated by the Tonopah Mining Co. under an agreement of lease. From the 156,060 wet tons of crude ore hoisted during the period, 24,990 tons of waste was sorted out, and of the remaining 131,070 tons, or 130,592 dry tons, 562 tons was shipped to smelters, 43,034 tons was shipped to and treated at the Millers plant, and 84,886 tons was milled at the new Tonopah mill, while 1055 tons was added to ore stoek on hand as of February 29, 1912.

Operating Costs

Total operating costs at Tonopah have been reduced from $12.28 in 1911 to $8.96 per ton in 1912, a decrease of $3.32 per ton. Mining costs in 1912 were $4.12 per ton, a reduction of 60c.; transportation charges were 28c. per ton, a reduction of $1.84; milling costs were $2.96 per ton, a reduetion of 17c. per ton; marketing costs (of ores, bullion, and metallurgical products) were 49c., a reduction of 54c.; and general eosts (including administration, offiee, legal, taxes, bullion taxes, and depreciation) were $1.11 per ton, a reduetion of 17c. per ton. Although the assay value of the ore mined was lower by $6.17 per ton ($24.34 in 1912, as against $30.51 in 1911), the net realization from Tonopah operation was 56.7% of the gross value in 1912, as compared with 52.5% in 1911, an increase of 4.2%. The ehief factor in cost reduetion has been the operation for the past seven months of the period of the new mill at Tonopah. Although mining costs that are not affected by the new plant show a noteworthy decrease, the mill, completed in July 1912 at a cost of $468,564. has been the means of operating and producing to the extent as outlined, without shipping to the smelters, which could only have been continued at a greatly higher cost. During the seven months' period of operation of the Tonopah mill, total operating eosts were $8 per ton, a decrease of $4.28 per ton. Exeluding the reduetion of 94c. in mining eosts, the remaining eosts have been reduced $3.34 per ton over those of 1911. On this basis the new milling plant will have returned the capital expenditure involved, by resulting cost economies after the milling of 141,000 tons of ore, or after the milling of 55,000 tons from the even date. During the seven months' period the net realization was 58.6% of the gross value. The Millers plant, operated during the last half-year as a custom plant, has made a profit of $9802. For the first two months of the period a monthly depreciation charge of $3750 was made, so that, excluding the depreciation item, a profit of $17,302 was earned at this plant.

For the silver produced during the year, the average price was 61.40e. per fine ounce; the highest price reeeived having been 64.18c. and the lowest 58.12e. per fine ounce.

The Belmont vein, as opened by the year's development, has in certain areas between the Belmont and Tesuro faults been found to contain included 'horses' of waste, and has, for this reason, a lesser quantity of ore between walls than was expected. In other areas, espeeially to the east of the Tesuro fault, the vein matter has been of lower grade than was anticipated. As was expected, the Belmont shaft, at a depth of 1466 ft., 72 ft. below the No. 13 level, encountered the east-dipping Belmont fault that forms the western boundary of the Belmont vein ore deposit. In the Belmont vein, east of the Tesuro fault, where development thus far has shown a falling off in value, some indications seem to point to rieher ore at a greater depth. On the other hand, the year's exploration of the Shaft vein has proved this vein to contain a greater tonnage, of a higher grade, than was expeeted, and the same is true, though to a lesser extent, of the Mizpah fault vein.

Ore Reserves

Beeause of the many factors of uncertainty as to widths and grade of ore, even in comparatively small-sized blocks, it is impossible to accurately calculate the tonnage and assay value of the various elasses of ore, but it is believed that the estimates made are conservative rather than liberal. On aceount of various reasons no development of the Belmont vein below the No. 13 level has been practicable. The ore reserves in the property, as thus figured, consist of 229,185 tons of positive, 126,020 tons of probable, and 155,218 tons of possible ores, or a total of 510,423 tons. The possibility of materially increasing the ore reserves during the coming year is good.

The year's development work aggregated 12,513 ft., and was seriously retarded in the first half of the year, while the Belmont shaft was out of commission, by the limited hoisting capacity, and during the second half-year by a scarcity of labor and by the larger quantities of water encountered at depth. Notwithstanding the more adverse conditions, more development work was performed, at a lesser total cost, than in the preceding year. On the 900-ft. level, little work was done, but the probable eastern limit of the Belmont vein was found. On the 1000-ft. level, development of the Belmont vein, to the east, has proved the eastern limit of the Belmont vein. Cross-cutting north from the Belmont vein, east of the Belmont shaft, has exposed the Shaft vein at two points, and driving on the Shaft vein from these cross-cuts has opened this vein to a small extent on the level. A new vein, called the Favorite, from its location on the Favor-

*From annual report to Tonopah Belmont Development Company.

ite claim, was cut by the continuation to the north of the 1001 cross-cut. A northeast drift 164 ft. long exposed no pay-ore, but a southwest drift 181 ft. long developed a shoot of good ore that to date is 140 ft. long, the ore in the drift averaging upward of 2 ft. wide and of good grade. On the 1100-ft. level no driving was done on the Belmont vein.

The Shaft vein has been further developed, west of the Belmont shaft, by two intermediate levels, one 25 and the other 65 ft. below the 1000 ft. level. On No. 12 level, driving to the east on the Belmont vein has shown the orebody to extend further east than on the 1100 and 1166-ft. levels, though the

NEW MILL AT THE BELMONT MINE.

grade of the ore is lower. The northwest cross-cut on this level was driven 445 ft.. and exposed two veins, the Thanksgiving and the Mizpah fault vein. On the No. 13 level the west drift on the Belmont vein has reached the Belmont fault, the western limits of the Belmont vein orebody. Driving to the east on the Belmont vein has not, as yet, at a point 559 ft. east of the Belmont shaft, reached the Tesuro fault. A winze below the level was sunk 90 ft., and in the bottom shows ore of excellent grade.

Retimbering the Shafts

After a forced stoppage of sinking the Belmont shaft during the period of retimbering, sinking was again resumed in November from the 1465-ft. point, and a larger flow of water than ever was encountered. Little progress could be made, and only 18 ft. of shaft was completed. During January 1913 the amount of water decreased to about 70 gal. per minute, the normal flow, and shaft-sinking has made excellent progress, 67.5 ft. having been sunk in February. The retimbering of the Belmont shaft was undertaken during the first part of the year and was accomplished with creditable celerity. Loading pockets for ore and waste with a combined capacity of 150 and 110 tons, respectively, was completed below No. 11, 12, and 13 levels of the Belmont shaft. The mine-cars are dumped from the level tracks into the pockets, being screened through grizzly bars spaced 10 in. apart, and the material is expeditiously loaded from the pockets into the skips by means of compressed-air operated gates and movable chutes. The double-deck cages previously used have been replaced by self-dumping skips of 60-cu. ft. (3-ton) capacity, and the speed of the hoist reduced from 1040 ft. to 900 ft. per minute on account of the heavier loads handled. For this speed change, and to insure smoother operation, the hoist was provided with Wuest cut herringbone gears on the primary drive from the motor, with most excellent results. The installation of the skips has increased the hoist capacity of the shaft and equipment by 35%. A concrete shaft collar was built at the mouth of the shaft while the retimbering was in progress, this being necessary by reason of the loose surface earth at the opening.

New Belmont Mill

The new mill at Tonopah, a brief description of which appeared in the last annual report, commenced work on July 20 and has proved satisfactory in every respect. The new mill has already shown a particularly gratifying saving in reduced costs and increased extractions, the average being 93.98%. The actual saving by the plant, however, cannot be fully shown by figures, and further advantages than the per ton economies set forth will certainly accrue. Not the least of these is the fact that the new plant will allow the mining and milling at a profit of ores of a grade that without the new plant could not be mined. Production from all sources was as follows:

Ore treated, tons	127,920
Gold production, ounces	38,371
Silver production, ounces	3,826,399
Total receipts	$3,160,751
Net earnings	1,773,227
Dividends paid	1,500,000
Undivided net income at February 28, 1913	1,761,175

Mining costs were as follows:

Development direct:	Amount.	Per ton.
Miners	$47,781	0.369
Muckers and trammers	26,338	0.203
Timber men and helpers	10,356	0.080
Stoping direct:		
Miners	73,992	0.572
Shovelers	46,950	0.362
Trammers	27,036	0.209
Timbermen and helpers	88,020	0.679
Filling	4,219	0.033
Piston drills (repairs and maintenance)	5,305	0.042
Stoping drills (repairs and maintenance)	6,580	0.051
Steel and sharpening	8,463	0.065
Explosives	42,624	0.329
Hoisting to surface	36,432	0.281
Auxiliary hoisting	4,745	0.037
Ore sorting and loading	13,142	0.101
Sampling and assaying	6,271	0.048
Surveying	4,677	0.036
Superintendent and shift bosses	16,110	0.124
Mine office	15,536	0.120
Surface and plant	16,565	0.128
Lighting	5,152	0.040
Heating	7,785	0.060
Drayage	3,652	0.028
Maintenance and repairs of buildings	793	0.006
Maintenance and repairs of machinery and machine tools	3,878	0.030
Maintenance and repairs of pipelines and tanks	4,183	0.032
Maintenance and repairs of railroad spurs	118	0.001
Maintenance and repairs of pole lines	14	0.000
Pumping	19,102	0.147
Ventilation	3,870	0.030
Total cost direct mining	$549,693	4.243

THE OLD AND THE NEW IN MEXICO.

An Auto-Truck Experiment in Mexico

By C. M. Eye

In May of the past year, the Concheño Mining Co. put into commission three auto-trucks over the Green wagon-road, from Temosachic, on the line of the Mexican-North Western railway, to the mines of the company at Concheño, 90 miles distant. This is a well built mountain road, but has an unusually large proportion of the distance represented by grades up to 18%. The first half is more nearly level, but has the heaviest grades, where the road crosses streams, and during the summer rains, is more subject to wash-outs. The last half consists largely of side-hill cuts in solid rock, but during the winter season this portion is the worst, due to accumulation of snow on north hillsides, and to slides and other débris coming down as a result of frost and thaws. The primary object in putting on trucks was to handle quickly a considerable shipment of steam-electric generating machinery, single pieces of which somewhat exceeded five metric tons in weight, and some of which pieces were difficult to transport otherwise, owing to their forms.

The trucks were operated steadily for about a month before the summer rains began. The work was then stopped for several months. As to the costs of this first campaign, I was unable to obtain any definite figures. Seven trips were made, however, in a little over a month, taking loads of from three to five tons per trip. At the end, however, the trucks were left in rather bad shape; one engine being so badly damaged that the truck to which it belonged was not put into commission again, when, at the end of the rainy season, the road was again in shape. In the meantime, repairs had been made on two of the trucks and operations were resumed early in November. Each truck had an American driver at a salary of $125 per month and an American brakeman at $75 per month (gold value in both cases) and board furnished in addition. One of the drivers had charge of both trucks and was not responsible to the mine management for results. All that the local organization had to do with the work was to designate the class of freight to be carried and to pay the bills. Therefore the data obtained is not so complete nor as clear as it might otherwise have been, and it is possible that better results might have been obtained had the work been directed from the mine. Many avoidable delays occurred, and some unnecessary expense was incurred, through lack of familiarity with the country and people and with existing conditions, not to mention lack of push. However, taken in conjunction with a knowledge of what might have been done under more favorable conditions, the figures may have some value. In considering trucks *v.* wagon freighting over that road, the following facts must be kept in mind:

1. Much more repair work must be done on the roads for trucks than would be required for wagon freighting.

2. It is not practicable to operate trucks over the road for more than six months of the year. There are four months during the summer and two during the winter that the work is pretty certain to be hung up. Wagon freighting is also impracticable for about two months in the summer and a month or two in the winter, but since the freighters haul by contract entirely, there is no expensive organization to provide for during these periods.

3. The service over such steep grades is very severe on trucks, and consequent repair bills will be high. It is true that the trucks in question were not high-grade nor particularly adapted to the work nor engined as heavily as they should have been, but, working under the severe conditions existing there, it is doubtful whether any truck would have stood up well or would not have had large repair bills.

4. Cost of repairs is much higher in Mexico than in this country owing to added freight and duty.

5. With American crew and high cost of gasoline and lubricants, cost of operation was much greater than in the States. It should have been possible, however, to substitute in a short time a Mexican brakeman for each truck, thereby making a considerable saving.

The work demonstrated quickly the uselessness of the block tire for the conditions which existed. The smooth rubber tire did better, and when furnished with heavy chains in muddy weather worked fairly well, but the all steel tire would undoubtedly be the proper tire for this service.

As will be noted, the cost per kilogram transported is beyond all reason. An allowance should be made, however, for spare parts on hand. When this was done, as nearly as it could be ascertained, the cost was about 25 centavos per kilogram, or $250 per metric ton. After making allowances for various defects of operation, and figuring conservatively on what might be accomplished during any part of six months of the year with the road in good shape, I estimate that good trucks well handled would be

able to transport freight for a possible ₱75 per ton without return freight, or ₱60 per ton with incomplete loading of concentrate and bullion on back trip. The minimum wagon freight rate is ₱60 per ton, ranging to ₱90 per ton for heavy machinery. The rate for mule and burro packing is about ₱40 per ton, which makes it, of course, advisable to ship everything that can be so shipped in this manner. With proper handling, and with back haul, I think that auto-truck work should be successful, under circumstances where the crew can be profitably employed at other work when the road is not in condition for trucking. It has the great advantage of quick delivery and can be regulated closer than can freighting by contract.

Deducting ₱2935.88 as fair estimated value of repair parts on hand, and for improved condition of the trucks, leaves ₱7872 as the actual operating expense, which reduces the cost to 25 centavos per kilogram, or ₱250 per ton.

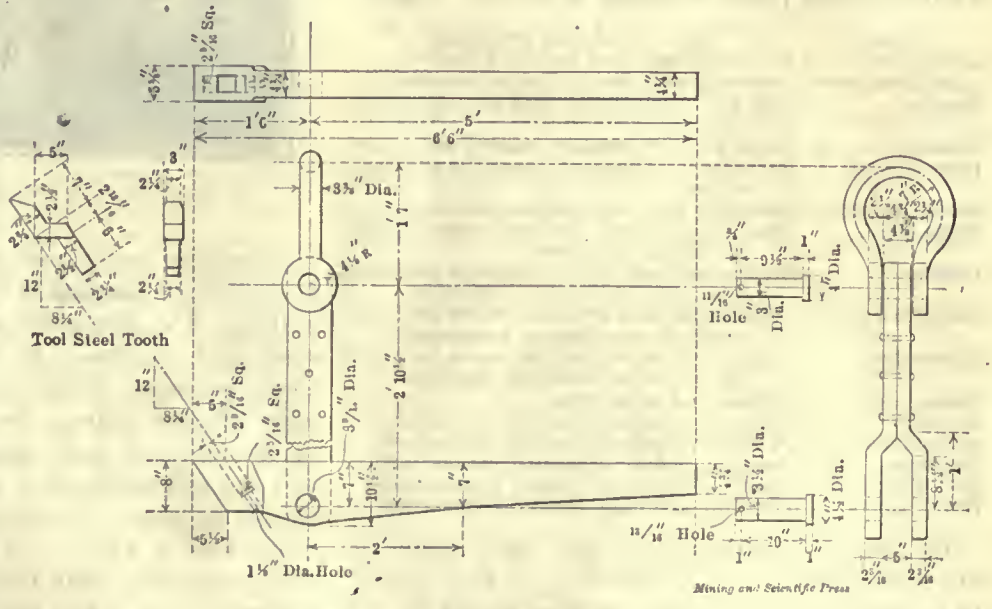
STATEMENT OF COSTS FOR THREE MONTHS OPERATION OF TRUCKS

Payment of salaries and wages	₱3,231.70
Charges for board of men	716.17
Miscellaneous agency charges (supplies)	212.56
Traveling expenses, men	257.64
Telegrams	13.03
Gasoline (at 50 centavos per gallon)	832.75
Repair parts as invoiced	3,723.56
Freight and express charges on same	205.80
Customs duties on same	862.56
Purchase tools and miscellaneous supplies	772.11
Emergency expense on road	50.00
Total expenditures accounted	₱10,877.88
Credit given for bullion transfer	70.00
For hauling 31,489 kg. (34.3 centavos per kg.)	₱10,807.88

Collar Puller for Converters

By L. O. HOWARD

An important feature of converting practice is the keeping open of the mouth of the converter. The material thrown up by the violent agitation caused by the blast is thrown up through the open mouth, where, through cooling, it becomes attached and gradually builds up 'noses' or 'collars', which if allowed to grow unchecked will in time completely close the opening. This difficulty is especially marked in the operation of the basic lined converter, since the preservation of the lining requires that the temperature be kept moderate. The best method of dealing with these accretions is to remove them as fast as they form, the common practice being to pull away the crusts with a hook operated by the crane, the converter being tilted at an agle of 45°. Another device has been perfected at the converting plant of the Old Dominion C. M. & S. Co., at Globe, under my direction. This is shown in the accompanying illustration.



DEVICE FOR CLEARING CONVERTER MOUTHS.

After giving hooks of different shapes and sizes a thorough trial at the Old Dominion plant, it was decided that they were impracticable, and experiments were made along other lines. Lee Young, one of the converter foremen, suggested using a heavy bar hung horizontally in such a manner that when dropped through the mouth of the converter the ends would catch under the projecting crusts and remove them.

When a rim is to be pulled, the cutter is picked up by the crane and dropped tail first through the mouth of the converter. The cutting end is worked into position where the bite is to be made, and a pull taken with the crane, thus lifting the tail end until it comes into contact with the opposite side of the converter and forcing the cutting tool into the collar. A steady pull with the crane will draw the tool through the mass until near the top, when the collar breaks and comes away easily.

One strong point in its favor is that the steel cutter easily tears through the heaviest collar without lifting the shell from the rolls. A bite at any angle may be taken and a greater or less amount of material removed at will. Fifteen or twenty minutes work each shift is sufficient to keep the shell open to any size required.

Production of slate is one of the important lesser industries of the United States. In 1912 the output of slate was valued at $6,043,318, an increase over 1911 of $315,299, according to A. T. Coons, of the U. S. Geological Survey, in an advance chapter on slate from 'Mineral Resources' for 1912. Of this amount, $4,636,185 represented roofing slates, the production of which was 1,197,288 squares. A square is a sufficient number of pieces of slate, large or small, to cover 100 sq. ft. of roof, allowing 3-in. lap.

Grinding Pans at Kalgoorlie

By M. W. von Bernewitz

Many metallurgists are at a loss to understand the reason why pans are used so much at Kalgoorlie. The first tube-mill to be used for grinding gold ores was introduced there, and 26 are now in use; nevertheless, pans are in operation in the same plants, crushing being done in three stages by stamps, pans, and the tube-mills, and in all about 160 pans are at work on the field. The general efficiency of pans and tube-mills was determined some years ago, and results may be summarized as follows: At the Ivanhoe, in comparative trials of two pans of 5-ft. diam. each, versus one tube-mill 39 in. by 13 ft., the pan cost less for construction and operating, and did better work. At the Brownhill, on coarse sand, two pans did better than one tube-mill. On sliming, the machines did about equal amounts of work. At the Boulder Main Reef, and Hannans Star trials, the pans showed more efficiency in grinding coarse sand, and were excellent amalgamators; but the tube-mill was cheaper to run and preferable for sliming purposes.

In describing pan practice at Kalgoorlie, machines may be divided into three classes: (1) those used after stamps crushing ore through a coarse screen; (2) on roasted ore; and (3) on roasted concentrate. At the various plants crushing is done as follows:

Name.	Mode of general reduction.
Associated	Ball-mills and pans grinding roasted ore.
Assoc. Northern.	Ball-mills and pans grinding roasted ore.
Boulder	Ball and Griffin mills, and pans on roasted ore.
Kalgurli	Ball-mills and pans on roasted ore.
Perseverance ...	Ball-mill and pans and tube-mills on roasted ore.
South Kalgurli..	Ball-mills and pans on roasted ore.
Hainault	Stamps and pans grinding coarse pulp. No further grinding.
Ivanhoe	Stamps and pans grinding coarse pulp and tube-mills for further reduction.
Lake View & Star	Stamps and pans grinding coarse pulp and tube-mill for complete reduction.
Horse-Shoe	Stamps and pans grinding coarse pulp and tube-mills for complete reduction.
Oroya Links....	Stamps and tube-mills.
Hainault	Pans for grinding roasted concentrate.
Horse-Shoe	Pans for grinding roasted concentrate.
Ivanhoe	Pans for grinding roasted concentrate.
Lake View & Star.	Pans for grinding roasted concentrate.
Oroya Links....	Pans for grinding roasted concentrate.

The pans used at Kalgoorlie are mostly made by Forwood, Down & Co., of Adelaide, and have proved to be useful and economical grinding machines. All parts of them are quite simple, save perhaps the driving clutches, which contain a number of small parts. Pans may be set on a cast-iron under-frame generally supplied, but this is rather low for repairs. A good concrete foundation, on which is built an 8 by 8-in. timber structure, well braced, or a high concrete foundation, will serve better. A man, repairing gear, should be able to stand up under a pan. The body of a 5-ft. pan is of cast iron weighing 4500 lb., while that of an 8-ft. machine is of ⅜-in. plate and a heavy cast bottom. There is also the neck cast with the bottom, through which passes the vertical driving spindle. The overflow lip is bolted to the pan body, there being a row of 1-in. holes at the top of the pan for the discharge of pulp into the lip, and a slot at the bottom for the heavy sand to return to the pan, the overflow lip acting as a classifier. The shoes and dies have the form of a sector of a circle, there being 18 of each in the 5-ft. size, weighing about 100 lb. each; and in the 8-ft., 8 shoes and 12 dies, weighing about 220 and 280 lb., respectively. The shoes are pegged on to the muller plate by wood pegs and blocks. The muller is free to swing, being hung from the yoke on a four-armed bridle. The yoke fits loosely on the driving spindle feathers, and adjustment is made by the usual hand-wheel and screw, working in the yoke head or thimble. Keyed to the inside of the pan rim are 5 baffle-plates to promote circulation and direct pulp to the centre.

Pans may be either driven singly by belt and gear, or by a shaft long enough for 4 pans on which is a clutch for each. At the Kalgurli, the countershaft

GRINDING PANS AT THE ASSOCIATED MINE.

is driven by motor, and from this is a belt which leads to each pan and is fitted with tight and loose pulleys. The Associated and others have the long shaft and clutches. At the Associated itself the shafts are motor driven. In the one case there is the wear of four belts to be taken into account, and in the other, that of the belt for each four pans, and the difficulties of a rather complicated clutch. Once the latter is tight and foreign matter gets into a pan, it will not let go, and the result is generally a smash. With the single-belt drive, the belt generally slips when anything gets in. Working two right and two left-hand pans equalizes the thrust on the pinion shaft.

The vertical spindle stands in an oil foot-step bearing, the bottom being a renewable brass button, ⅝ in. thick and cupped. Where it passes the pan neck, the spindle is beveled and a pair of bushings are fitted in. These keep the spindle true while working, and prevent its jumping up. The crown wheel is on the vertical spindle and the pinion on the driving shaft, the former having twice the number of teeth of the latter. The pinion is cast with an extended disc, with which the clutch shoes or umbrellas engage when the clutch lever is thrown over the centre. Gear should be well greased, and it should last for years. At the Asso-

ciated Northern, most of the wheels last seven years. Split pinions are used at the Associated.

Speeds vary, as will be seen below, and should be determined by what is wanted, fine grinding and amalgamation, or otherwise. A high speed is not suitable for either of these. Between each shoe and each die is a space of about one inch, and there is also an annular space of nearly two inches between the outside of the dies and the periphery of the pan. These serve for circulation and amalgamation. The 5-ft. pan is a convenient size, and about 140 of them are working, also 19, 8-ft. pans. In the mills for stage-crushing, it is the practice the periphery. The suction of the revolving muller draws this sand in from the lip through the slot of about 1¼ by 6-in. size for further grinding. The grinding action is one of pressure-torsion, while classification goes on at the lip. For the proper working of pans, the feed and water must be carefully adjusted. Too much water results in thin pulp and a washing out of sand. A skilled attendant can judge this to a nicety. A similar practice to the above is adopted in grinding roasted concentrate. No advantage has been found in centre feeding over the usual side method. Following are some details of pan practice:

Name.	No.	Size, ft.	Speed, r.p.m.	Hp.	Feed +150, %.	Discharge −150, %.	Screen used.	Daily capacity, tons.	Life of shoes and dies, days.	Cost per ton. Cents.
Grinding roasted ore:										
Associated	20	5	50	5	47	85	27 by 27	9	120	40
Associated Northern	5	5	47	6	45	85	various	7	180	40
Boulder	22	5	60	5	70	90	various	7	180	24
Kalgurli	16	5	56	8	47	80	27 by 27	11	140	40
Perseverance	14	8	30	11	54	80	30 by 30	11	140	40
South Kalgurli	5	8	33	12	56	94	27 by 27	24	shoes 90 dies 120	22
Grinding roasted concentrate:										
Hainault	2	5	48	5	29	94	27 by 27	24	150	22
Horse-Shoe	4	5	48	5	36	94	27 by 27	24	150	22
Ivanhoe	5	5	52	5	46	94	27 by 27	12	140	43
Lake View & Star	4	5	45	5	46	94	27 by 27	12	70	43
Oroya Links	4	5	45	5	46	94	27 by 27	12	70	43
Following stamps:										
Hainault	6	5	48	7	36	52	14 by 14	16	150	43
Ivanhoe	20	5	58	6	36	52	8 by 8	15	69	15 to 23
Lake View	15	5	60	9	39	60	8 by 8	13	50	20

to have one pan for each 5 stamps, as at the Hainault, Ivanhoe, and Lake View. In dry-crushing plants, I think the 8-ft. size the most suitable, as there is no direct feed to it, as from 5 stamps to a 5-ft. pan. The Perseverance has 14 and the South Kalgurli 5 of the large size, and report good results. Save the Kalgurli, the other dry plants amalgamate in the pans, and from 25 to 40% of the gold is caught there. The pans crushing roasted concentrate also amalgamate. The Hainault and Ivanhoe use mercury in their pans crushing raw ore. Gold saved in this way is secure from theft while a pan is at work. At the Associated and Northern it is customary to add 5 lb. of mercury to a new pan, and 1 lb. or more daily to each, according to grade of ore.

Power used varies, and a newly shod pan takes up to 12 hp. I have watched the ammeter of a motor driving 4 pans; usually this takes 25 amp. or 20 hp., running up to 35 amp. or 28 hp. for the first few hours' run of a new pan. Roasted ore is easier to grind than raw, the power absorbed on the latter being 2 hp. higher as a rule. The 8-ft. pan takes slightly over double the 5-ft., with a capacity of two to two and one-half the latter.

In feeding pans it is best to have a proper mixing pan, which supplies a launder to each, thereby getting equal feed. There are several good distributors for this purpose. Now, taking the pan as used in grinding roasted ore: The pulp enters the pan on the side opposite the discharge lip, and is directed by the baffle-plates to the centre of the pan, finds its way between the shoes and dies, and comes out at

The cost systems are not all on the same basis. The Ivanhoe costs are per ton of concentrate ground, ore milled, and sand ground. In Boulder and South Kalgurli the pulp is not separated prior to grinding. The Boulder and Kalgurli do this, these pans only getting coarse material. The Perseverance has two tube-mills to regrind the pan discharge, these being added to cope with the extra tonnage from the new ball-mill plant, built after the fire. The South Kalgurli system is one of stage-grinding in 8-ft. pans, which is a good one. All the minor pulp flows to one pan, and this discharges into one on either side, the overflow from which goes to spitzluten, its underflow passing to two more pans, all the slime then flowing to settlers with good results. The shoes of the first pan last 60 days, against 90 days in the others.

The feed through 150 mesh at the Boulder will be noticed to be high. This is due to the product from the Griffin mills being much finer than from ball-mills.

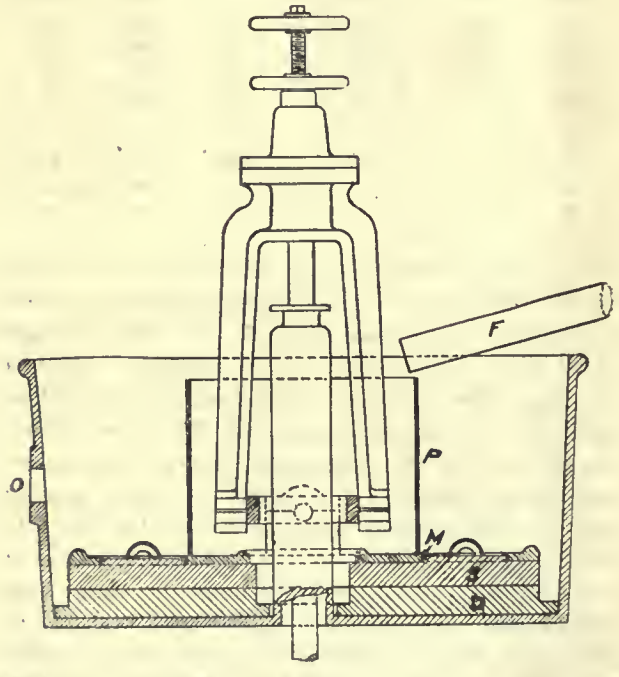
The Hainault has 6 Middleton-Cobbe pans. These are used for coarse crushing only, the screen on the battery being 14 by 14-mesh, and the screen on the pan about 18 by 18-mesh, a certain grading being required for the leaching plant. The pan discharge is dealt with a Richards' classifier prior to concentration.

Mesh.	Battery discharge, per cent.	Pan discharge, per cent.
+ 80	50	29
+150	14	19
−150	36	52

The Cobbe pan has its muller fixed so that, in

working, it cannot be raised, but the dies arranged so that they may be lowered or raised, this being done by a hand-wheel and screw outside the pan, while a steady pressure is attained. In an ordinary pan where the grinding pressure depends on the the weight of the muller, the capacity falls off as the shoes wear down, and compensating weights are put on to help. As a rule, though, these are not of much use. Any desired screen may be fixed for the Cobbe discharge. It is a centre-fed pan, and the muller is barely covered in working.

At the Lake View & Star mill, each mortar discharges into a Freeman pan. This is a good style of machine for breaking down 8 mesh particles, and is now used on the Fingall, Sons of Gwalia, and a few smaller mines. The pan is centre-fed. About half way up one side of the pan a 3-in. pipe is fitted in, this extending half way to the centre of the pan, and is fitted with a short bend. The function of this pipe is to take off a certain grade of pulp; in fact, the action is one of classification due to centrifugal force. The particles must be ground to a certain size before they reach that part of the pan for discharge.



FREEMAN PAN. F, FEED TO CENTRE; O, CLASSIFYING PIPE OUTLET.

At the Ivanhoe, the battery pulp first passes the plates and Wilfley tables, then is further ground in pans, goes over more tables; these are followed by classifiers which deliver sand to two more tube-mills, which are in turn followed by tables. The final sand, slime, and concentrate are separately treated. One 5-ft. pan for 5 stamps; and one for each Edwards' simplex furnace on concentrate.

For the clean-up of a pan, the pulp is siphoned out while in circulation, the muller lifted and swung out of the way. Little amalgam sticks to it or the shoes. The dies are next lifted, scraped, and washed in the pan. All the rich material is collected, and the bottom washed out. One man can clean a pan in two hours, and two men can clean and shoe a pan in three hours. The collected amalgam is either ground in a berdan pan or clean-up barrel.

Winter Work on the Kenai Peninsula

By W. M. Brewer

Except in southeastern Alaska around Juneau and on Prince of Wales Island, where the mild climate permits, it has generally been considered in the past that any attempt to carry on quartz mining operations during the winter in other portions of this Northland would meet with failure. This opinion has been a great handicap to the raising of necessary funds for any class of quartz mining operations, because of the natural desire that money should earn interest the entire year. This idea is entirely erroneous, so far as it applies to quartz, because operations can be carried on equally as well in the winter as in the summer, not only in southeastern but also in southwestern and the interior of Alaska, and in some respects with greater facility. Transportation over snow trails in the winter is much cheaper than either by railroads or the summer trails, while actual mining work can be carried on, and men will work with quite as great efficiency during the winter months as during the summer, provided they are comfortably housed and furnished with good and proper food. During the past winter I have demonstrated that even construction can be carried on successfully, and in order to refute any argument to the contrary, I will give briefly my experiences.

Erecting a Stamp-Mill

In August 1912 I went to the Kenai Peninsula to a point twelve miles from Seward and 1400 ft. above sea-level, for the purpose of building a stamp-mill for sampling and testing the ores on a group of claims on Lost creek, Kenai mining district. While the mill is merely a small two-stamp triple-discharge of Joshua Hendy manufacture, equipped with stamps each weighing 1050 lb. it must be remembered that the building necessary to house this is practically a duplicate of that for a 5-stamp mill, that the foundations require to be as carefully planned, and the arrangement of the grizzly, ore-bin, feeder, and other accessories must be the same in order to establish a gravity system and insure economical work. Consequently, if a 2-stamp mill can be erected during the winter months, one of larger capacity can equally as well be built.

The fall of 1912 in southwestern Alaska was unusually wet. The precipitation some days, according to the Government records, was as great as 2½ inches in 24 hours, while more than 1 inch in 24 hours fell often almost continuously; in fact, rain fell as long as ten or twelve days and nights without ceasing. The result was that the trails were so badly washed out as to make hauling of any heavy loads practically impossible. Men working at the surface wore slickers and gum boots, and their efficiency was thereby seriously impaired. Owing to this condition, I determined to make the attempt to construct the mill during the winter months.

On the coast at sea-level in this part of Alaska snow rarely falls much before Christmas, but in the

mountains, only 12 miles away, and even at the low altitude of 1400 ft. snow commenced falling at the end of October last, and remained as a mantle covering the surface to a maximum depth of seven feet on the level. It was, though, not until late in December that the trail from Seward was good for travel with sleighs, then there was between four and five feet of snow on the property at which I was working. In order to keep a snow trail open under these conditions, continuous travel with at least one or two horses had to be kept up to establish a firm foundation before heavy loads could be hauled over it without breaking through the crust. Although in November the snow trail was good at camp, it was after Christmas before continuous hauling from Seward at sea-level to the camp with sleighs could be done.

About 1400 cu. yd. of slate had been excavated in a side hill affording an excellent millsite. Heavy hewed timbers were set in place for the foundations of the building and mortar. The grading had been done during November and the early portion of December despite prevailing snowstorms and other drawbacks. The end of December found all the foundations in place and everything in readiness for placing the heavy mortar weighing 5000 lb. and other machinery. This work was carried on during January when we were favored with about four weeks of clear dry cold weather, the thermometer ranging along about zero. By January 25, the plant was completed.

In the mill building itself, including the ore-bin, there were about 18,000 ft. (board measure) of lumber and hewed timbers. The total height of the building from the foundation to the eaves of the roof over the grizzly was about 42 ft., the front of the building over the plates being about 20 ft. The roof area was approximately 1000 sq. ft.; 50 ft. long by 20 ft. wide. About 70 tons in all was transported over the snow from Seward. This included machinery, lumber, hardware, camp supplies, hay and grain, rails, cable, hoist, and everything else necessary to keep the work going, all at a cost of about one-third of what it would have been during the summer, even if the season had been one of usual fair weather instead of being unusually wet. Any increase in cost for construction work, owing to snow and short period of daylight, was more than offset by the saving made on the cost for hauling.

Operating in the Far North

So far as mining operations are concerned, these can be carried on with equal efficiency during the winter months as during the summer. Indeed, this is nothing new, because as early as during the winters of 1901-2 at White Horse in the Yukon Territory, quartz mining was carried on, and considerable underground development accomplished with the thermometer ranging from 10 to 40° below zero. In fact more quartz mining has been done in that area during the winter months than during the summer. In summer it has always been difficult to obtain labor, for the reason that nearly every man wants to be out prospecting for placer ground.

In addition to the work I accomplished there were also gangs of miners doing underground development work on the property of the Kenai-Alaska Gold Co., also on the property known as the Skeen-Lechnor, both on Falls creek near the 25-mile station on the Alaska Northern railway, while at the last named property a sawmill was run and several tons of machinery hauled in over the snow, though no construction was attempted. During the past winter several stamp-mills in the Fairbanks district have been running continuously, therefore the idea that has hitherto been so prevalent that it was necessary to close down all quartz mining operations in the fall and not open again until the following summer, must be considered erroneous. It is no more difficult to operate quartz mines in Alaska during the winter than it is in Montana, Colorado, Utah, or any other mining state.

Geology of Rochester, Nevada

By J. Claude Jones

Rochester, a new and promising district in Nevada, is in the Humboldt mountains, about twelve miles east of Oreana, a station on the Southern Pacific railway just north of Lovelocks. Nenzel hill, in which lie the orebodies from which the greater part of the ore is now coming, is part of the divide

MAP OF NEVADA.

of the range and separates the drainage of American canyon to the east from that of Rochester canyon to the west. The towns of Rochester and East Rochester lie in the latter. The northern ridge bounding Rochester canyon culminates in Lincoln hill about two miles west of Nenzel hill.

The rocks exposed in the area were mapped by

the Fortieth Parallel Survey as the Koipato formation of Triassic age. The boundary of the overlying Star Peak formation was drawn as passing through Nenzel hill, but actually occurs somewhat farther to the east. At the time of the earlier survey the Koipato was supposed to consist of silicified sedimentary rocks, but, as was noted by F. L. Ransome[1] in his reconnaissance of the area in 1909, they are largely devitrified and altered volcanics.

Composition of Nenzel Hill

Nenzel hill is composed of a series of rhyolitic tuffs, obsidians, and rhyolites, now devitrified and silicified, but retaining enough of their original character to be recognizable in the field. The obsidian and tuffs near the top of the hill occur in thin alternating beds dipping approximately 20° to the east. Lower down on the west slope the rocks are better crystallized and are true rhyolites, though usually with a glassy groundmass. For the most part the rocks are characteristically light colored, breaking into angular fragments, and where tuffaceous or with spherulites, they mimic quartzitic sandstones and conglomerates to a remarkable degree. In thin sections the obsidians disclose a microcrystalline groundmass with an occasional phenocryst of quartz and spot of iron oxide with a rude resemblance to the outline of the original ferromagnesian mineral. The tuffs are quite similar with the addition of phenocrysts of orthoclase and angular fragments of pumaceous glass.

All of the rocks are at least partly silicified, the secondary quartz appearing in veinlets, and in irregular blotches where it has completely replaced both groundmass and phenocrysts. The original quartz phenocrysts are usually surrounded by a fringe of the secondary silica and show the characteristic undulatory extinction resulting from strain. The orthoclase is often partly replaced by quartz and has irregular patches of sericite developed in the crystals. Similar rocks found in Cottonwood canyon several miles to the north were analyzed for the Fortieth Parallel Survey, and the following analysis[2] is taken as indicating the general composition of the rocks in this area.

The silicification of the rocks increases as the orebodies are approached and grades into a complete replacement where the ore is found. This is illustrated by the following incomplete analysis of a specimen taken from the hanging wall a few feet from the ore in the Codd lease.[3]

The sulphur found comes from a small amount of pyrite disseminated through the rock in perfect minute striated cubes and pyritohedrons. It is found indiscriminately through the areas of silicification and devitrification, and was introduced by different solutions from those that caused the silicification.

The orebodies are typical replacement veins following two sets of fracture planes, the one striking nearly due north and south, the other about 30° east of north. The larger orebody follows a fracture of the latter system and is intersected at several points by smaller ones on the former system. Both systems dip steeply to the west. In the Causten, Codd, and Big Four leases at the southern end of the hill the ore zone extends through a width of from 10 to 30 ft., with alternating stringers of quartz and partly replaced country rock. Among these is a quartz stringer 4 to 8 ft. wide that carries silver in amounts said to average from $30 to $40 per ton. All of the stringers carry silver, and the entire zone is said to average $10 to $15 per ton. The ore minerals are irregularly disseminated in dark spots and minute crystals through the fine-grained replacement quartz, and are occasionally segregated in small vuggs. The only silver minerals recognized were pyrargyrite and possibly native silver, although it is possible that other sulphantimonides of silver are present. There is little or no evidence of vein filling, the solutions evidently having been only directed in their general course by the joint cracks, and having worked out through the rock, replacing it to varying distances on either side. As a result, the walls, while rather sharply defined, undulate, and the orebodies pinch and swell to some extent. The chief development of the Nenzel hill orebodies is in the three leases mentioned where adits have been driven in to the ore, giving approximately 100-ft. backs. A hundred thousand tons or more of ore is said to be in sight.

Lincoln Hill Orebodies

On traveling west toward Lincoln hill along the ridge forming the north slope of Rochester canyon, the rocks become more metamorphosed, culminating in a mica-tourmaline schist on the west slope of Lincoln hill. Many veins of quartz and black tourmaline are found on Lincoln hill, and in the property of which Mr. Borland is one of the owners, a similar vein contained considerable visible free gold. The veins of Lincoln hill are more of the type of filled fissures in distinction from the Nenzel hill orebodies. The tourmaline in the schist is a pink variety or rubellite, but the predominating alkali is soda rather than the usual lithium. The mica that is associated with it also seems to be the rare soda mica, paragonite. Tourmaline is usually rather closely associated with intrusive rocks, and it is not improbable that the granodiorite that appears near Rye Patch, to the north, underlies the area and the more intense metamorphism of the rocks and the quartz tourmaline veins of Lincoln hill is due to its influence.

Replacements Following Intrusions.

The origin of the ores of Nenzel hill could not be determined in the hasty examination given them, but it is certain that they were formed later than the general devitrification of the Koipato. The disseminated pyrite and sericite in and near the orebodies suggest hydrothermal solutions, but whether they were connected with the intrusion of the granodiorite during the late Cretaceous time or came at a later time, must be left for future determination.

[1]Ransome, F. L., U. S. Geol. Surv. Bull. No. 414, p. 32, 1909.

[2]King, Clarence, 'Geology of the Fortieth Parallel,' Vol. 2, p. 722, 1877. SiO_2, 74.74%; Al_2O_3, 14.14; Fe_2O_3, 0.79; CaO, 1.51; MgO, 0.39; Na_2O, 0.92; K_2O, 5.29; ignition, 1.88; total, 99.66 per cent.

[3]Analysis by W. S. Palmer, Mackay School of Mines. SiO_2, 87%; Al_2O_3, 9.6; Fe_2O_3, 1.2; CaO, none; MgO, trace; S, 0.2; total, 98 per cent.

The Pinder-Berry Stamp-Mill

By S. L. Berry

In an effort to improve upon current stamp-mill construction, a type of stamp has been developed that involves such differences from the usual form as to warrant, perhaps, special description. It is the outgrowth especially of the experience of J. W. Pinder, and the first stamp of this type was built and placed in operation in Shasta county, California. Details as to its work are given below, following a general description of the stamp as now built.

The mortar has a base of standard thickness and width, is circular, with the screen around the circumference and equally distant from the stamp, the front upper part of the body cast with the base, the back upper part removable and secured by toggle clamps for easy handling. The screen is in two pieces, rectangular in shape, permitting reversal when worn at the bottom, and held by rubber-lined steel bands secured by toggle clamps. Screen changing is easily and quickly done, and the entire mortar can be opened for changing shoes and dies, and for cleaning out. The feed water is introduced, under pressure, at six points around the bottom of the mortar, in order to keep the material loosened to facilitate the rapid settlement of free gold through the mass. When quicksilver is used, it will be protected from being splashed about by the stamp and lost.

The concrete foundation shown is reinforced, and is provided with a tunnel to allow access to the lower ends of the bolts. Cast-iron sole plates are used under the battery posts, and the posts are fastened directly to the foundation by two heavy rods.

Boss-head and shoes are provided with holes forming finally a central channel to deliver the ore to the centre of the die, resulting in a maximum crushing capacity. This feature, combined with the long screen and increased number of drops, permits a heavy duty, as has been proved by test.

The guide shown is iron, bored to fit the well finished stem, thus reducing vibration. It is adjustable for alignment with the stem in both directions, has no nuts or threads in contact with it, and is split so that the stem can be taken out by slackening the nuts on the back side of the girth and turning the bolts part way round.

With the present form of tappet, held on to the stem by friction, the practical limit in the number of drops per minute has been about reached. This is due partly to the difficulty of preventing slipping of the tappet and partly to the violence of the blow struck by the cam. With the construction employed, a broad, shallow thread on the stem, a sectional tappet provided with clamping keys, and a simple, practical cushion between a cast-steel wearing plate and the body of the tappet, this limit has been greatly extended. It is now feasible to make as many as 138 six-inch drops per minute, by proper cam design. The question of cam design for any reasonable number of drops is a simple one, no difficulty at all being found with the above number.

With this mill there may be used any kind of cam desired, the standard, the noiseless, or the high-speed, the selection depending upon the results desired. The threaded tappet would be used with all styles, the cushion feature with the high-speed, and with the standard if quieter operation is desired. The advantages of the threaded tappet are found in the greater ease of adjustment and the greater security against slippage. Two taper keys are used, and, as the frictional element has been removed, these do not require to be set up with anything like the same degree as with the old-style tappet. Adjustment for wear consists in slackening the keys with a machinist's hammer, turning the tappet on the stem, or the stem in the tappet, and keying up. No sledging is required.

In general, the battery frame is of the size and construction used for a five-stamp battery, but an improved method of bracing it has been worked out, leaving it free from the influence of a settling ore-bin. Two 1350-lb. stamps can be placed in a frame having the posts 60 in. apart.

In mills large enough to warrant it, it is proposed to use a short crane having a span of about 8 ft., and available for handling cam-shafts, pulleys, and stamp parts. It is the intention to change shoes and dies, and other stamp parts, from the floor behind the battery, leaving the front entirely clear for plates or other machinery. For this purpose the feeders would be moved back and part of the upper floor, which is left loose, removed.

Advantages of This Type

The advantages of this type of construction are:

1. The feed is, at all times, even and regular, being distributed instantly under every part of the crushing surface of the shoe, giving the greatest possible duty to the stamp at each blow and increasing the crushing capacity to a remarkable extent.

2. The wear of shoes and dies is comparatively true and even.

3. There are no flying pieces of ore to cut and break the screens. This is, at times, a serious detriment to the standard stamp, where ore is fed to the outside of the die, the larger pieces struck, but not crushed, by the shoe, fly with great force against the screen.

4. The feed being central and even, there is no wrenching strain on the shank of the stem to cause it to crystallize and break, as so often occurs on back-fed or solid stamps.

5. The screen length being so much greater than on the standard battery, also greatly increases the capacity of the stamp by permitting immediate discharge of the pulp as fast as crushed, avoiding unnecessary sliming.

6. The injection of the feed-water into the bottom of the mortar, as described, permits the collection of the free gold without amalgamation. The forced injection of the water keeps the pulp soft and agitated, and prevents packing, while the liberated gold will immediately go to the bottom without the aid of quicksilver. But quicksilver may be used if desired, and to much better advantage than in the standard mortar where it is constantly splashed about from under the stamp and much of it lost. No chock-blocks or inside plates are required.

Recognizing the great value of injecting feed water into the bottom of the mortar for the above reason, many efforts have been made from time to time by prominent metallurgists to accomplish this object, but without success. This failure was due to the comparatively small discharge capacity of the standard mortar, and the limited amount of water that could be used for that purpose did not serve to prevent the solid packing of the pulp before it could be discharged, the injection of so small a quantity of water into the comparatively large box area having but little effect. The angular form of the mortar was also a preventative, the packing, beginning to form in the corners and between the dies, soon blocked the inlets.

The comparatively small size and weight of the Pinder-Berry mortar offers a great advantage in economy of hauling and transportation.

A Comparative Test

The following is the comparative result of a test run, of 23 days, of the Pinder-Berry and standard stamp, in a Shasta county mill, September 1909.

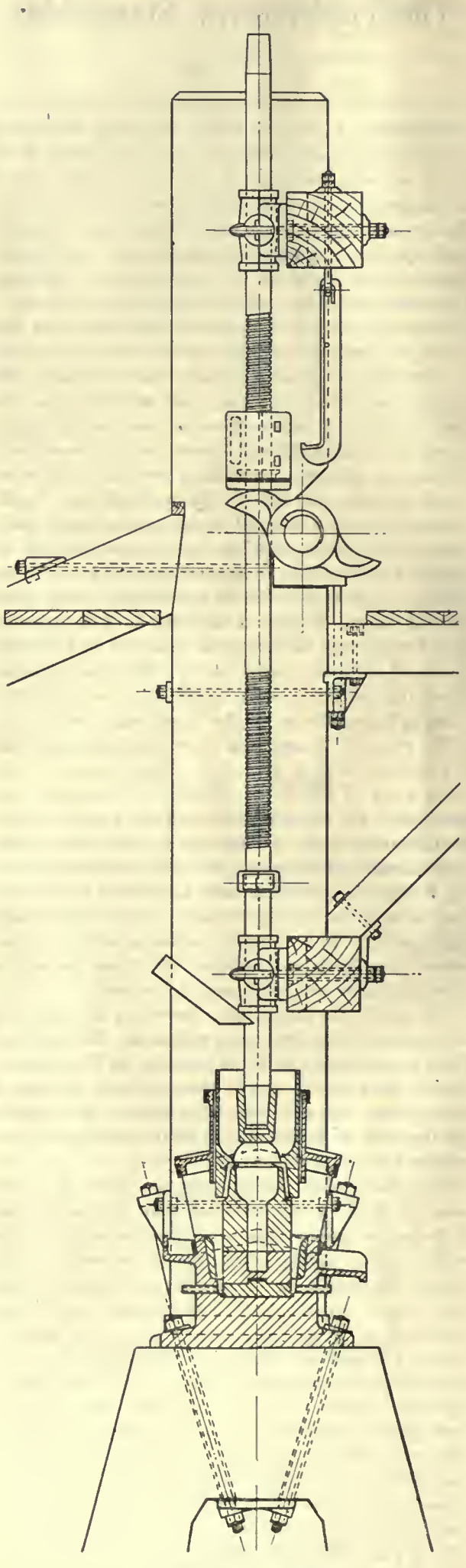
The original mill was provided with ten stamps. After preliminary experiments, Mr. Pinder had a mortar, boss-head, cam, shoe, and die cast in Redding. The cam-shaft was long enough to allow the new cam to be put on the overhanging end by moving it endwise as much as possible. Five stamps and the single one were run 21 days at about 109 drops per minute, the five stamps crushing 5.2 tons per stamp and the single one 11.5 to 12 tons. For two days the five were hung up and the single run at about 138 drops, crushing 16.2 tons. The ore was measured by cars and was hand-fed to the single mill. During the run the battery water was fed in at the usual place in both mills, the experiments with the water entering at the bottom following later. The stem was not threaded, but the tappet was held by set-screws in addition to the usual keys. A cushion was used, consisting of rubber packing protected by boiler plate ¼ in. thick. Details of the run follow:

	Pinder-Berry.	Standard.
Weight of stamp, lb.	1348.000	1000.000
Drops per minute	138.300	109.600
Horse-power per stamp	2.650	1.750
Ore crushed per stamp, tons	16.200	5.200
Ore crushed per horse-power, tons.	5.890	2.970
Horse-power per ton of ore crushed	0.169	0.336

Screen, 30-mesh steel wire, drop 6 in.; ore, black slate with quartz stringers.

Actual running time: Pinder-Berry, 22 days, 23 hr., 40 min.; standard, 20 days, 19 hr., 35 min. The standard was hung up 53 hr. 25 min. for screens, tappets, and clean-outs. The Pinder-Berry was hung up 20 min. on the 15th day for clean-out, and to adjust the tappet for shoe and die wear. Since the foregoing test the mortar and stamp details have been remodeled and greatly improved.

In addition to the greatly increased tonnage of this stamp, the important saving in lost time, as compared with the standard, on account of slipping tappets, breaking screens and stems, may be placed at 15%, and in cost of labor and attention at 50% in favor of the Pinder-Berry.



PINDER-BERRY STAMPS.

The Uranium and Radium Situation

By Charles L. Parsons

Some months since rumors reached the U. S. Bureau of Mines of an increased demand for carnotite ores from Colorado and that these ores were being shipped abroad in some quantity. Further, it was reported that the methods of production involved large losses of material and that methods for concentrating low-grade material now being thrown on the dump were greatly needed. Accordingly, R. B. Moore and K. L. Kithil were assigned to the task of investigating the situation, with headquarters at Denver. The surprising conclusion has been reached that while all the radium placed upon the market in the past few years has been produced in Europe, a large portion of this output has come from American ores. Radium institutes have been established in Austria, France, Germany, and England, a European science and industry have been developed from American radium ores, and even the uranium present with the radium has been manufactured into marketable condition only in foreign countries.

While the Austrian Government, realizing the untold possibilities of the radium ores of St. Joachimstaal, has purchased the mines, put their output under direct governmental supervision, and has entered into an arrangement whereby this ore is worked up in coöperation with the Vienna Academy of Sciences for experimental purposes in a carefully administered radium institute, America has allowed her large and greater resources to be exploited on a basis which wastes perhaps irretrievably a large portion of the material mined, and has exported carefully selected ores at a price by no means commensurate with its radium value if worked up at home. Even before carnotite was exported, pitchblende of the highest grade was sent out of the country at the time when the world's radium output was supposed to be coming from Austrian ores. At least 20 to 25 tons of high-grade pitchblende has been sent out of the country. Within the last two years, however, foreigners have realized the value of our carnotite resources and most of the radium that has been exported has gone abroad in this ore.

Shipments of Ore

During the last year, carnotite carrying 28.8 tons of U_3O_8, from which 8.8 gm. of radium chloride or 11.43 gm. of radium bromide could be obtained, were produced. Practically all of this ore was shipped abroad for the extraction of radium. The value of the radium salts extracted would be at the minimum market price $528,000. The total supply of radium salts from all other sources including the Austrian mines was probably not more than 3.65 gm. of radium chloride, basing the production of the Austrian mines for 1912 upon that of 1911 which is known.

Pitchblende, the richest of all uranium minerals, is composed mainly of uranium oxide, but also carries small quantities of a number of other substances. It has been found in small quantities in Connecticut, and in the feldspar quarries of North Carolina. Practically the total American output has come from the mines in Quartz Hill, Gilpin county, Colorado. The mineral is a heavy black substance which can be readily identified by anyone who will suspend a sample of the pitchblende above a photographic plate wrapped in black paper and kept in the dark for a few days with a key or other metal opaque to radium radiations placed between the sample of ore and the plate so that when the plate is developed a shadowgraph of the object may identify the ore. Pitchblende may carry as high as 80% uranium oxide.

Carnotite

Carnotite is a yellow mineral consisting mainly of potassium uranyl vanadate, but containing also small amounts of barium and calcium compounds. Being a uranium mineral as is pitchblende, it of necessity carries radium, although it has not yet been definitely established that the uranium and radium are in equilibrium as they are in pitchblende. However, it is known that in our western carnotite the amount of radium is not far from the equilibrium ratio, and in calculations given above, an allowance of 10% has been made to cover this possible deficiency. While carnotite is known to occur in smaller quantities in other states, the more important deposits are scattered over a considerable area in Colorado and Utah, embracing Meeker and Skull creek, Colorado; Green river, Thompson's, Moab, Richardson, Table Mountain, Pahreah, and other places in Utah. The largest proportion of ore, however, has been produced in or around Paradox valley in southwest Colorado, from which it has to stand long hauls by pack animal or wagon to the railroad. Carnotite always carries vanadium as well as uranium and radium, but is purchased almost wholly on its radium content, comparatively little being allowed for the vanadium present. The ore consists of a fine grained sandstone containing yellow finely pulverulent carnotite, occurs in pockets, and is easily mined. As ore below 2% uranium oxide cannot at the present time find a market, a considerable portion of the ore has been thrown on the dump and is now being wasted, as material of lower grade has to be discarded on account of the long haul and the fact that European buyers have set this standard as to quality. Ores of higher grade are sometimes obtained, but they occur only in small pockets, and it is generally advisable to mix these high-grade ores with ores of somewhat lower grade in order to increase the marketable output. Ore of 2% uranium oxide is now worth approximately $75 per ton f.o.b. New York. In the mining of these carnotite ores it is probable that five tons of material capable of concentration are thrown upon the dump for every ton that finds its way to market. To develop methods for concentration of these ores and save the valuable material now wasted is one of the problems before the Bureau of Mines.

It is difficult to estimate the total amount of radium that has been produced up to the present time, but it is quite certain that if the ores which have been mined in this country and abroad and sold for radium production have been actually worked up into this material there is now in exist-

ence something like 40 gm. (1¼ oz.) of radium.

The price of radium salts varies somewhat. In large quantities it has been $60,000 per gram for both radium chloride and radium bromide, although the latter contains less metallic radium in proportion to its weight than the former. It should be remembered, therefore, that it is more advantageous to purchase radium chloride than radium bromide. In small quantities the average price has been $80,000 per gram, which represents about $2,250,000 per ounce. The figures given show that the United States has taken the palm from Austria as the radium producing country of the world. Few people have been cognizant of the fact that the United States has such deposits within her borders. Up to the present time little interest has been taken in the matter and only one firm has engaged in the extraction and refining of radium in this country. This firm has not yet entered the radium market.

Practically every ton of ore mined in 1912 went abroad, and as the American deposits are far from inexhaustible, the reserve is being depleted, and material of great value and of unknown possibilities which cannot be replaced is being shipped out of the country.

Uses of Radium

The applications of radium are still too little understood to admit of definite statement. Its discovery and marvelous properties have already changed our ideas regarding the constitution of matter, and scientific investigation will undoubtedly lead to valuable results which we cannot now even forsee. Altogether too many incorrect statements and vague speculations have been placed before the public as to its use in medicine. A recent report of the London Radium Institute and the many articles emanating from minor laboratories experimenting in the application of radium to therapeutics all tend to show, however, that it has a real value, the certain application of which must await further experimentation. In the meantime no credence should be given to the many stories that are sure to be printed, unless they are backed up by the highest medical authority, which will always give publicity with caution. The best medical authorities appear to agree that up to the present time, radium has not been proved to be specific for any disease, although it has been shown to be helpful in many cases, and the outlook for its future application to certain diseases are decidedly encouraging.

Apparently no uranium is worked up in the United States, but, according to statistics gathered by the division of mineral resources of the U. S. Geological Survey, about $14,000 worth of its oxides and salts were imported into the United States in 1911. It is one of the few materials shipped abroad as ore and returned in manufactured form. A preliminary report on uranium, radium, and vanadium by R. B. Moore and K. L. Kithil will soon be issued by the Bureau of Mines. This bulletin describes the carnotite deposits of Colorado and Utah and the pitchblende deposits of the former state. It also contains detail of which the foregoing is simply a general summary.

Iron and Steel Committee of the A. I. M. E.

The following Iron and Steel Committee has been appointed by the American Institute of Mining Engineers, to serve until the next annual meeting: Charles Kirchhoff, chairman; Albert Sauveur, vice-chairman; Herbert M. Boylston, secretary; John Birkinbine, William H. Blauvelt, James Gayley, Henry D. Hibbard, Henry M. Howe, Robert W. Hunt, J. Esrey Johnson, Jr., William Kelly, Richard Moldenke, Joseph W. Richards, A. A. Stevenson, Felix A. Vogel, Leonard Waldo, William R. Walker, William R. Webster, Frederick W. Wood, members.

It will be noted that the various interests of the iron and steel industry are authoritatively represented on this committee by producers of raw materials and of finished materials, by consumers, consulting metallurgists, and educators. The primary duties of the committee are to secure important papers on iron and steel, to promote their discussion, to organize lively and fruitful meetings, and otherwise to foster the interests of the large number of members of the Institute connected with the iron and steel industry in its many phases. Its success during the past year has been noteworthy. Through its instrumentality many valuable papers were presented at the Cleveland and New York meetings, followed by animated and productive discussions, while the attendance of iron and steel men at both meetings was remarkably large and representative.

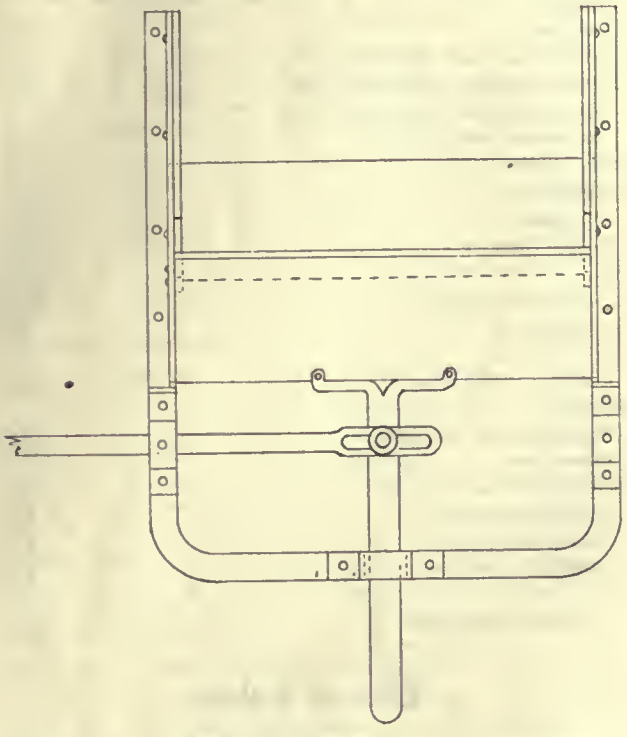
Since the next meeting of the Institute is to be held in a Western mining district far remote from iron and steel centres, plans are now being made for a meeting in a more accessible place in the latter part of October under the auspices of the Iron and Steel Committee. Arrangements are under way, and even at this early date the indications point to a successful meeting. Efforts will be made to secure important papers covering the four divisions into which the industry may be classified, namely: (1) Mining and preparation of ores, including concentrating, nodulizing, sintering, and briquetting; manufacture of coke and other fuels, and refractory materials. (2) Manufacture of pig iron, including blast-furnace construction and appliances. (3) Manufacture of wrought iron and steel, including mill construction and appliances. (4) Manufacture of finished products of cast iron, steel, and wrought iron, including testing, heat treatment, and metallography.

Mica to the total value of $331,896 was produced in the United States in 1912, according to D. B. Sterrett. This corresponds to a decrease of $23,908 compared with 1911. The production came from eight states, North Carolina, New Hampshire, Idaho, New Mexico, South Carolina, Colorado, South Dakota, and New York, named in the order of the value of their output. The production of sheet mica amounted to 845,483 lb., valued at $282,823, compared with 1,887,201 lb., valued at $310,254, in 1911. The total output of rough-trimmed sheet mica amounted to over 2,000,000 lb. in 1912. The mica mines of the United States are capable of a large annual production.

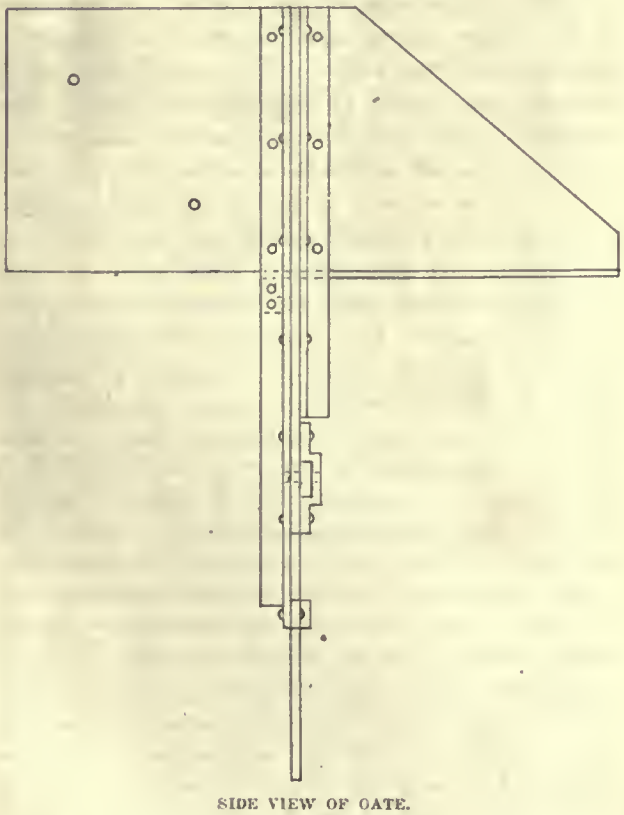
Ore Gate at the Mammoth Mine

By Charles W. Morse

At the Mammoth mine in Shasta county, California, of which Robert E. Hanley is superintendent, the ore gate shown in the accompanying figures is



FRONT VIEW OF ORE GATE.



SIDE VIEW OF GATE.

used. It is the best ore gate I have ever seen. It can be built from the smallest size up to that at which the finger or Treadwell gate becomes preferable. It is made in the mine shop of sheet metal and angle iron and can be quickly bolted to the wooden lip of the chute and later removed for use in other parts of the mine. The door closes from below, pushing the material out of the way instead of closing on it, which latter often causes delay from mining fine material. Throughout this mine the gates are controlled with long levers, but for gates in a shaft they could be designed with rack, pinion, and wheel, or with pistons actuated by compressed air or other power if more convenient.

One size of gate used in the mine is 26⅝ in. wide, 27 deep, and 14 high. The material used is ⅜-in. steel and ⅜ by 2 by 2-in. angle-iron. Bolts and rivets have ½-in. shanks. An angle-iron is placed across just back of the gate, and this 2-in. strip is

MAMMOTH ORE GATE.

all there is to the back portion. It rests on the floor of the wooden chute when placed in position. The strip placed between the angle-irons to form the groove in which the gate slides is ½ by 1½ by 30 in. The lever arm is made of 1 by 3-in. stuff, and the guide carrying the gate is made of the same material. The accompanying sketches show a front view of the gate partly open and a side view with lever removed.

Oil Production of the World in 1912

According to statistics collected by the German Petroleum Joint Stock Co. of Berlin, the total production amounted to 47,100,000 tons, against 46,100,000 tons in 1911. For 800,000 tons of this increase the United States is responsible, its output having aggregated 29,663,927 tons, against 28,878,870 in 1911. Russia's aggregate output advanced by 110,000 tons, 9,263,566 tons against 9,157,820 tons, the surplus of about 200,000 tons produced by the Baku fields having been more than sufficient to cover the deficit in the output of the Grosny wells. Rumania shows an increase of about 260,000 tons; total, 1,806,942 tons, against 1,544,847 tons in 1911. Galicia's output, on the other hand, has receded from

1,180,568 tons in 1911 to 1,455,660 tons. Among the other producing countries special mention is due to Mexico, which, with an output of 2,100,000 tons, shows an increase of more than 10% on the preceding year. The Dutch Indies, however, whose production is of special importance for Western Europe, on account of the high benzine contents of the oil, has supplied about 10% less than in 1911, the exact figures for the two years being 1,670,668 tons and 1,520,000 tons.

Mining Conference at Urbana

In connection with the dedication of the Transportation and Mining building at the University of Illinois, a series of conferences of engineers, operators, and instructors in transportation and mining were held May 8, 9, and 10. Among other addresses were the following: 'Conservation and Commercialism,' by Francis Peabody, president, Peabody Coal Co., Chicago, Illinois; 'Waterpower v. Coal in the Production of Power,' by Isham Randolph, consulting engineer, Chicago, Illinois; 'Organization as Affecting Mining,' A. J. Moorshead, president, Madison Coal Corporation, St. Louis, Missouri; 'The Future of Illinois Coal,' G. W. Traer, Chicago, Illinois; 'Illinois Mineral Producers,' E. W. Parker, chief statistician, United States Geological Survey, Washington, D. C.; 'Preparation of Coal,' by D. W. Buchanon, president, Bituminous Coal Washing Co., Chicago, Illinois.

'Safety First' (*a*) from the standpoint of the miner, Joseph Pope, president, United Mine Workers of America, district 12, Springfield, Illinois; (*b*) from the standpoint of the operator, Thomas Moses, general superintendent, Bunsen Coal Co., Westville, Illinois; (*c*) from the standpoint of the mine inspector, John Dunlap, state mine inspector, Peoria, Illinois; discussion led by Martin Bolt, chief clerk, State Mining Board, Springfield, Illinois.

'Modern Practice in Illinois Mines as Illustrated by Some Recently Developed Mines' (*a*) 'The Buckner Mine,' C. M. Moderwell, president, United Coal Mining Co.; (*b*) 'Cedar Point No. 5 Mine,' C. C. Swift, general superintendent, La Salle County Carbon Coal Co., La Salle, Illinois; (*c*) 'Saline No. 3 Mine,' W. R. Johnson, general superintendent, Saline County Coal Co., Harrisburg, Illinois.

'Concrete in Mine Construction,' by S. F. Allard, chief engineer, Bunsen Coal Co., Westville, Illinois.

'Steel in Mine Construction,' by Carl Scholz, president, Coal Valley Coal Co., Chicago, Illinois.

'Fire Protection of Mines' (*a*) from the standpoint of the mine operator, John P. Reese, general superintendent, Superior Coal Co., Gillespie, Illinois, and Walter Rutledge, State Mine Inspector, Alton, Illinois; (*b*) from the standpoint of the miner, Duncan McDonald, secretary, United Mine Workers of America, district 12, Springfield, Illinois; (*c*) from the standpoint of the mining engineer, G. E. Lyman, Madison Coal Corporation, St. Louis, Missouri.

'The Fire-Proofing of Mining Plants,' by H. M. Wilson, chairman, mine fire committee, National Fire Protection Association, and resident engineer, U. S. Bureau of Mines, Pittsburg, Pennsylvania.

Costs at the Brakpan Mine

During 1912 this property at Johannesburg produced 738,108 tons of ore from an average milling width of 'reef' of 56.39 in., with the following mine and mill costs:

	Cost per Ton
Mining:	
Stoping	$1.11
Timbering and packing	0.24
Shoveling and tramming, dump	0.66
Shoveling and tramming, mine	
Transport underground	0.11
Transport on surface	0.01
Hoisting	0.20
Pumping	0.16
Other charges	0.17
Total mining	$2.66
Development	0.36
Total underground	$3.02
Milling:	
Sorting and crushing	$0.09
Stamping	0.20
Tube-milling	0.17
Cyaniding sand	0.16
Cyaniding slime	0.14
Bullion recovery	0.09
Total treatment	$0.85

Zinc in Boilers

Use of zinc in boilers, according to W. W. H. Gee, involves a knowledge of the electrolytic resistance of the boiler waters and the effective voltage at temperatures from 150 to 200°C., concerning which there is great need of experimental data. The amount of zinc used in some marine boilers is as great as from 400 to 600 lb. of rolled zinc per year. If the zinc is efficient in producing electrical currents, then the average current may be from 17 to 25 amperes. It was obvious that such currents would be obtained much more economically by the use of a dynamo. The direct use of electrical currents has been the basis of a number of patents. Those of Elliott Cumberland were especially described at a meeting of the Faraday Society. Iron anodes are placed in the water of the boiler, which latter is made the cathode. A low voltage of supply provided by a small motor-generator is used. The method has proved effective, not only in preventing corrosion, but also in removing scale from the heating surface and preventing its formation. Experiments carried out at the Manchester School of Technology have shown that the current densities necessary to protect iron, copper, and other metals from the corrosion of fresh and salt water are of low value, and hence in the case of boilers and condensers the annual cost of the electrical energy required is a small item. The chief cost will be in the renewal of anodes. Harris and Anderson have also applied electrical currents for the prevention of the corrosion of condensers. They find that a condenser with a cooling surface of 1025 sq. ft. requires only 2 volts and 2 amperes, and the special anodes used by them cost from $15.60 per 1000 sq. ft. per year.

Special Correspondence

NEW YORK

FAILURE OF GRANBY BOND ISSUE.—U. S. R. & R. PASSES.—HOLLINGER REPORT.—BRADEN PRODUCTION.—COPPER AND SILVER NEWS.

Last week Granby offered 6% convertible bonds to the amount of $1,500,000, but the response by the shareholders was decidedly depressing and the underwriters, Speyer & Co., had to take 90% of the issue, which nets the Granby company 96. The poor reception of the issue is ascribed to the dejected state of the market at present, and a too keen recollection of the 13,500 shares of treasury stock which were issued three years ago at $85 and later slumped to $26. It will be remembered that for some time it was proposed to finance the building of the new plant at Hidden Creek from the profits of the Grand Forks plant. Evidently "there's a reason." Admission of the shares of the Alaska Gold Mines Co. to the unlisted department of the Boston Stock Exchange covers 193,279 fully paid shares and stock receipts for 517,295 half-paid shares. There are 39,426 shares which are being held under an option at par until July 1, next, the total authorized capital being 750,000 shares. The company owns $3,184,000 out of a total authorized issue of $3,500,000 first-mortgage bonds and $10,095,140 out of $12,000,000 of capital stock of the Alaska Gastineau Co. A few weeks ago, April 25, when the date of the annual meeting of the United States Reduction & Refining Co. rolled around, only one shareholder turned up, none of the officers being present. The annual report for last year has now been given out and shows that the only work done was cleaning up around the plants, netting a profit of $35,541. The Golden Cycle company has taken over the treatment contracts of the U. S. company, and when the cleaning-up work is completed at the end of the month, the activities of the latter company will finally cease. The lease upon zinc smelting plant by the United States Zinc Products Co. has been canceled and revenue will cease *Sic transit gloria mundi.* Hollinger reports that in the period of January 1 to March 25 the profits were $370,000. For the month ended March 25 the average gold content of the ore milled was $19.61, and a recovery of 95% is reported. The mill was in operation 87% of the time and milled 10,581 tons of ore.

Production at the Braden last month was the smallest of any month this year except February. The recovery made in the milling operations was also slightly lower than last month, being 63% in the wet plant and 74½ in the Minerals Separation plant. The Hardinge mills are in process of installation and should be all in operation by July. Pope Yeatman, the consulting engineer, who is now at the property, cables that by October next the mills should be handling 100,000 tons per month.

News from the copper mines has been discouraging this week. Results at the Braden have already been referred to. The report of the Nevada Consolidated for the quarter that ended on March 31 shows net earnings less than two-thirds of the corresponding quarter last year. The report of the Anaconda company for last year was also regarded as not especially encouraging, and Wall Street regretfully concludes that there is little prospect of increased dividends unless the price of copper averages better than 15¾ cents. On the other hand, it must be remembered that the increase of production cost last year, to which attention has been called, was chiefly due to the higher rate of wages paid. Since the wage scale depends upon the price of copper, any rise in the selling price of the metal would not be all clear gain to the company. The share market is in the dumps, and nothing seems able to pull it out. But with the number of idle cars decreasing, the steel business good, and manufacturers refusing to advertise because they are already behind on their orders, the rest of the country seems to do pretty well.

China seems to be mainly responsible for the recovery in bar silver during the month of April. London prices opened at 26½d. and closed at the high of the month of 27 15/16, making 1 7/16d. as the gain. This brought the monthly average to 27 7/16, against 26 11/16 in March and 27 5/16 a year ago. The fact that bars have come back to a level of the corresponding date in 1912 is in itself one of the proofs of the power of the metal to withstand uncertain times. Meanwhile, China has, in the financial sense, begun to get her feet upon the ground, and has again become a taker of silver.

Reports from three weekly clean-ups of the Pato dredge belonging to the Oroville Dredging Co. Ltd., and operating in Colombia are now available. The first clean-up, on March 15, yielded $12,000 from 85,000 cu. yd., corresponding to 14.11c. per yard. March 25, $7150 was realized from 16,332 cu. yd., and April 1, $5000 from 12,000 cu. yd. The average for the last two weeks was therefore 43.77 and 42c. per yard.

BOSTON

MICHIGAN COPPER MINES TO THE FORE.—SOUTH LAKE ATTRACTING ATTENTION.—MASS CON. AND LABOR TROUBLES.—COPPER RANGE NOW EARNING DOUBLE ITS DIVIDEND REQUIREMENTS.

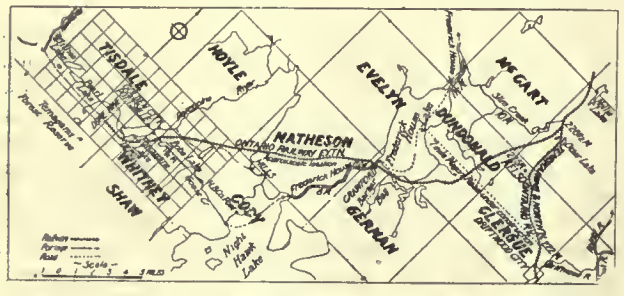
Attention in Boston centres largely on the operations of the South Lake company of Michigan, as it is thought to stand a fair chance of finding one or more profitable lodes. The management has begun cross-cutting from the 300-ft. station to open the Evergreen veins cut in the shaft and again cut by horizontal diamond-drill holes from the 300-ft. station to determine the path of the cross-cut. At 400 ft. another station will be cut and a cross-cut driven to the Evergreen. Although the Evergreen lodes are to be developed at once, this work will not be allowed to delay the cross-cutting for the South Lake lodes, regarded as by far more important. It is estimated that the first of these lodes will be opened about 1000 ft. from the shaft and the work will require about a year. John C. Watson, the dean of the Lake companies, who has resigned from several other companies, on account of age, has retained his connection with South Lake, believing it will make the biggest mine in the South Range country. The Lake country is now having its troubles with the labor question. The Mass Consolidated was obliged to shut down. The Mass management is determined not to recognize the Western Federation of Miners, and its properties will remain idle until employees apply for reinstatement individually. The Copper Range report for 1912 made a good showing. The company earned a balance of $1,692,566 applicable to dividends, against $805,560 in the previous year. Earnings were therefore $4.29 per share, while $2 per share was paid in dividends. After meeting dividend requirements, the company carried forward a surplus of $904,138. After paying $3.50 per share in 1911, Copper Range had a deficit on operations of $552,542. In 1910, $4 per share was paid in dividends, with the result that a deficit of $236,480 resulted. Copper Range is considered to be one of the most conservative mining investments in the world, and the company's failure in 1910 and 1911 to earn the dividends it was paying, compelling it in 1912 to reduce its dividend rate, exerted a depressing influence upon the copper list here. For some time it was thought that Copper Range would never recover lost ground. Nothing could be more reassuring than the news that the company is now earning its old dividend rate, with 29c. per share to spare. The Baltic mine of the company continues to be disappointing, but its reduced output is largely offset by increase at the Trimountain. Even Baltic, since the first of the year, has returned to its normal yield of 22 lb. per ton. Champion has had a satisfactory career, and the Atlantic property, the last acquisition of Copper Range, earned the company last year a net profit of $40,385. The quick assets of the Copper Range holding company have increased from $200,000 to $1,094,000. After a postponement of 60 days on account of Mexican war conditions, the Cortez Associated Mines held its annual meeting in Boston on May 3. The company has large estates in Hidalgo, Mexico, but has been unable to raise working capital for some months past on account of local conditions in Mexico.

PORCUPINE

INTERRUPTION OF TRAIN AND POWER SERVICE.—BOOM EXPECTED IN KIRKLAND LAKE DISTRICT.—HOLLINGER REPORT.—CROWN RESERVE AND THE MCENANEY.

During the past few weeks the rapid melting of the snow has caused severe floods around Porcupine. While no great damage has been done to the town, about half a mile of the railroad track west of South Porcupine has been washed out, so that it is impossible to get coal and supplies through to the Dome and Timmins over the railway. Unless this is repaired shortly, it will in all probability have a serious effect on the mines, as, on account of the break-down of the Wawaitan Power Co., all the mines have had to put their steam plants into commission. The Pearl Lake property has already had to shut down, and while they are endeavoring to generate power by steam they will not be able to run at capacity until the plant at Wawaitan Falls has been repaired.

There seems to be every possibility of a boom in the Kirkland Lake region during the coming season, and from all accounts those who are most heavily interested appear



THE PORCUPINE DISTRICT.

anxious to bring this about. So far, there is only one producing mine, with a few promising prospects, but there seems to be a feeling of optimism, and as soon as the snow has completely left the ground, a great amount of surface work will be done. The Burnside property adjoining the Foster-Tough has been purchased by the Aladdin Cobalt Mining Co. This is the first English company to become interested, but it may not be so significant as the claim-owners in the district would like to believe. This company's action in taking over the Silver Queen, the flotation of the Aladdin Cobalt stock in England, and the acquiring of the Chambers-Ferland property, is open to criticism as the stock is at present selling on the English market at a greatly inflated value. It would appear that this company is working the stock market to as great an extent as its mining properties. There is, however, a promising strip of territory lying in the vicinity of Kirkland Lake, and it is probable that during the coming season other discoveries of importance will be made.

The annual report of the Hollinger mine, covering 1912, shows that during the latter half of the year the company earned a profit of $600,664, in spite of the fact that during part of the time the mill was not in good working order and that the output was greatly curtailed during the last six weeks of the year on account of labor troubles. During the year the following uuderground work was accomplished: Driving, 3280 ft.; cross-cutting, 1381 ft.; winzes, 324 ft.; raises, 150 ft., and shaft-sinking, 66 ft. A total of 30,740 tons was stoped from the first and second levels. The estimate of ore reserves is based upon the results of development work and is as follows: Tons, 644,540; value, $11,271,400; estimated at beginning of 1912, $10,230,000. There are 34 known veins on the property on which no work other than sampling the surface outcrops has been done, and these are included in the ore reserves at an arbitrary nominal figure. Underground work during the year was the means of discovering seven new veins, and in the mine at the present time there are 24 faces which carry ore and are available at working places. The mill treated a total of 45,195 tons, having an average value of $21.24 per ton. The average value of the ore reserves is, however, estimated at $17.50 per ton, and the natural assumption is that some time in the near future the grade of the ore treated will show a considerable drop in value. Several changes have been made in the mill, tending to give a more efficient treatment at a lower cost. The amalgamation of the concentrate in pans has been discontinued, and this product is now cyanided. The agitators first installed did not give good results with the heavy ore and were changed into Dorr thickeners. Several other changes of minor importance are being made, which, while affecting the output to some extent, do not call for any radical change in the milling practice.

It is stated that the directors of the Crown Reserve Mining Co. will float the McEnaney property in Porcupine as a separate company, and although nothing official has as yet been given out, it is believed that the plan will be as follows: The McEnaney Mining Co. will be formed with a capitalization of $2,000,000, with shares at $1 par value. Of this amount, 500,000 shares will be issued to Crown Reserve stockholders at 80c. This will bring in $400,000, which will be returned to the Crown Reserve Mining Co. to cover the amounts paid by the company for the development of the McEnaney property. A large block of stock will also be paid to Mr. McEnaney according to the original conditions for the purchase of the property. The balance of the stock will be taken into the treasury of the Crown Reserve company, and by this plan the shareholders will benefit to the fullest extent by the profits to be made from the McEnaney, and will also have full control over the operation of the mine. The developments of the McEnaney have been most satisfactory, and the company is now proceeding to enlarge its mill.

COBALT, ONTARIO

EIGHT-HOUR LAW AND THE UNION.—NIPISSING REPORT.

The Cobalt branch of the Western Federation of Miners held two meetings on April 27 to discuss the bearing that the proposed eight-hour day would have on labor. This act will not come up until the next session of the legislature, and various amendments to it were suggested. A vote was cast to determine whether or not the Union would declare a strike on May 1, but at both meetings the resolution was voted down. A two-thirds vote in favor of a strike is necessary before the men can be called out, and it is stated that there was a majority against the resolution of 11 votes. This action of the Cobalt branch will have an important bearing on other branches throughout the district, although it is believed that if the eight-hour law is defeated when it again comes before the house, there will be trouble. The ill success attending the strike in Porcupine seems to have made the agitators more determined than before, and it is believed that continued efforts will be made to precipitate trouble among the workers in the Cobalt mines. The Western Federation is also making a particularly strong effort to organize in the Sudbury district, where heretofore their efforts have been unsuccessful. The annual report of the Nipissing Mines shows an increase in the value of the output, but a decrease of half a million ounces from the production of the preceding year. A large increase is also shown in the value of the ore reserves. The figures for 1911 and 1912 are as follows:

	1911.	1912.
Surplus	$1,204,742	$1,443,953
Gross production, ounces	5,197,042	4,688,261
Gross value	2,820,257	2,896,890
Profit on production	2,095,241	2,081,710
Ore reserves	7,883,992	9,643,338
Dividends	1,843,297	1,842,500

The price received for silver was 7.872c. per ounce greater in 1912 than in 1911, and the profit on production was 72.86% of the gross value of the output. The cost of production was 17.39c. per ounce. The low-grade mill, which cost a total of $324,650, is treating over 200 tons per day and making a good recovery at less than the estimated cost per ton. The company has reserves of 185,000 tons of milling ore which will run between 20 and 30 ounces per ton.

CANANEA, MEXICO

CONDITIONS IMPROVE.—RAILWAY RETURNED TO SOUTHERN PACIFIC.—CANANEA CON. INCREASING OPERATIONS.—CALUMET & SONORA.—DEMOCRATA.—MEXICAN METALS.—LAMPAZOS.—CERRO DE PLATA.

The mining outlook in Sonora, especially locally, seems to be better than it has been for the past two months. The state government has returned the railroad to the Southern Pacific company, and in the near future it is possible that supplies will come in freely to all properties. With the resumption of railroad traffic on the Cananea-Naco branch of the road, Cananea is again enabled to receive its supplies, and as a result two of the companies have resumed operations—the Democrata and Calumet & Sonora. The Cananea Consolidated Copper Co. is gradually increasing operations, and it is probable that in a comparatively short time normal conditions will prevail. The smelter continues to run with four furnaces and two converters, and even at this rate is producing an average of 60 tons of copper bullion per day. At the mines, conditions remain the same as during the past six or eight weeks, only four being operated at present, the Kirk No. 9, Elisa, Capote, and Sierra de Cobre. These properties ship direct to the smelter. The other mines, which ship to the concentrator, are still idle. The concentrator will probably be again in operation during the next week or two. The two reverberatory furnaces were again placed in commission during the past week. The Calumet & Sonora of the Cananea company, W. H. Tangye superintendent, resumed operations on a small scale the first week in May, starting up the electrostatic, or dry, mill. The company expected to be operating on almost a normal basis by the middle of the month with a force of between 100 and 130 men in the mines and wet mill. The company has completed the installation of a 36-ton crusher and picking belt. Before shutting down, in March, because of the unsettled local conditions and absence of railroad facilities, the company was earning a small profit, and with the use of the new equipment. It expects to increase its earning capacity and in a short time be on a dividend-paying basis. The dry mill is now operating with zinc and lead concentrates which had been piled up because of the inability to secure empty cars for shipping. Eight carloads have been loaded, and five more await empty cars.

The Democrata company, C. E. Hoffman manager, resumed work on April 26, and now is employing 300 men in its mine and smelter. The latter is handling 450 tons of ore per day. The matte produced is converted into bullion at the Cananea company's smelter. The Democrata smelter contains a 250 and a 125-ton furnace. Development on the 500-ft. level has exposed a large body of high-grade copper ore. The Mexican Metals Co. (Moctezuma-Arizpe Dev. Co.), Aug. Fritsche manager, has been operating steadily during the battles in this neighborhood. Its mines are 18 miles southeast of Cananea and away from the scene of excitement. However, it suffered to some extent on account of the absence of railroad facilities, and a number of times its 5-ton Pierce-Arrow motor truck was sent to Bisbee, about 70 miles from the property, for supplies, with excellent results. On account of the non-arrival of distillate for the engines that furnish power for the plant, the mill is operating with but one shift, but at that is averaging 5500 lb. of concentrate per day, which nets the company $51 per ton. Some development is also being done, consisting principally of the sinking of the Alacran and Palo Seco shafts to the 400-ft. level. The company is employing 75 men at present. Operations at the Superior-Bonanza property, six miles west of Imuris, have been abandoned for the present by the Cananea Con. Copper Co. Due to the inability to secure supplies, work was stopped over a month ago. The property is a copper mine and has been managed by Henry Boilweg. The Cananea company has surveyed a right-of-way for a narrow-gauge railroad from Imuris to the property, but this will probably not be constructed until the state is again normal. The Lampazos silver mine, below Moctezuma, which has been operating under the direction of Herman Wendler, has been closed indefinitely by its owner, the Banco de Sonora. The decision to abandon operations for the present came as a result of repeated visits to the camp by armed forces who were naturally assisted with supplies or money. The bank has been developing the property with a view to sale. The mine is some distance from a railroad, Nacozari being its shipping point, about 90 miles north. The Cerro de Plata mine, about 17 miles west of Cumeral, and operated by Holt Bros. of Magdalena, has been operating continuously during the unsettled period. A mill has been built and is now operating with excellent results. The mine is worked for silver and has unusual merit. Del Pilar mine, near Santa Cruz, has been operating steadily also, under the management of A. O. Koppes. It is a copper mine, and the principal owner is E. D. Arnold, of Nogales, Arizona.

BUTTE, MONTANA

ANACONDA REPORT ENCOURAGES OTHER COMPANIES.—BARNES-KING.—BUTTE & SUPERIOR.—GENERAL ACTIVITY.

B. B. Thayer's annual report to the stockholders of the Anaconda Copper Mining Co., which was published this month, is very satisfactory to Butte interests. When the largest operator in the camp sees fit to carry on 34 miles of underground development in one year, the smaller fry feel encouraged to dig some part of a mile themselves. There is philosophy in this, if not reason. But in all ways the report of the Anaconda company shows confidence in

CENTRAL MONTANA.

the permanence of the orebodies, and in the future of the copper metal market. Mines are being deepened, equipment improved, and smelters and mills enlarged. In only one respect does the Anaconda company seem to be dissatisfied with Montana products: the quality of available coal is not as good as the neighboring Wyoming and British Columbia coals. Therefore, the company is gradually suspending operations in its Montana coal mines and relying more and more on coal and coke from neighboring states. The Barnes-King Development Co. mined and milled 3048 tons from its North Moccasin property, Fergus county, during the month of April. The average yield was $8.15 per ton. Prospecting is being continued at the company's Piegan-Gloster mine at Marysville, and some commercial ore is being developed. The concentrator of the Butte-Superior Copper Co. is not running to capacity as yet, which means that some troubles are still unsolved in the treatment methods. Nevertheless the tonnage handled is gradually increasing, and the extraction is improving. At present the mill is treating 700 tons per day, and yielding a 47% zinc concentrate, with a saving of approximately 75%. On ore running 20% zinc a fair profit can be made on this basis. Meanwhile, further underground development is not being neglected.

According to experienced operators, there is more general activity in mining throughout Montana this year than for some time past. Many old properties are being re-

opened and new prospects developed. The mines and cyanide mills of the Little Rockies in Blaine county are active, and the Judith mountains in Fergus county are showing signs of rejuvenation. Radersburg, Virginia City, Rimini, Scratch Gravel Hills, Corbin, Rochester, Marysville, Hecla, Beartown, Elliston, Mill Creek, Bridger Mountains, Troy, Libby, Carter, and Philipsburg all have mines at work now, so that some good discoveries may be reasonably expected. The railroad activity in the western half of the state is also stimulating prospectors, and something may be found in new regions. The oil enthusiasts should also be mentioned—drilling is now in progress in at least two places in eastern Montana, and something may come of it.

KALGOORLIE, WESTERN AUSTRALIA

GREAT BOULDER MINE.—VACUUM FILTERS.—MARMONT MINE. —SOUTH KALGURLI-HAINAULT AMALGAMATE. —OROYA LINKS.—DEEP LEAD AT KANOWNA.—BULLFINCH PROPRIETARY.

Although the Great Boulder management has stopped development in the three bottom levels, it having been proved early last year that the main lode had passed into the Golden Horse-Shoe property, the ore reserves have only been reduced from 786,900 short tons, of an estimated value of $13.26 per ton on January 1, 1912, to 731,300 tons of an estimated value of $13.28 per ton on January 1, 1913. In the interval, 216,700 tons, yielding a revenue of $2,865,800, or $13.22 per ton, have been treated. The ore reserves are sufficient to supply the mill for another 40 months. Richard Hamilton, the manager, has recently given up his option on the Great Victoria mine at Southern Cross, giving as his reason that the results of extensive development undertaken by the company were not considered to justify the purchase under present conditions. Probably the price of $500,000 asked for the property had something to do with Mr. Hamilton's timidity. An action has been started by the Moore Filter Co. against the Talisman Consolidated Co. of New Zealand, and the Lord Nelson Co. of Victoria. The former is a substantial company, producing $1,000,000 per year, but the latter averages only $250,000 per year. The threatening lawsuits are causing a good deal of anxiety, although the United States decision is unlikely to have any effect on Australian courts.

Bewick, Moreing & Co. have thrown up the option on the Marmont mine, which they held on behalf of the Great Fingall company, and, almost immediately after, the original owners opened rich ore on the fourth level. This mine has produced $675,000 from 41,500 tons. The Fenian, adjoining and working the same lodes, has produced $1,818,600 from 87,000 tons, and paid $805,800 in dividends. At No. 7 level, 625 ft., the lode has just been cut in a cross-cut and assays $600 per ton for the first 6 ft. opened. Adjoining the Fenian, on the northwest, is the Queen of the Hills, owned by the Lake View & Oroya Exploration Co. This mine is equipped with a 2-stamp pneumatic Holman mill, one 14 by 16-ft. tube-mill, and a cyanide plant, operated by a Crossley gas engine. Milling started at the end of February, and the first monthly return will be issued early in April. The ore in sight was estimated at 86,000 tons of a recoverable value of $9.84 per ton. Costs are not expected to exceed $4.80, leaving a profit of $5.04 per ton. The mill has a capacity of 4000 tons per month, and this should show a profit of $21,000.

The South Kalgurli Gold Mines, Ltd., has absorbed the Hainault Gold Mine, Ltd., and will be known in future as the South Kalgurli Consols. The new company will have a nominal capital of $750,000 in shares of $2.50 each. Shareholders in the South Kalgurli receive 200,000 shares, or share for share held, while the Hainault holders will receive 50,000 shares, or one for every three held, and 50,000 shares will be held in reserve. Costs on the South Kalgurli have recently averaged $4.76 per ton, and on the Hainault $5.54 per ton, the former having a dry and the latter a wet-crushing plant. The bulk of the gold from the South Kalgurli was won from the east, or Lake View lode, while the Hainault's operations have been confined to the west, or Perseverance lode. All the levels in the South Kalgurli have been extended to test virgin ground in the Hainault. Shareholders in the South Kalgurli will receive $1.44 per share dividend, after paying which there will remain $125,000 for working capital. The remodeled company appears to have a fair chance of success.

The Edna May, at Weston, has treated 114 tons of ore from the winze below the 70-ft. level, returning $5580. This brings up the total return to 1421 tons, yielding $57,100. The whole of this ore has come from driving 250 ft. at the 70-ft. level and sinking a winze 55 ft. below that level. The drift has been driven 10 ft. wide, but the lode is much wider. Near the east boundary a cross-cut proves the lode at this point to be 44 ft. wide, of an assay value of $11 per ton. A new vertical shaft is now being sunk, and tenders for a 10-stamp mill, with 1250-lb. stamps, have been called for, although the water supply has not been proved and the ore in sight is barely 25,000 tons. So far as tested, the lode is one of the best found in the state, but it is in a kaolinized country and may not continue to any depth.

There has been a marked decline in the income and

IVANHOE GOLD MINE.

profit of the Oroya Links, Ltd., since the depletion of the ore-shoot opened by Rutter and other lessees between July 1911 and January 1912. For instance, for the first half of 1911 the ore treated averaged $5.48 per ton, and a loss of $42,750 was incurred; during the second half of 1911 the grade improved to $5.82, and a profit of $51,400 was earned; during 1912 the average grade was $5.60 and a profit of $160,000 was shown; during the last three months, however, the grade has declined to $5.10 and the profit has only averaged $3600 per month. The property consists of 417 acres, which were at one time worked by a dozen separate companies, mostly with poor results. As the company is spending only $3800 per month on development, against $15,000 by the Golden Horse-Shoe, and $10,000 by the Ivanhoe, each on 24 acres only, and the management is prejudiced against lessees, most of the ground is lying idle.

Richard Hamilton of the Great Boulder mine, in conjunction with Sydney Yeo, representing Lionel Robinson, Clark & Co. of London, has taken a working option on 20 acres on the continuation of the North Lead, Kanowna. For some time past, Mr. Rollo, a prospector, has been drilling to find the lead. Eventually he sunk a shaft 90 ft. and opened gravel carrying 2 oz. per ton. Between 1897 and 1900, this lead and its tributaries produced $5000 worth of gold, but when water was encountered work was abandoned, as the areas allowed for alluvial claims were limited to a maximum of one acre, and it did not pay to put a pump and boiler on such a small area. As the ground was all abandoned for years, it was thrown open for leasing, and may still produce a lot of gold.

The Bullfinch 15-stamp mill has been running since the beginning of the month and has been crushing 8 to 9 tons per stamp per day. Fred Morgan, the manager, states that he hopes ultimately to treat 10 to 11 tons per stamp per day. Another 5 head of stamps and a tube-mill are being installed, and it is then expected that the monthly output will be 6000 tons. The grade of ore being treated is above the average, as most of it is coming from old dumps, which contain portions of the rich ore treated two years ago.

General Mining News

ARIZONA

Cochise County

(Special Correspondence.)—At the Leadville mine, shaft-sinking and driving is in progress, but no ore will be shipped until proper facilities have been provided. Twenty-five men find steady employment in the mine. The district shipped 12 cars of ore from the Calumet & Arizona to the Douglas smelter, and 27 cars from the Great Western to the El Paso smelter. In all, there are 200 men at work in the mines.

Sulphur Springs, May 8.

Work on the new mill of the Commonwealth Mining Co., at Pearce, is progressing rapidly, and the frame of the building is being put in place. At Bisbee, there are now 4700 men employed at the various mines, the monthly payroll being about $450,000. The slag dump is being removed from the old smelter site, some being shipped for remelting and some for ballast on the El Paso & Southwestern railway.

Gila County

(Special Correspondence.)—During April, development in the Inspiration mines covered 2510 ft., a decrease of 2100 ft. compared with the previous month. From the Joe Bush and Live Oak shafts, 11,000 and 6000 tons of ore, respectively, were hoisted, and the stock-pile now contains about 200,000 tons of ore. At the Miami mill, there are still two idle units, due to the recent cave-in, and many large surface cracks are opening. At a depth of 1040 ft., in the Arizona Commercial mine, at Globe, a low-grade pyritic orebody was cut on May 3.

Miami, May 9.

(Special Correspondence.)—Jim Fleming has cut high-grade silver ore in the old Champion mine, which he recently acquired. After cleaning out the old workings, development work was commenced after a cessation of 25 years.

Miami, May 7.

Maricopa County

(Special Correspondence.)—The Kay Copper Co. has let a contract for sinking a 100-ft. shaft on its property at the mouth of Black Canyon creek, 50 miles north of Phoenix. The new shaft is to be sunk about 1200 ft. north of the present working shaft, which has been sunk to 340 ft., where by driving south on the vein, toward the Harris Copper Co.'s property, large bodies of high-grade copper ore have been proved. Where the company is starting to sink its second shaft, there will not be any cross-cutting or prospecting to find the ore, as it comes near the surface, and at many places for 300 ft. north and south along the vein, ore is showing on the surface. Where the shaft is to be sunk the orebody shows over 30 ft. in width. The Kay Copper Co. is contemplating building a smelter near its mine, and probably a smelter will be erected at the mouth of the Black Canyon creek to treat the ores of the district. The Kay Copper Co. now has thousands of tons of high-grade chalcopyrite ore blocked out, and the Harris Copper Co. has considerable ore in sight in its property, which adjoins the former property on the west and south.

Phoenix, May 8.

Pima County

The Olive district, 20 miles south of Tucson, is the scene of much activity. The Tucson Mines Development Co. is developing a silver-lead group of claims, and a 50-ton concentrator, costing $25,000, will be in operation in a few days. The San Xavier mine is being opened by the Empire Zinc Co. and shipping ore regularly. The Pioneer smelter at Sahuarita is being altered and will be re-started in about 30 days.

Pinal County

(Special Correspondence.)—The Hayden smelter is running at full capacity with a daily output of 200,000 lb. of blister copper. A large quantity of concentrate is being diverted to the smelter from El Paso on account of the strike at the latter smelter. The Hayden plant is to be enlarged as early as possible by the addition of two blast-furnaces and one reverberatory. A Great Falls type of convertor has recently been put in commission. It is expected that this plant will grow on account of its advantageous position in this ore-producing district, and which is already producing considerable tonnage. The concentrator is now reducing 7800 tons of ore per day.

Hayden, May 8.

CALIFORNIA

Butte County

A fire of mysterious origin on May 12 destroyed a substation of the Pacific Gas & Electric Co., against which a general strike has been called by the Pacific Light & Power Council. Three 60,000-volt transformers were burned out. The immediate loss will be approximately $25,000, but the indirect loss may be much larger, for absence of power has shut down all work on gold dredges. Dredges

DREDGE AT OROVILLE.

are not often 'held up' by bandits, but on the night of May 11 a robber attempted to rob one at Oroville, and was frustrated by one of the employees switching out all lights.

Calaveras County

(Special Correspondence.)—Most of the mines in the vicinity of Cañon Hill, depending on the Utica company for water-supply, have temporarily closed down. The Utica company has most of its men repairing and reconstructing the flumes, which should be completed by June 1. The Angels and Gold Cliff mills are the only plants operating here at the present time, getting their supply from the water reserved for domestic purposes. Their compressor is run by power furnished by the Sierra & San Francisco company. This condition will prevail for another 30 days, when the Utica management expects to have the flumes repaired and affairs in a normal condition. Mr. Airnall, the superintendent of the North Star mine, was at Angels Camp last week, and there was some hope among the stockholders that work would be resumed on that property. The North Star is on the foot-wall side of the Mother Lode running through Angels, and west, and under the Gold Cliff. The company has a 30-stamp mill and a modern equipped mine. There is considerable talk regarding the affairs of the Lightner Mining Co. An assessment has been levied, and Mr. Chalmers, the former superintendent, will have the same position he held before the bonding company took over the mine. Mr. Clarke, the superintendent for the bonding company, spent considerable money in sinking a new shaft and cross-cutting. This shaft is in the hanging wall and about 1000 ft. deep. The bonding company wanted more time for exploration, but was refused. The Chamber of Commerce and representative citizens called a meeting on May 6 for the purpose of protesting against some of the bills inimical to mining now before the legislature. The D. D. Demarest Co. is working its plant at full capacity. Notice has been received here that the Railroad Commission will meet in Sonora on May 13 to investigate the high freight rates submitted to them some months ago.

Angels Camp, May 7.

The old Morgan mine, which has been the subject of many lawsuits for a number of years, is to be reopened.

MARIPOSA COUNTY

The Original Mining Co., operating on the Merced river, declared its first dividend, amounting to 3c. per share, on May 3. George W. Egenhoff is general manager.

NEVADA COUNTY

The Empire Mining Co. has paid a third installment of $60,000 for the purchase of the Pennsylvania mine. This makes $140,000 paid to date, out of $500,000 agreed upon, the final payment being due in May 1916. George W. Starr is in charge of the Empire and Pennsylvania mines.

SHASTA COUNTY

Rich native copper ore has been opened in the Greenhorn mine, near Tower House, 22 miles from Redding, by F. and H. Warren, who have worked it for 13 years. The ore was cut 280 ft. from the surface, and general samples returned 17% copper and $1.50 in gold per ton. The furnace of the Noble Electric Steel Co. at Heroult, which was started on May 2, is working well, and on May 7, 23 tons of metal was tapped, and it is expected that the daily output will reach 13 tons.

SIERRA COUNTY

At the North Fork mine, near Forest City, the winze sunk near the face of the inclined shaft 2000 ft. from the surface, is down 75 ft., and a cross-cut is being driven to prospect for the Uncle Sam vein, which is supposed to be a north extension of the Tightner vein. G. F. Stone is in charge.

All the buildings at the Rainbow quartz mine, near Alleghany, were destroyed by fire on May 10, the damages being about $10,000. The Four Hills power-plant was damaged by a snowslide during the past week. The trail in Jim Crow canyon, leading up to the Sierra del Oro, is being repaired. The Oro Fino mill is treating 20 tons of ore per day.

TRINITY COUNTY

(Special Correspondence.)—The placer claims of J. C. Van Matre, on Stewart's Fork of Trinity river, have been taken on option by H. E. Cheesebro and W. J. Baker of Chico, who are said to be acting for the Trinity Dredging Co. of Chico. The property is being prospected by a Keystone drill, with a view to installing dredges.

Minersville, May 5.

It is stated that the Trinity Gold Mining & Reduction Co. will resume work at the Headlight mine early this summer, operations having been stopped in January owing to the weather. A cross-cut and raise from the lower adit have opened considerable gold-silver sulphide ore assaying $8 to $34 per ton; also mineralized schist worth from $1 to $5 per ton has been developed. The 40-stamp mill will be altered to treat the sulphide ore.

TUOLUMNE COUNTY

(Special Correspondence.)—The company which has a bond on the Louisiana mine, near Tuolumne, is sinking a new shaft 200 ft. north of the old one, and proposes to continue the work until a depth of 300 ft. has been attained. It is now 110 ft. deep, and the vein is opening well. Electric power is used for operating all machinery. The Rising Sun and Sonorita mines, situated near Arastraville, have been bonded to R. B. Harper and S. D. Zaro, of Santa Clara. The price to be paid for the properties is $12,000, a partial payment of $3000 to be made in 60 days and the balance in three equal payments in 8, 14, and 20 months from date of agreement. Operations have been suspended at the Gold Ship gravel mine, near Groveland, pending the raising of more funds. The property is credited with holding out great promise of becoming a heavy gold producer, yet it is reported that the stockholders refuse to provide more money for its further development. The development of the property has been under the direction of William Graham, who is one of the largest stockholders. The consulting engineer for the Jumper mine company inspected the property, at Stent, last week. The shaft is to be repaired and deepened. The Old Dominion mine, situated near Columbia, has been bonded to Thomas P. Bacon and L. W. Lassell, of Alameda, for $30,000. The first payment, amounting to $10,000, is to be made within 18 months, and the balance within two years later. The bondholders agree to finish the construction of a 2-stamp mill and employ six men, one shift continuously, during the option. The owner, George F. Grant, of Columbia, is to receive a royalty of 25% during the first six months, and 20% thereafter. Operations have been suspended at the Tarantula mine, situated near the Shawmut. The property is to be examined by engineers, and it is understood that work will be resumed at an early date.

Sonora, May 10.

Salt Lake people are interested in the Hope property in this county, which has produced about $400,000 in gold. It has been recently examined by George Weston, who also secured additional property. At 300 ft. from the apex of the vein are three 'streaks' of ore, totaling 2 ft. in width, assaying $1.20, $16.80, and $162.40 per ton. This is below the older workings, and by extending the adit 350 ft. there would be 200 ft. of new stoping ground.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—The Dorit Mining Co., operating mines up Chicago creek, has started the erection of a 60-ton mill, and a contract has been awarded to the Traylor Machinery Co. of Denver. F. L. Patrick, of Idaho Springs, is manager. A streak of ore from 3 to 6 in. wide has been cut in the west drift of the Seaton vein, and assays 870 oz. silver and 16.50% copper. The shoot was cut in the drift run from the lateral of the Newhouse adit. E. D. Payne is manager. W. H. Hollingsworth, of Dumont, operating a property on Albro mountain, has uncovered an 18-in. streak of smelting ore that assays up to 720 oz. silver per ton. The shoot is exposed for 15 ft. Shipments will be started next month. The management of the Newhouse adit has made a reduction, for operators carrying on development, in the charges for compressed air and haulage. The former charge of $4 per day for air has been cut to $1, and on hauling, the charge has been cut from 25c. to 17c. per ton. A number of operators and lessees have already taken advantage of the reduction. A. D. Bryant, of Lawson, has taken a lease on the east drift of the Bellevue-Hudson vein intersected 900 ft. from the portal of the Rochester adit. Driving will be started on a 6-in. streak of solid ore that is worth $43 per ton in gold, silver, and lead. E. Dingle & Co. are driving a cross-cut to intersect the No. 1 level of the Albro mine, situated on Albro mountain. The objective will be reached within 40 feet.

Idaho Springs, April 21.

DOLORES COUNTY

On May 28 the Rico Mining Co., of Rico, will hold a meeting to decide whether to sell the property to Day & Greenwood, of Salt Lake City, Utah, the terms to be, a lease for 10 years, and an option to purchase for $1,000,000. Under the lease, the lessees had the option for one year to operate the mill and power-plant at an annual rental of $5000.

EAGLE COUNTY

John A. Hassell, who represents the London and New York people who have acquired the Lady Belle property at Brush Creek, states that the quartzite walls in the mine are similar to the formation in the Silver King mine, at Park City, Utah. Another adit will be driven 50 ft. lower than the discovery point, and ore shipments will be started as soon as possible from the dump. Good roads will be constructed to the mine.

TELLER COUNTY (CRIPPLE CREEK)

The Colburn mill is now treating 270 tons of ore per day. The Clancy process has been abandoned. The first annual meeting of the El Oro Mining & Milling Co., operating in Eclipse gulch, was held at Cheyenne on May 6. A vein 6 ft. wide in a blue breccia dike, has been opened on the Lady Stith claim on Globe hill, owned by the Stratton estate. The ore contains sylvanite and free gold. May

10 was pay-day at Cripple Creek, and about $375,000 was distributed by the different companies.

Eighty feet below No. 16 level of No. 2 shaft of the Portland, water has interfered with sinking operations. Excavations for the new cyanide plant at the Gold Sovereign on Bull hill are completed, and the buildings are to be erected immediately.

IDAHO

Idaho County

The Humboldt Consolidated Mining Co., holding 21 placer claims, comprising 320 acres of ground, in the old Warren mining camp, is preparing to resume operations on an extensive scale, and about June 1, J. M. Gunning, president of the company, will take up his residence there to superintend operations. Machinery and equipment have been ordered, and a battery of three hydraulic giants, in addition to two already installed, will be put in commission as soon they can be delivered. Two large grizzlies also have been ordered, together with a portable sawmill of 1000 ft. daily capacity, and an electric dynamo to furnish current for light. The ditch through which water is conveyed to the giants is to be enlarged, and later in the season a higher canal, which will give 75 ft. additional fall, will be constructed. A large reservoir, providing a 20-ft. head, is now half completed and will be finished in time to store the flood-waters from the mountains.

Shoshone County

(Special Correspondence.)—The Coeur d'Alene North Fork Mining & Smelting Co., at Monarch, has been in the hands of a receiver for over a year. With the sanction of the district judge, a lease has been let to Benson, Murphy & Co., who will sink a winze 250 ft. on the vein from the 1400-ft. level. They also have the option of stoping from the 1500 to the 1400-ft. level. This development work should prove the value of the mine, which will then be sold to pay debts owing. The lessees are already at work, and have a good deal of ore in the mill-bins.

Monarch, May 6.

In the long suit of the Stewart Mining Co. *v.* the Ontario Mining Co. for alleged extraction from its property by the latter, the Supreme Court of Idaho has affirmed the judgment previously given in the District Court, and denies the Stewart company any relief, and quiets the title of the Ontario company in and to the orebodies in dispute.

In No. 2 adit of the H. E. M. mine, in the Evolution district, 10 ft. of high-grade lead carbonate ore has been opened. The shoot was cut out by a fault several months ago, but was found again by a cross-cut from No. 2 adit.

MICHIGAN

Houghton County

The Calumet & Hecla company has shipped 500 tons of tailing from the conglomerate dumps on the shores of Torch lake to Montana, where it will be tested on a Peck centrifugal concentrator which is operating at the Anaconda plant. This concentrator has been making a good recovery of copper from waste on the Anaconda dump.

The itinerary of mine-safety car No. 8, in the copper district of Michigan is as follows: May 5 to 17 at the Calumet & Hecla mine, May 19 to 24 at the Mohawk, and May 26 to 31 at the Copper Range Consolidated properties.

MISSOURI

Jasper County

The Kansas State Utilities Commission has issued an order allowing the Kansas Natural Gas Co. to sell its product for steam boilers at 12.5c. per 1000 cu. ft., and the company will supply gas for boilers in the Joplin district at that price. Domestic rates remain at 28c. per 1000 cubic feet.

MONTANA

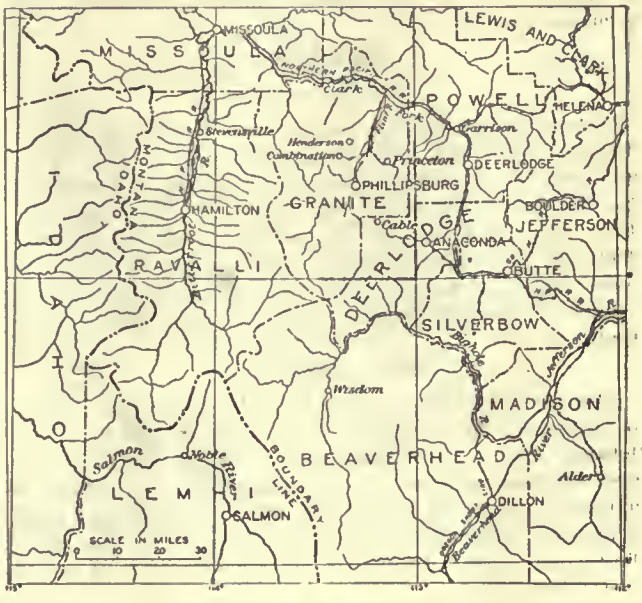
During April, mines in this state produced gold worth $121,264, distributed among the following counties: Broadwater, $492; Choteau, $31,753; Fergus, $39,561; Jefferson, $39; Lewis and Clark, $4809; Madison, $44,429, and Silverbow, $181.

Lincoln County

(Special Correspondence.)—According to information received here, Charles Muffly, of Townsend, has almost completed the organization of a company to work the Howard placer claims, on the headwaters of Libby creek. A large hydraulic plant will be erected. The placer ground is about 20 miles south of Libby, near the holdings of the Libby Placer Mining Co., operated by P. J. Brophy and other Butte capitalists. Mr. Muffly has been in Libby several times during the past two seasons, and during that time has had the property thoroughly examined. There are 840 acres in the several claims owned by the Howards, and there is water in abundance. From this ground a good deal of gold has been won in the past 50 or 60 years, this having come from the bedrock along the stream, and which was worked by hand-shovel and a primitive sluice-box.

Libby, May 11.

The B. & B. mines, 19 miles from Troy, have employed 15 men during the winter, and a good deal of ore has been opened. It is probable that a concentrating plant will be erected during the summer. The Big Eight also employs a few men. These properties produce lead-silver ore, with some gold and copper. The Greenough interests control the B. & B., while the Big Eight was recently purchased for $50,000 by H. L. Day, of the Federal Mining Company.



PART OF MONTANA.

Madison County

A large Star drilling machine of 1500 to 2000-ft. capacity is being erected at the Alder gulch gravel properties, under control of Charles F. Helman, W. C. Watson, and W. B. McCubbin.

Silverbow County

(Special Correspondence.)—The reduction in the cost of operating the Butte mines by compressed air, as compared with steam, has been a subject of much discussion at various times, and while it was believed that electricity was much cheaper than steam, there never has been any official statement on the subject. Only a short time ago John D. Ryan, president of the Amalgamated Copper Co., with several capitalists and Max Hebgen, vice-president and general manager of the United River Light & Power Co., made an inspection of the company's plant, and afterward Mr. Hebgen made the following statement: "Although our main power-stations are 100 miles from Butte, we furnish all the electric power and light for that great mining city, and the use of this power in lifting, operating, and ventilating, as well as lighting, has made it possible to work the mines and smelters without a stop, even when the price of copper was at a low ebb. The use of hydro-electric power in the copper mines has actually added one cent per pound to the value of the enormous output of Butte's copper mines." A couple of years

ago it was conceded that the Anaconda company was producing copper at about 9c. per pound. This was before the big compressor plant was installed and steam was being used to operate the plant. Therefore, it is quite plain that if two years ago the company was producing copper under steam power at 9c. per pound, today it must be producing at 8c. People who have made a study of the difference in cost of steam and electricity declare that there is no question that the saving is at least 50% in favor of the latter. Where it costs 20c. per ton to hoist ore by steam, it today costs 3c. per ton by compressed air, a saving of 17c. per ton. Then there is to be further considered the operation of the pumps by electricity as compared with the former use of steam, and the underground haulage by electricity as compared with horses and mules two years ago.

Butte, May 2.

The new shaft of the Butte Main Range Mining Co. is now being sunk by windlass for the first 60 or 70 ft., while machinery is installed, when the shaft will be sunk to 1500 ft. During the past week the Butte-Duluth Mining Co. made its first shipment of electrolytic copper, weighing 50,000 lb. The leaching plant is being enlarged to 200-ton capacity.

NEVADA

Clark County

A 40-ton concentrating plant is to be erected at the Potosi mine in the Good Springs lead-zinc district. This, with that at the Yellow Pine mine, makes two mills in the district. The Potosi has been well developed, and there are 15,000 tons of ore on the dump, while about 1000 tons is shipped monthly. The mill is to consist of jaw-crushers, rolls, jigs, screens, and Overstrom tables, and concentrate containing 40% zinc and 60% lead can be produced.

Humboldt County

(Special Correspondence.)—An impetus has been given to mining at Rochester by the opening of the Rochester Belmont Mining Co.'s Sunflower group of claims on the west of Nenzel mountain to lessees. Ben R. Binns is manager. Lessees at the Weaver No. 2, Big Four, and Codd claims are shipping about 100 tons of ore per day, while the tonnage expected from all mines within 30 days should be over 200 per day.

Rochester, May 8.

Lander County

The Nevada Cinnabar Co. has acquired the property of the Shoshone Quicksilver Co., at Ione, 50 miles from Austin. About $100,000 will be spent in this purchase, and erecting a reduction plant, and from 75 to 100 men will be employed. The ore occurs in rhyolite and phonolite. The Mercury Mining Co. is now producing 70 flasks of mercury per week.

Nye County

Ten mines at Tonopah produced 10,873 tons of ore, worth $237,891, during the week ended May 10. On the 1070-ft. level of the Merger, 10 ft. of high-grade ore was opened in No. 3 raise. The pumps are handling 65,000 gal. of water per day. Shipments were 54 tons to the Belmont mill at Millers. During April the Extension mine produced $56,700 from 4660 tons of ore. In the Belmont, the 1166-ft. level cross-cut opened the Shaft vein, which is over 5 ft. wide. The April bullion shipments were 22,600 lb. The return from the Montana-Tonopah in April was 1440 lb. of bullion and 34 tons of concentrate from 4393 tons of ore. The North Star shipped 200 tons of ore worth from $25 to $51 per ton during the past week. The vein recently opened has been driven on 165 ft., with an average width of 8 to 12 feet.

Storey County

During the past week the northeast drift on the 2500-ft. level of the Sierra Nevada was advanced 16 ft., the vein being 6 ft. wide, of low value. From the Ophir 2400-ft. level, 106 cars of ore assaying $23.81 per ton were shipped to the Kinkead mill. The Mexican mill treated 556 tons, worth $6316, from the Monte Cristo section. At the C. & C. pumping shaft, all machinery is in good order.

NEW MEXICO

San Miguel County

About 50,000 lb. of concentrated meerschaum is being shipped monthly from the American Meerschaum & Pipe Corporation's mill on the Sapello river, 30 miles northeast of Silver City. This product goes to Ogdensberg, New York. The meerschaum commands a good price, and 160 men are employed. J. W. Bible is manager and I. H. Stanley is mill superintendent.

Socorro County

The Mogollon Mines Co., which absorbed the Ernestine and other properties, has the new engine in position, and when alterations are completed the stamp-mill will have an increased capacity of 50 tons per day. Oil will be piped across the Gila river by gravity, instead of by pumps.

SOUTH DAKOTA

The Homestake Mining Co., on May 7, declared its regular monthly dividend of 65c. per share, on the capital of 218,000 shares. This amounts to $141,700, making the year's total of $748,500.

TEXAS

Culberson County

The Hazel mine, in the western part of this county, 10 miles north of Allamore and 14 northwest of Van Horn, is being unwatered by the Hazel Mining & Milling Co., of Dallas. The shaft is 750 ft. deep, and there is said to be 40,000 tons of silver ore opened in the old workings. Walter C. Case is in charge.

WASHINGTON

Ferry County

(Special Correspondence.)—The Granby company, of British Columbia, requires more pyrite ores, and has bonded the Copper Key claims, at Belcher mountain, in which a large tonnage has been developed; also the Oversight group, which will be prospected by diamond-drills. At what is known as the Lame Foot 'camp,' the Granby company has bonded the Washington and Dutch Jake claims and other outlying iron claims situated between Belcher mountain and Curlew lake. The Lame Foot properties have been surveyed for diamond-drilling, sulphide ores being of considerable quantity.

Spokane, May 9.

With the defeat of the movement to consolidate the Republic Mines Corporation and the North Washington Power & Reduction Co. by the sale of the holdings of R. A. Koontz and J. W. Turner in the latter concern to the Harper Consolidated Mines, a deal involving 250,000 shares of stock and carrying control, the Harper Consolidated company will endeavor to become the dominant factor in Republic. Mr. Harper stated that his company planned to rehabilitate the North Washington Power & Reduction mill, and that the capacity of the plant would be increased immediately to 250 tons per day. He announced also that the Harper Consolidated Mines would complete the North Washington company's power project, capital being available to finish the transmission line from Republic to Nelson, British Columbia. This will connect with the Bonnington Falls system of the West Kootenai Power & Light Co., providing electric power for all the mines and mills in the district and lighting current for the town.

Litigation between the Quilp Mining Co. and the Republic Mines Corporation, involving extralateral rights on a vein in the Surprise mine, and damages for $400,000 based on alleged misrepresentation, has been settled at Spokane. The Quilp mine passes to the Imperator-Quilp and Republic Mines Corporation under a bond of $250,000, of which $60,000 has been paid by the Imperator-Quilp, which waives 25% net royalty against 50% gross on ore mined. The Republic company gives up a net royalty of 25% and a flat rate of 50c. per ton mined in the disputed ground until the Quilp bond is fully paid.

CANADA

British Columbia

During April the Granby mine produced 104,848 tons of ore, and the smelter at Grand Forks treated 105,433 tons, yielding 1,806,452 lb. of blister copper, making the year's total 414,310 tons of ore and 7,394,697 lb. of copper. Net earnings for the quarter were $194,000, making $990,225 for the first nine months of the fiscal year. A vote taken by miners on strike at Nanaimo resulted in a large majority for a resumption of work, but on account of the few voters it was though inadvisable to return to the coal mines. United Mine Workers' officials, who called the strike, state that a settlement will not be made until ordered by their organization.

Ontario

(Special Correspondence.)—The newly formed Dominion Nickel & Copper Co. is displaying commendable activity and has a large force of engineers engaged in drawing plans and laying out the ground for the new works. A considerable amount of grading for the new smelters has been accomplished. While contracts for the machinery have not as yet been let, it is expected that they will be given out shortly. The company proposes to erect four blast-furnaces and two large reverberatory furnaces, and will use the large basic converters which have been so successful in the Copper Cliff plant. Nothing definite has as yet been done regarding the power question, which has been left in the hands of the Pearson Engineering Co. of New York. Following the resignation of A. P. Turner, president of the Canadian Copper Co., several changes have been made in that organization. John Lawson, formerly vice-president, has been made president; Mr. Slaughter, formerly mechanical engineer, has been made vice-president; J. Agnew, formerly smelter superintendnt, is now general superintendent; and W. Kent, who had charge of the reverberatory furnaces, has been made smelter superintendent. Good progress is being made with the development of new properties, and it is expected that they will be able to contribute to the tonnage within a short time.

Sudbury, May 6.

Permission to drain Kerr lake at Cobalt and keep it empty for seven years, was granted by T. E. Godson, mine commissioner at Toronto, to the Crown Reserve and Kerr Lake companies. It will cost about $35,000 to do this work as outlined in this journal of April 26, but it is probable that high-grade ore will be recovered thereby. Twelve tons of powder exploded in a magazine of the Curtis-Harvey company at Timmins. The explosion was felt 30 miles distant, but did less damage than was expected, as the magazine was built in sand. The first unit of the Foster-Tough mill at the Kirkland Lake district will be in operation in a few days. This company has shipped 74 tons of ore to date, which yielded 1637 oz. gold and 2300 oz. silver, worth $34,116.

At the Goldfields mill, Larder lake, the 30 stamps are crushing 75 tons of ore per day, and it is proposed to add four new tube-mills during the summer. Power for the Larder Lake district is supplied by a hydro-electric plant at Raven falls, about 10 miles distant. During April the Nipissing produced ore worth $231,163.

Porcupine is supplied with power from the Wawaitan and Sandy Falls power-plants, and several weeks ago the former was put out of commission by the penstock breaking away. A good deal of damage has been done to the latter plant, so the mines and mills will have to rely on their own steam plants.

A party of well known prospectors recently passed through Cobalt, on a six months' prospecting trip to Ungava. Two other parties have also gone to the northern districts. At Sudbury the Mond Nickel Co.'s electrical plant was destroyed by fire on May 2, and damages are between $50,000 and $100,000.

MEXICO

Chihuahua

During January and February, the Creston-Colorado, El Itayo, Dolores, and La Dura mines of the Minea Company of America, made profits of $62,500 per month. Considerable development has been done on the new ore-shoot on No. 6 level of the Alvarado mine. The San Patricio silver mine, at Parral, has been sold to a syndicate controlled by Bernard MacDonald, and a 300-ton cyanide plant is to be erected. At the Magistral, in the Inde district, work is going on at No. 7 level, and a contract has been let for an experimental treatment plant. Good ore has been opened in the Esmeralda mine below the 500-ft. level.

Jalisco

El Favor Mining Co. paid a dividend of ₱70,000 on April 30, being the second this year. Progress at the mines and mills is satisfactory. During the year 1912 the Amparo Mining Co., in the Etzatlan district, produced ₱1,855,082 from treatment of 92,365 metric tons of ore, the gold and silver being valued at ₱908,726 and ₱941,539, respectively. Mining costs were ₱4.11 and milling ₱3.24 per ton. Net

MAP OF JALISCO.

profit was ₱817,969. Assay of the ore before treatment was 8 gm. gold and 290 gm. silver per ton, on which the recovery was 90.9% by concentration and cyanidation. Ore reserves total 724,899 tons. The main shaft was sunk to the 1300-ft. level, and ₱130,363 was spent on construction and additions. James H. Howard is general manager. The Casados mine, in the Hostotipaquillo district, shipped 63 tons of ore in March, averaging 72 gm. gold and 11 kg. silver per ton in one carload, the other being a trifle lower grade, and the whole netted ₱25,000. The 25-ton plant, consisting of a Huntington and a Lane mill, Deister tables, and cyanide plant, is in operation. A 100-ton mill is to be erected, and material is on the property.

Mexico

During April the El Oro mill treated 21,930 tons of ore and 14,930 tons of tailing, yielding $184,580. Expenses were $129,850, and the profit was $63,170, including $8440 from the railway.

Sonora

The Cinco de Mayo mine, belonging to Francisco H. Garcia, now provisional Huertista governor of Sonora, has been confiscated by the state of Sonora, which alleges that Garcia acquired this rich property through his personal relations with Porfirio Diaz and Luis E. Torres, a former governor of Sonora. The property is to be robbed of its rich ore and then either leased or sold. Sonora mining men have been advised from official sources that they shall pay their taxes to the Sonora government under protest, and the Mexican government will see that the taxes are only paid once, whoever might collect them. Disturbances around El Tigre have prevented development of the Temblor mine, which is said to be very rich.

Schools and Societies

THE UNIVERSITY OF NEVADA, Reno, held its commencement on May 14, with the usual speeches and conferring of degrees.

A BUREAU OF MINES has been established in connection with the mining department of the University of Arizona. This will deal with the mining, smelting, and geological problems of the state, and will also collect and publish statistics of all kinds relating to mines in Arizona.

THE ILLUMINATING ENGINEERING SOCIETY at Chicago held its regular meeting on May 14. 'Light and Art' was the subject discussed by M. Luckiesh, of the physical laboratories of the National Electric Lamp Association, Cleveland, Ohio. The lecture was illustrated by special apparatus, showing the relation of light to architecture and sculpture.

JUNIOR AND SENIOR STUDENTS of the mining department of the University of Idaho, under Messrs. McCaffery and Stewart, returned on April 29 to Moscow after a two weeks' inspection trip to the mines at Butte and smelter at Anaconda, Montana. Four graduates of the college holding responsible positions at the Anaconda works, showed the students around.

THE UNIVERSITY OF ILLINOIS' Transportation Building and Locomotive and Mining Laboratories, at Urbana, were dedicated on May 8. On the following day there were discussions on 'Modern Problems,' 'The Changing Character of the Problems of the Railroad,' 'Proper Aims in Training for Railway Service,' 'How Can the Technical School Help in the Solution of Railway Problems?', 'Research as a Factor in Railway Administration,' 'Conservation and Commercialism,' 'Organization as Affecting Mining,' 'Water-power *v.* Coal in the Production of Power,' 'The Future of Illinois Coal,' 'Illinois Mineral Producers,' 'Preparation of Coal,' 'Safety First,' 'Modern Practice in Illinois Mines as Illustrated by Some Recently Developed Mines,' and 'Fire Protection of Mines.'

THE UNIVERSITY OF CALIFORNIA held its annual commencement at the Greek theatre and campus, Berkeley, on May 14. A total of 725 students received degrees, as follows: Bachelor degree, 534; master, 90; doctor of laws, 12; doctor of philosophy, 10; and degrees to students of the Medical College in San Francisco, 88. Benjamin Ide Wheeler, president of the institution, delivered the annual address. A number of the faculty have resigned during the year, and in new appointments thirteen of the other universities in the United States have been drawn upon. The MacNamara Mining Co., of Tonopah, Nevada, has offered a mine model to the university. At the Commencement exercises it was announced that Mrs. George Williams Hooper, of San Francisco, had donated property valued at $1,090,000 to the university.

THE COLORADO SCHOOL OF MINES *Quarterly* consists of 144 pages, and gives details of the college calendar for 1913 and 1914, the 24 members of the faculty and 37 special lecturers, the history, organization, financial support, and location of the institution, and full particulars of the various courses. Candidates for the freshman class should have taken a thorough course of at least four years in a good high school, or in a manual training high school. Between May 26 and June 5 the summer work in surveying is done, and on July 14 the summer school begins. The academic year 1913-14 opens on September 2. The experimental ore-dressing and metallurgical plant was erected in 1912 at a cost of $75,000, and is 100 by 150 ft. in area, situated on the bank of Clear creek, near Golden. The power-plant consists of a suction-gas plant of 100-kva. capacity, the vertical 3-cylinder engine being direct-connected to an alternating-current generator. The water-supply is 20,000 gal., stored in a concrete-lined well. The treatment plant includes samplers, ore crusher, rolls, stamps, mills, tube-mill, tables, classifiers, and complete cyanide plant. The thirty-ninth annual commencement will be held on May 23 at the Simon Guggenheim hall. The annual address will be given by Dr. James Douglas. Seventy students, under G. W. Schneider, recently spent three days at Leadville studying geology and mining.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

E. S. BOALICH is at Los Angeles.

S. S. WYER has been visiting New York.

LEO VON ROSENBERG has been at Nevada City.

F. LYNWOOD GARRISON was in New York last week.

H. S. DENNY has returned to Mexico from London.

A. RADCLIFFE was in New York recently from Copiapo.

C. F. RAND has gone to Cuba but will return on May 26.

A. F. HOLDEN is critically ill at his home in Cleveland, Ohio.

S. S. CLARKE has been visiting zinc properties in northern Arkansas.

T. A. RICKARD has been lecturing at Harvard University this week.

F. H. MORLEY will reach New York May 24, returning from Europe.

H. KENYON BURCH left Miami on May 2 for a short trip to Los Angeles.

F. A. VOORHEES has removed to San Francisco from Bacis, Durango.

R. W. HUNT delivered an address at the University of Illinois recently.

HENRY B. HOVLAND, director of the Inspiration Consolidated is at Miami.

S. F. SHAW, superintendent at the Tiro General, Charcas, Mexico, is in New York.

R. C. GEMMELL is general manager for the Utah Power Co., succeeding D. C. JACKLING.

V. F. MARSTERS is at San Juancito, Honduras, Central America, on examination work.

GEORGE A. CAMPHUIS, on the staff of L. MAURICE COCKERELL, is at Orogrande, New Mexico.

HENRY H. ARMSTEAD, president of the Mexican United Co., has returned to New York from Mexico.

NORVAL J. WELSH is at Orogrande, New Mexico, as consulting engineer for the Otero Copper Company.

R. H. ELLIOTT has resigned as superintendent for the Liberty Bell G. M. Co., and removed to San Francisco.

W. G. RICE, president of the Superior & Boston, who has been at the property for some time, has left for Houghton, Michigan.

C. E. MILLS, general manager for the Inspiration Consolidated, is taking an extended trip to the principal mining centres of the United States.

L. MAURICE COCKERELL, of London, England, has recently been at Orogrande, New Mexico. He has established offices in the Mills building, El Paso, Texas.

SEVERUS JONES and GLENN NEWPORT, engineers for the Inspiration Con., left for Rhodesia, South Africa, on April 29 in the interest of the Guggenheim Exploration Company.

A. B. FOOTE has succeeded his father, A. D. FOOTE, as general superintendent for the North Star Mines Co. A. D. FOOTE will serve as consulting engineer. WILLIAM HAGUE will continue as managing director.

HUXLEY ST. JOHN BROOKS, having severed his connection with the Pereira Gold Mines, Macequece, Portuguese East Africa, has joined the metallurgical staff of the Machavie Gold Mining Co., Potchefstroom, Transvaal.

The Metal Markets

LOCAL METAL PRICES

San Francisco, May 15.

Antimony	12—12½c	Quicksilver (flask)	$40
Electrolytic Copper	16¼—16½c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES.

(By wire from New York.)

NEW YORK, May 14.—Copper is strong and large European orders have caused an advance. Calumet & Hecla is credited with having sold a large quantity of copper at 16c. during the week, and Lake is quoted generally at 15⅞ to 16c. per lb. The Amalgamated selling agency is quoting 15.90c. electrolytic, June and July delivery, and the A. S. & R., 15.95c. for any delivery. Exports for the week ended May 8 were announced as being 3627 tons, and since May 1, in round figures, 10,000 tons, aa against 8663 for the same days in 1912. London prices are firm. American agencies are quoted as asking £73 10s. for electrolytic. Lead remains unchanged and spelter is weak with pressure for sales much in evidence.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
May	8	April 16	59.80
"	9	" 23	59.77
"	10	" 30	60.56
"	11 Sunday	May 7	60.98
"	12	" 14	60.25
"	13		
"	14		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	59.25	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
May	8	April 9	4.30
"	9	" 16	4.33
"	10	" 23	4.39
"	11 Sunday	" 30	4.50
"	12	May 7	4.40
"	13	" 14	4.33
"	14		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
May	8	April 9	5.62
"	9	" 16	5.50
"	10	" 23	5.42
"	11 Sunday	" 30	5.36
"	12	May 7	5.31
"	13	" 14	5.28
"	14		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
May	8	April 9	15.17
"	9	" 16	15.37
"	10	" 23	15.44
"	11 Sunday	" 30	15.26
"	12	May 7	15.30
"	13	" 14	15.54
"	14		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
May	1912	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
April	1912	125,694,001	69,513,846	53,252,326
May	"	126,737,836	72,702,237	69,485,945
June	"	122,315,240	66,146,229	61,449,650
July	"	137,161,920	71,093,120	60,121,600
August	"	145,628,521	78,722,418	70,485,150
September	"	140,089,819	63,460,810	60,264,796
October	"	145,405,453	84,104,734	47,621,342
November	"	134,695,440	69,369,795	55,906,550
December	"	143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February	"	130,948,881	59,676,402	72,168,623
March	"	136,251,849	76,585,471	77,699,306

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending				Week ending		
April	16	41		April	30	41
"	23	41		May	8	40
				"	15	40

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	....	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

ALUMINUM

Announcement that the Aluminum Company of America is to undertake the construction of a plant for rolling sheet aluminum at Arnold, Pennsylvania, and the publication of the annual report of the Aluminum Industrie Aktien Gesellschaft of Neuhausen, showing that the profits of the business of that company permitted the payment of a 20% dividend this year, as compared with 14 last year, indicate the healthy state of the aluminum producing and manufacturing industry. The Swiss company, with its four plants, of a total capacity of over 15,000 tons annually, is the largest individual producer; the American company, operating two plants at Niagara Falls and another at Massena, New York, has a capacity of 13,000 tons, which will be greatly increased upon the completion of the new plant in Tennessee, already mentioned in these columns. The large and growing consumption of aluminum is a good example of the modern demand for metal.

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, May 14.
Associated Oil 5s	101¼
E. I. du Pont 4½s	83½
Natomas Con. 6s	94¾
Unlisted.	
Associated Oil 1st ref.	90
General Petroleum 6s	59½

Unlisted.	Closing prices, May 14.
Natomas Dev. 6s	100
Pac. Port. Cem. 6s	90
Riverside Cem. 6s	77
Standard Cem. 6s	91⅝
Santa Cruz Cem. 6s	85½
So. Cal. Cement	78

STOCKS.

Listed.	Closing prices, May 14.
Associated Oil	42¼
Amalgamated Oil	84½
E.I. du Pont Powder pfd.	88
Pac. Coast Borax, pfd.	100½
do com.	80
Pac. Crude Oil	25c.
Sterling O. & D.	1.00
Union Oil of Cal.	91½
West Coast Oil, pfd.	70

Unlisted.	Closing prices, May 14.
Mascot Copper	1
Noble Electric Steel	15
Natomas Consolidated	10
Pac. Coast Borax, old	206
Pac. Portland Cement	60
Riverside Cement	45
Standard Cement	18
Standard Oil of Cal.	187
Santa Cruz Cement	45

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 15.

Atlanta	$ .17	Mizpah Extension	$ .56
Belmont	6.25	Montana-Tonopah	1.50
Big Four	.60	Nevada Hills	1.05
Buckhorn	1.25	North Star	.60
Con. Virginia	.13	Ophir	.14
Florence	.45	Pittsburg Silver Peak	.52
Goldfield Con	2.05	Round Mountain	.54
Halifax	1.20	Sierra Nevada	.12
Jim Butler	.88	Tonopah Extension	2.55
Jumbo Extension	.22	Tonopah Merger	.94
MacNamara	.17	Tonopah of Nevada	6.00
Manhattan Consolidated	.07	Union	.14
Mexican	.75	West End	1.15
Midway	.49	Yellow Jacket	.16

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	May 15. Bid	Ask
Adventure	$ 1¼	1¾
Allouez	32	33
Calumet & Arizona	63	63¼
Calumet & Hecla	455	460
Centennial	12½	13½
Copper Range	42½	42¾
East Butte	11½	11¾
Franklin	5⅞	6
Granby	62¾	63
Greene Cananea	6⅝	6¾
Hancock	18½	19
Isle-Royale	21¾	22½
Mass Copper	3½	5

	May 15. Bid	Ask
Mohawk	$ 49	49½
North Butte	28	28¼
Old Dominion	46½	47
Osceola	81	82
Quincy	63½	65
Shannon	8	8¼
Superior & Boston	3	3½
Tamarack	27	28
U. S. Smelting	38¾	39
Utah Con.	7½	7⅝
Victoria	1	1½
Winona	1¾	2
Wolverine	50	51

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

May 15.

	Bid.	Ask.
Alaska Mex.	10⅜	11
Alaska Tread.	41⅜	43⅜
Alaska United.	21⅜	23⅝
Alaska G. M.	10⅝	11¼
Braden Copper.	7⅝	7⅞
B. C. Copper.	2⅞	3
Davis Daly.	2¼	2½
Dolores	2	4
El Rayo	1	2
First Nat.	1¾	2
Giroux	2	2¼
Green-Can.	6¾	7
Hollinger	17	18
Inspiration	16⅝	17¼
Iron Blossom	135	145
Kerr Lake	3⅛	3¼
La Rose	2⅝	2⅝

	Bid.	Ask.
Mason Valley	6	6½
McKinley-Dar.	1⅞	2
Miami 6s	168	173
Mines Co. Am.	2½	2⅝
Nipissing	8¾	8⅞
Ohio Copper.	¾	⅞
San Toy	18	20
Sioux Con.	2	5
S. W. Miami.	5	7
So. Utah	¼	⅜
S. O. Calif.	174½	176
Tri Bullion	⅛	¼
Tuolumne	2¼	2½
United Copper.	¼	¾
Wettlaufer	14	15
Yukon Gold.	2⅝	2¾

LONDON QUOTATIONS

(By cable, through the courtesy of Catlin & Powell Co., New York.)

	May 15. £	s.	d.
Alaska Mex.	2	11	3
Alaska Tread.	8	15	0
Alaska United.	4	15	0
Arizona	1	17	6
Camp Bird	0	18	9
El Oro	0	18	9
Esperanza	0	15	0
Granville	0	12	6

	May 15. £	s.	d.
Mexico Mines.	5	15	0
Messina	1	7	6
Oroville	0	7	6
Rio Tinto	2	0	0
Santa Gertrudis	1	6	3
Stratton's	0	2	6
Tanganyika	2	7	6
Tomboy	1	3	9

AUSTRALIAN

	May 15. £	s.	d.
Brit. Broken Hill.	1	17	6
Broken Hill Props.	1	17	6
Golden Horse-Shoe	2	12	6
Gt. Boulder Props.	0	11	3
Ivanhoe	3	7	6
Kalgurli	2	0	0

	May 15. £	s.	d.
Mount Boppy	0	17	6
Mount Elliott	5	5	0
Mount Lyell	1	5	0
Mount Morgan	3	10	0
Waihi	1	11	3
Waihi Grand Junc.	0	16	9

APRIL PRODUCTION OF THE PRINCIPAL COPPER MINES

	Pounds.		Pounds.
Ahmeek	1,503,535	Granby	1,806,452
Allouez	663,905	Greene-Cananea	3,581,691
Anaconda	7,324,880	Isle Royale	563,983
Arizona Copper		Moctezuma	2,753,249
Baltic	1,830,000	Mohawk	1,312,000
Boston & Montana	6,202,300	Miami	2,312,900
Butte Coalition	2,115,400	Nevada Con.	
Calumet & Arizona	5,756,000	North Butte	1,967,000
Calumet & Hecla.	5,048,812	Old Dominion	3,013,000
Centennial	213,580	Ray	
Champion	2,256,000	Superior	291,525
Chino		Tamarack	630,190
Copper Queen	7,079,600	Tennessee	
Detroit	1,856,517	Tri-Mountain	1,034,000
East Butte	1,073,600	Utah Copper	
Franklin	336,000	Wolverine	858,000

QUARTERLY REPORTS

The Utah Copper Co. reports for the quarter that ended on March 31, a total production of 23,884,467 lb. copper, a decrease of 1,045,183 lb. The net profit was $1,535,363, a decrease of $262,289; net surplus $348,735, a decrease of $267,629.

The Ray Consolidated Copper Co. produced 12,369,696 lb. copper at a profit of $678,875 in the first quarter of 1913.

The Chino Copper Co. reports operating profits of $778,804 for the quarter that ended on March 31.

The Mason Valley Mines Co. produced 29,707 tons of ore, yielding a profit of $73,517. The smelter treated 70,709 tons, including custom ore, which produced 6249 tons of matte, and 4,611,881 lb. of copper, during the quarter.

The Giroux Consolidated Mines Co., Nevada, produced 93,899 tons of ore, having a gross value of $351,660, during the first quarter of 1913. Operations left a deficit of $35,251, but later work has shown reduced costs.

NEW YORK MARKET NEWS

Report of the Anaconda Copper Mining Co. for the year ended on December 31, 1912, made public in New York this week, shows a surplus available for dividends of $15,856,335, an increase of $7,812,617. This is equivalent to $3.66 per share, as against $1.85 for the previous year.

The Calumet & Arizona regular quarterly dividend of $1.25 per share was announced May 5.

The Colorado Mines, Railways & Utilities Corporation has authorized conversion of the stock of the El Paso Con. G. M. Co., into stock of the Corporation. Appointments to the board of directors include: A. L. Burris; Albert Ehinger of Basle, Switzerland; H. W. Davis, Wilmington, Delaware; Jacob Halstead, New York; O. L. Hasey, Albany, New York; J. C. Helm, Denver; and G. N. Miller, New York. R. A. Parker was appointed engineer of mines, and W. H. Smith, secretary-treasurer.

LONDON SILVER SHIPMENTS

Far Eastern shipments of silver from London up to April 24 were £2,667,300, compared with £2,875,800 a year ago. India has taken more this year than last, the exports to that dependency being £2,501,300, compared with £2,245,800 in the corresponding period last year. China's shipments direct from London are still only £166,000, against £630,000 in the preceding year to date. Pixley & Abell report likewise that London stocks on April 24 were £3,500,000, those of Shanghai £4,360,000, and of Bombay £1,250,000, making a total of £9,110,000, not counting metal afloat. Sharps & Wilkins say: "The news of a probable settlement of a Chinese loan has imparted a better feeling to the market generally, and the tendency points to higher prices."

Book Reviews

ORE MINING IN MINNESOTA. By C. E. van Barneveld. P. 214. Index. University of Minnesota, 1913.

Probably in no other part of the United States has as much serious thought and attention been given to the mining of large ore deposits as on the Minnesota iron ranges. Beginning with the pick and shovel method on the Marquette range in 1855, mining methods have been developed, discarded, and improved until today, as a result of this evolution, we have in the Lake region, and on the Mesabi range in particular, what has come to be recognized as the standard method of open-pit mining, and for that variety of the caving system commonly known as 'top slicing and caving.' While the report under review is devoted exclusively to the practice on the iron ranges of Minnesota, the methods described are universal in their application to the mining of large deposits and Western members of the profession may well profit by the experience of the engineers in the iron districts of Minnesota. The introduction contains an interesting historical sketch of the development of the iron industry in the Lake Superior region from an annual production of 1449 tons in 1855 to the enormous figure of 493,000,000 tons, produced during the 55 years that ended on January 1, 1911.

An outline of the geology of the iron ranges is furnished by W. H. Emmons, who goes into detail concerning the formations of the Mesabi, Vermillion, and Cuyana ranges. The character and genesis of the iron ore is also discussed. The chapter devoted to prospecting takes up the various types of equipment employed for this work, giving details as to the operation of churn and diamond-drills, together with sampling methods, and the speed and cost of drilling with the different classes of drills. The method of estimating ore presents some interesting problems, and the computations entering into the estimate are given, together with maps showing all of the data for the construction of cross-sections and the estimation of ore reserves. The description of the mining methods used is complete in every detail and is presented in an interesting and instructive manner. The orebodies of the district may be roughly divided into two classes—those requiring underground methods, and those susceptible of being stripped and mined with steam-shovels. At the present time it is believed that fully one-half of the known reserves of the district must be mined by underground methods. Toward this end, various methods of development and mining have been tried, culminating in the present practice, which is conceded to be the most economic as well as the safest for the mining of large ore deposits. The present-day underground method, which has become standard for working this type of deposit, is known as the 'top slicing and caving' method, locally called 'slicing.' It has made possible the safe mining of ore in quantities undreamed of by the miners of former generations on the iron ranges. The details of the 'slicing' method are illustrated by means of photographs and diagrams showing the methods of mining and timbering as employed in the working of these deposits. One of the most valuable features of the work is the compilation of the costs of the many operating details, here published for the first time. Other data as to contract labor, men employed, tonnage developed and mined, together with itemized statements of costs in all departments of the work, present an interesting subject for study and shows what is being accomplished with the mining methods in use.

On the Mesabi range the shafts are shallow. Comparatively little hard rock is encountered and no deep sinking problems are involved. The main troubles occur in sinking through the surface to the solid rock. In sinking through loose sand, loose gravel, silt, and quicksand, where it has been necessary to support the ground ahead of the excavation, special problems have arisen and these, together with the methods used when sinking in firm ground, are described in detail. Methods of timbering are explained with diagrams, and costs are given for the different types of construction. The steel shaft sets employed in the district are also illustrated, and the cost of manufacture and placing is given. One of the difficulties which the underground mines have to contend with occasionally is a wet heavy overburden consisting of boulders and quicksand. Between the ore and the overburden there is often a capping of impervious clay that prevents a thorough draining of the ground above. Consequently, when the roof is dropped, sudden heavy rushes of quicksand are apt to come in. Problems such as this are numerous in the operation of the wet mines, and as to their solution and its cost, valuable information is given. A table of the underground mining costs at one of the representative properties on the Mesabi range shows in detail how it has been possible to mine large tonnages at a cost of 0.773c. per ton.

Open-pit mining is largely a problem in civil and mechanical engineering, and the methods employed and equipment used is discussed in detail together with the costs incurred in all departments of the work. The 'milling system,' which is a combination of stripping and underground mining, has been found to be advantageous under certain conditions. This method presents interesting features, which are fully illustrated, and which prove the method to be ideal in the working of a medium size orebody that would pay to strip, but would not admit of economical locomotive haulage of the ore. The cost of pit equipment at open-pit mines, including buildings, shops, equipment, steam-shovels, locomotives, stripping cars, a wrecking crane, and track is important, and a number of pages have been devoted to actual figures. Examples of open-pit mining are given in a detailed account of the mining operations at the Biwabik mine, Shenago mine, and Stevenson mine. The western Mesabi orebodies resemble those of the central and eastern parts of the Mesabi range in shape, size, and general structure. There is, however, an important difference in the character of the ore. For purposes of comparison the western deposits have been called 'washable orebodies,' and the central and eastern, 'standard orebodies.' The latter ores are merchantable and can be shipped direct. Western Mesabi or washable ores must be treated in order to make them ready for the market. The milling process at the Trout Lake concentrator, which is one of the most representative mills of the district, is described, with illustrations of the mill showing the arrangement of the machinery. The work closes with a discussion of the mining methods employed on the Vermilion range. Development and mining methods, with details as to the cost of the different operations on this older range, are given. As a whole, the book is the most important and comprehensive account of mining methods in the Lake Superior region yet published. It represents several years' work and is an excellent example of the work now being done in those schools where the professors do not cease to be mining engineers when they become teachers.

RESUSCITATION. By Charles A. Lauffer. 47 pages. Illustrated. John Wiley & Sons, New York, 1912. For sale by the *Mining and Scientific Press*. Price, 40 cents, postpaid.

This little book is a presentation of the 'prone pressure' (or Schaefer) method of resuscitation from electric shock, traumatic shock, drowning, or asphyxiation. As the author very properly points out, it is only by prompt application of artificial respiration that life may be saved, and in order to assure such promptness it is essential that the great mass of workmen and the public in general be trained in its principles. The book under review should do much toward disseminating such knowledge and seems to meet all the requirements of such a manual. The prone pressure method is a one-man method, and requires no equipment other than the hands of the operator.

GREENE-CANANEA COPPER CO. passed the dividend due May 1 owing to the unsettled condition of affairs in Mexico. The last disbursement was 45c. per share, made on February 28.

THE LUCKY TIGER-COMBINATION G. M. Co. is paying regular monthly dividends of 5c. per share; not 3c. as stated in our issue of May 3.

Company Reports

TEMISKAMING MINING COMPANY, LTD.

This company has a mine and 40-stamp mill at Cobalt, Ontario, and the report of the general manager, Norman R. Fisher, covers the year that ended on December 31, 1912. Mining and development covered 4645 ft., making a total of 12,810 ft. to date. The main shaft was sunk to 664 ft., and at 650 ft., a level was opened, on which 324 ft. was driven in diabase formation. Prospecting was generally unsatisfactory. On the 300-ft. level a vein of smaltite-niccolite, low in silver, was recently cut, and from its character may expose a good shoot of ore. On the 650-ft. level, in the diabase, and 40 ft. below its contact with the overlying Keewatin formation, a 3-in. vein has been opened for 30 ft., and several lenses contain rich ore. The 575-ft. level crosscut is out 640 ft., and only one vein was cut, 1 to 2.5 in. wide, of high-grade ore with considerable milling ore contiguous. Stoping during the year totaled 314,385 cu. ft., and ore mined and raised, 31,449 tons, at a cost of $5.28 per ton. The lineal feet broken in drifts and cross-cuts per drill-shift was 1.23 ft., and an average of 3.64 ft. per hour was attained in drilling. The mill treated 40,056 tons of 22.6 oz. of silver ore, yielding 744,370 oz., with an extraction of 82.1%, at a cost of $1.72 per ton. Concentrate produced totaled 890 tons, averaging 836 oz. per ton, marketed at a cost of 1.12 per ton milled. The ratio of concentration was 45 into 1. The smelter paid for 16,037 lb. of copper, the first time in the history of Cobalt that this metal has been produced in commercial quantity. The mill has now produced 1,824,016 oz. silver in 2.75 years. There was 114 tons of ore, averaging 4360 oz. per ton, shipped, making the year's production 1,242,243 oz., a total of 6,433,636 oz. to date. The year's income was $776,075, expenditures $362,459, net profit $413,616, dividends $300,000, and a surplus of $590,592, the latter now totaling $1,309,155. The report concludes by saying that the occurrence of ore in this mine is so erratic that, even if it is not found during the driving of levels, all the intervening country between these must be opened by raises and sub-levels before its true value can be safely determined.

CALUMET & HECLA MINING COMPANY.

This is the largest copper company in the Lake Superior district, and has an interest in the following companies:

Name.	Shares issued.	Held by Calumet & Hecla.
Ahmeek Mining Co	50,000	24,200
Allouez Mining Co	100,000	41,000
Centennial Copper Mining Co	90,000	41,500
Cliff Mining Co	60,000	19,400
Gratiot Mining Co	100,000	50,100
Isle Royale Copper Co	150,000	30,500
La Salle Copper Co	302,977	152,977
Laurium Mining Co	40,000	37,550
Osceola Consolidated Mining Co	96,150	32,750
Seneca Mining Co	20,000	11,207
Superior Copper Co	100,000	50,100
Tamarack Mining Co	60,000	19,400
White Pine Copper Co. (common)	85,320	43,202
White Pine Copper Co. (preferred	6,092	6,092

During 1912 the stamp-mills treated 2,806,610 tons of 'rock,' which yielded 67,856,429 lb. of copper, at a cost of 9.86c. per pound, against 8.52c. in 1911, the principal reason for this increase being due to a 10% rise in wages to employees from May 1, 1912. The average price received for copper was 16.65c. per pound, and $42 per share was paid in dividends. At the end of the year the company had cash and quick assets over liabilities of $10,716,413, equal to $100 per share of the capital stock. After two years of experimenting with various types of drilling machines, the Leyner-Ingersoll one-man drill was adopted, and is being placed in service as fast as practicable, resulting in a decrease in breaking costs. At the old re-grinding plant 481,320 tons of coarse tailing recovered from Torch lake by dredging was treated, producing 2,155,292 lb. of copper at a cost of 4.99c. per pound. The foundations and nearly all steel work for the new re-grinding plant, 123 by 432 ft., has been completed. Exhaust steam from the stamp-mills is conducted by pipe, 8 to 36 in. diam., and 1700 ft. long, to the new turbo-generator plant.

Production from the more important of the subsidiary companies was as follows:

	Ahmeek.	Isle Royale.	Osceola.	Superior.
Copper product'n, lb.	15,950,492	8,186,957	18,413,387	3,921,974
Yield per ton, lb.	25.2	15.4	14.8	.....
Price received, cents.	16.61	.....	.....	.....
Cost per lb., cents.	7.85	11.89	10.36	12.75
Total receipts	$2,757,577	.....	.....	.....
Profits	1,465,370	$430,045	$1,163,289	$182,473
Dividends	1,100,000	.....	.....	.....

ANACONDA COPPER MINING COMPANY

This company, whose report covers the year ended December 31, 1912, operates the following in Montana: 2138 acres of mining property at Butte, concentrating and smelting plants at Anaconda, smelter at Great Falls, coal mines at Belt, and large timber reserves; also coal mines in Wyoming. The year's results may be summarized as follows:

Ore mined, tons	4,576,289
Precipitate from mine-water, tons	3,667
Reduction works' operations:	
Anaconda treated ore and other material, tons.	3,880,203
Copper produced, pounds	222,763,670
Gold, ounces	52,564
Silver, ounces	9,702,604
Great Falls treated ore and other material, tons	1,189,039
Copper production, pounds	71,710,491
Gold, ounces	8,750
Silver, ounces	1,312,132
Total production:	
Copper, pounds	294,474,161
Gold, ounces	61,314
Silver, ounces	11,014,736
Customs ore treated, tons	581,031
Revenue from copper, gold, and silver	$51,723,032
Income from miscellaneous sources	643,625
Total	$52,366,657
Mining expenses, including development	$16,905,772
Ore transport	1,381,810
Treatment	8,863,801
Metal freight to East	3,730,455
Administration	394,063
Ore purchased, etc.	4,836,823
Depreciation	1,009,453
Total	$37,123,177
Dividends paid	$10,831,250
Surplus for year	5,025,085
Final surplus, including railway dividends and previous surplus	8,695,173
Metals on hand	$14,895,384

TRINITY CONSOLIDATED HYDRAULIC MINING CO.

This company operates gravel mines at Douglas City, Trinity county, California, and this is the first annual report covering the year ended November 30, 1912. The report of the general manager, D. W. Shanks, gives the following information: The property is divided into two groups, the Union Hill of 1941 and the Hupp of 399 acres. Of the former group, only the Union Hill has been developed and equipped. Water is brought from Grass Valley creek, a tributary of the Trinity river, to a point 450 ft. above bedrock at the mine. The ditch is 12 miles long, and has a capacity of 4000 cu. ft. per minute, and the total system cost $250,000. The entire property is lighted by electricity, generated by the company. The Hupp group contains some of the oldest mines in the Weaverville district, and the Five Cent gulch and Brown's Ranch are being

operated. Water is brought from East Weaver creek, and there are 160 acres of good timber for the mines. Last season there was no water in November or December, and a full supply was not running till May, the season being the driest recorded for 30 years.

At the Union Hill section the old channel is 1400 ft. wide and from 50 to 120 ft. deep, the 5 to 15 ft. of gravel next to bedrock carrying practically all the gold. The banks of gravel are sluiced and the material carried in ditches 500 to 1500 ft. long to a shaft, which connects with an 1100-ft. tunnel driven through the ridge and discharging into the Trinity river. In the tunnel, for its entire length, are sluice-boxes for recovering the gold. The mine is worked 3 to 18 hours per day, and there are no large boulders to hinder operations. The average depth of gravel in Five Cent gulch was 9 ft., and 250 ft. wide, without any overburden. At Brown's ranch the gravel is tough, and needs constant blasting, and with a head of 165 ft. with 1000 in. of water available, it is not possible to move a large quantity, the average depth being 10 ft. The year's results were as follows:

Gravel sluiced, cubic yards	830,000
Gold recovered	$48,272
Value per yard, cents	5.83
Operating cost per yard, cents	3.11
Total cost per yard, including office expenses, cents	4.88
Net earnings	$7,705
Interest on debts	$13,973
Deficit	$6,268

NIPISSING MINES COMPANY.

This company operates valuable silver-producing properties, and low and high-grade treatment plants at Cobalt, Ontario, and the report to hand covers work during the year ended December 31, 1912. The report of the general manager, R. B. Watson, gives the following information:

Mine development, feet	13,020
Stoping done, cubic yards	15,764
Ore reserves:	
High-grade (containing 5,491,343 oz. silver), tons	3,304
Low-grade (containing 4,151,995 oz. silver), tons	185,173
Production of silver from individual veins in 1912:	
No. 63, 108, 148, and Little Silver, ounces	743,657
No. 64, ounces	268,627
No, 73, 80, and 100, ounces	3,264,126
No. 122, ounces	364,401
No. 128, ounces	26,622
No. 133, ounces	20,828
Total	4,688,261

Surface prospecting was done by hydraulic methods, and during the season 33.2 acres of ground was cleared, the average depth of soil being 4.75 ft., and a good number of veins was exposed, one near No. 92 producing 27,000 oz. by open-cut work. The area lying north of the town of Cobalt continues to be the most productive of the company's property, yielding 75% of the year's total. Workings on veins 64, 73, 80, and 100 are connected underground, the main working shaft being at vein 73, where all the ore is delivered to the aerial tramway. No. 73 vein developed well at depth during the year, and on No. 3 level the shoot had been proved for 600 ft. in length, while starting at the Trethewey line, a continuous orebody lying parallel to the Keewatin contact has been opened for a total distance of 1050 ft. Ore reserves in this vein contain 2,652,000 oz. in high-grade, and 909,000 oz. of mill ore. No. 100 vein was considerably prospected, and ore reserves contain 1,600,000 oz. Work on No. 64 was confined mostly to sinking the main shaft, which was 585 ft. deep on March 1, 1913. All the ore produced came from the conglomerate. Development of No. 122 was not favorable. The new low-grade mill, costing $325,000, was started in November, and during February 1913 it treated 200 tons of ore per day. Treatment consists of the following: Forty 1500-lb. stamps, four 6 by 20-ft. tube-mills, six Dorr classifiers in closed circuit with the tube-mills, agitators, vacuum-filter, and precipitation of the silver by aluminum dust. The precipitate from the press contains 93% silver, and in one operation bullion 999 fine is produced. The high-grade mill has been described in *The Mining Magazine* of June 1912 and the *Mining and Scientific Press* of January 4, 1913.

The financial results of the year's operations of the company are as follows:

Ore treated and shipped, tons	1,851
Ore treated by high-grade mill (2212 oz. per ton), tons	1,752
Gross contents of ore production, ounces	4,719,578
On hand at December 31, 1912, ounces	712,798
Total	5,432,376
On hand at December 31, 1911, ounces	744,116
Production in 1912	4,688,260
Average price received per ounce, cents	61.46
Gross value received from silver and cobalt	$2,896,990
Total cost of production	815,280
Net	$2,081,710
Dividends paid in 1912	1,800,000
Dividends paid to date	9,540,000
Ore production to date, tons	26,321
Silver contents, ounces	27,741,248
Value of silver, cobalt, nickel, and arsenic	$15,833,607
Net value received	14,648,442
Cash in banks at December 31, 1912	921,343
Ore and bullion	586,663

IVANHOE GOLD CORPORATION, LTD.

This is one of the most important and profitable concerns operating at Kalgoorlie, Western Australia, and since 1897 has produced 2,522,852 tons of ore yielding $33,791,000, and paid $14,880,000 in dividends. During 1912 operations resulted in the following:

Mine development, to 2720 ft. depth, feet	3,602
Ore reserves, to 2420 ft. (East lode, 809,174 tons), tons	1,080,850
Average value per ton	$9.74
Ore treated, tons	237,266
Value of gold (110,439 oz., and silver 23,263 oz.)	$2,240,000
Profit	960,000
Dividends paid	912,000
Investments at December 31, 1912	840,000
Expenditure to date on plant (including development, $2,400,000)	4,400,000

The report of the general manager, R. B. Nicholson, shows that development on the lowest levels has been of an unsatisfactory nature, low value of the ore in north drifts below the 2270-ft. level having been associated with a bar of graphitic slate. On the 2420-ft. level the East lode north drift was extended to 477 ft. from the east cross-cut, and up to 366 ft. graphite was opened, with low-grade ore; then 366 to 423 ft. the average was $9.12 over 72 in. width, followed by valueless ore. Cross-cuts in other sections cut bands of graphite. The south drift was extended to 509 ft., in ore averaging $3.96 per ton over 72 in. At 2570 ft. depth the cross-cut at 307 ft. east cut the East lode, which was 24 ft. wide, worth $3.42 per ton. The north drift opened ore valued at $5.60 to $4.08 per ton. A fault was met with 96 ft. south, and also in the east cross-cut, striking northwest and dipping east, but did not disturb the lode. At 2720 ft. the main east cross-cut was driven 42 ft. from the shaft, including the chamber, which is 29 ft. long by 12 ft. high by 19 ft. wide. The main shaft is 2754 ft. deep and is to be sunk deeper. Four lodes are worked in this mine, namely, the East, Middle, New, and Boulder, their respective reserves being 809,174, 193,824, 53,936, and 23,916 tons of ore. The report is accompanied by the usual detailed costs, and five mine plans.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

CUPELS made at the United States mints during the fiscal year 1912 totaled 70,000.

TRAMMING COSTS at the Bunker Hill & Sullivan mines, where an electric line handled 701,620 tons of ore during the past 19 months, were 7.4c. per ton.

PRECIPITATION of silver from cyanide solutions in the low-grade mill of the Nipissing Mines Co., Cobalt, is effected by aluminum dust, hitherto not largely used for this purpose.

ELECTRIC LOCOMOTIVES were installed during 1912 on the 1800, 2000, 2200, 2400, 2600, and 2800-ft. levels of the North Butte mine, resulting in large economy in hauling ore, mining timber, and waste used for filling stopes.

AVERAGE WIND VELOCITIES at Ancon, Cristobal, and Culebra, in the Panama canal zone, have been determined to be 25.5, 28.6, and 31 miles per hour, respectively. Wind movements do not vary much, and there is no record of a storm of cyclonic dimensions ever having visited the isthmus.

CHEMICALS consumed by the mines of South Africa during 1912 were: chemicals and assay requisites, $920,000; cyanide, 11,677,925 lb., costing $2,200,000; lime, 521,452 bags, costing $595,000; mercury, 3291 flasks (75 lb. each), costing $140,000; and zinc and zinc discs, 9,521,747 lb., worth $800,000.

FLUE DUST at the Copper Queen smelter was reduced from a maximum of 8.87% per ton of charge in June 1912 to 2.72% per ton in December, by deflecting the fumes from the converters from the cupola dust-chambers, and also by the fact that when the reverberatory plant was started the fines were sent to that department.

GOLD AND SILVER used in the industrial and fine arts in the world during 1911 amounted to gold worth $164,272,000, and silver 143,768,500 fine oz. Of these totals Asia used gold worth $50,000,000, United States $31,439,300, United Kingdom $18,000,000, France $17,501,000, and Germany $15,536,000, while Asia used 66,371,000 oz. silver, United States 29,897,000 oz., United Kingdom 12,000,000 oz., Germany 10,000,000, and France 7,544,500 ounces.

SURFACE PROSPECTING at the Nipissing mine, Cobalt, is done by means of hydraulicking. During the 1912 season 33.2 acres of ground was thus cleared, the average depth of soil being 4.75 ft. Pressure is obtained by a turbine pump, situated on the shore of Cobalt lake, direct-driven by a 650-hp. high-speed motor, which throws through a 3.5 or 4-in. nozzle, 4800 gal. of water per minute at 121 lb. pressure at the nozzle. This plant worked from May 8 to November 29, 1912, for 16 hours per day. The surface of the rock is exposed, and any veins outcropping can be easily seen. The cost during the term was $19,293.

ACTION OF OXIDIZERS in cyaniding is not thoroughly understood. Morris Green, of Johannesburg, suggests that the addition of potassium permanganate, not in excess, is useful not so much in oxidizing reducing matter as in yielding a solution which dissolves the gold content of the charge more readily. Experiments proved this idea to be quite fallacious. Potassium ferricyanide is a well known oxidizer, but its reaction with potassium cyanide and other substances involved in cyaniding, appears to be quite unknown. A pure solution of ferricyanide in water is found to have no action on gold. The addition of the salt to a cyanide solution always accelerated the rate of solution of gold in the latter, but eventually destroys potassium cyanide, and introduces reducing matter into the solution; but notwithstanding this, its presence causes gold to dissolve more rapidly. The assistance given by oxidizers in the dissolution of gold is of a secondary nature. Unlike free oxygen, oxidizers do not retard dissolution. Potassium nitrate, bichromate, and chlorate were found to be without influence upon the solubility of gold in cyanide solutions.

A SHAFT-SINKING RECORD was made by the Springfield Tunnel & Development Co., two miles from Columbia and a half mile from Springfield, Calaveras county, California, in March of the current year. From February 25, at 7 a.m., to March 27, at the same hour, a 3-compartment shaft 6.5 by 17 ft. outside of timbers, was sunk 195.5 ft. in lava breccia for 185 ft., which was hard to drill but broke well, the remainder of the distance being in slate, in which good progress was made. Four men were working each shift, making 12 per 24 hours, using two Damas machine-drills and a 1-ton skip. The men did all timbering and 'mucking'; timber being 8 by 8 in. square.

TRANSPORT OF ORE at the Belmont mine to the mill storage-bins is by means of a Hunt automatic railway, which is so entirely automatic in its operation that it requires no attention whatever from the time of starting with its load until the car returns ready for another load. One man only is needed to operate this railway, who loads the car from the bins by means of air-operated gates, and starts it. The two-ton car runs down the track, dumps its load into either mill-bin, and returns to the starting point, the workman not accompanying the car. A second Hunt railway, with 1½-ton car, handles waste by the same system, the car of this railway dumping at and returning from the waste-dump, about 470 ft. from the waste-bins at the shaft. These railways, especially the shorter ore railway, have, on account of the speed at which the cars run, a capacity greatly in excess of any possible tonnage they might be called upon to handle.

CONCENTRATION at the Bunker Hill & Sullivan mills, covering treatment of 697,560 tons during the past 19 months, and concentrating 7.26 tons of crude ore into 1, produced the following results:

Concentrate produced, first class, tons	65,960
Concentrate produced, tailing, tons	1,123
Middling produced, tons	890
Slime produced, tons	28,030
Tailing, tons	601,556
Metal contents of products:	
Lead total, pounds	103,592,150
Silver total, ounces	1,868,351
Average extraction:	
Lead, per cent	79.58
Silver, per cent	73.86
Total metal production with shipping ore:	
Lead, pounds	106,872,886
Silver, ounces	1,923,477

COAL-MINE ACCIDENTS during 1912, according to F. W. Horton of the U. S. Bureau of Mines, resulted in the death of 2360 men, on an output of 550,000,000 short tons mined by 750,000 men, making a death rate of 3.15 per 1000 employed; the lowest since 1899. This general improvement has been brought about by a combination of causes, the principal one of which has been more efficient and effective mine inspection on the part of the state mining departments and state mine inspectors throughout the country, supplemented by greater care on the part of both the operators and the miners. The investigative and educational work of the Bureau of Mines has kept both the operator and the miner alive to the various dangers connected with coal-mining and has shown what precautions should be taken to avoid these dangers. The Bureau is therefore gratified with the improvement shown, particularly as the greatest improvement relates to dangers concerning which the Bureau has been conducting special investigations. The Bureau of Mines officers strongly express their appreciation of the coöperation of the state mining officials and the operators in the work of making coal-mining safer.

Recent Publications

Gold of the Klondyke. By J. B. Tyrrell. Reprint from the *Transactions* of the Royal Society of Canada. P. 31. Ill. Ottawa, 1912.

Radium. Vol. 1, No. 1. P. 14. Ill. Radium Publishing Co., Pittsburgh, Pennsylvania. April, 1913. A new monthly journal dealing with the source of uranium ores, notes on radium, and the latest investigations.

Underground Water Resources of the Coastal Plain Province of Virginia. By Samuel Sanford. Bulletin No. 5. Prepared in coöperation with the U. S. Geol. Survey. P. 361. Maps, charts, index. Virginia Geological Survey. Charlottesville, 1913.

Bureau of Mines publications, Washington, 1913:

Metal-Mine Accidents in the United States in 1911. Compiled by Albert H. Fay. Technical Paper 40. P. 54.

Coal-Mine Accidents in the United States, 1896-1912. With monthly statistics for 1912. Compiled by Frederick W. Horton. Technical Paper 48. P. 74. Ill.

Selection of Explosives Used in Engineering and Mining Operations. By Clarence Hall and Spencer P. Howell. Bulletin 48. P. 50. Ill.

Commercial Trend of the Gas Producer in the United States. By R. H. Fernald. Bulletin 55. P. 92. Ill.

National Mine-Rescue and First-Aid Conference at Pittsburgh, 1912. By H. M. Wilson. Bulletin 62. P. 74.

Wastes in the Production and Utilization of Natural Gas, and Means for their Prevention. By Ralph Arnold and F. G. Clapp. Technical Paper 38. P. 29.

Flotation Processes. Abridgements of the Australian patents and other details. Compiled by P. M. Newton. P. 18. *Mining and Engineering Review*, Melbourne, Victoria, 1911. This is an interesting and valuable little publication, dealing with important methods of recovery of metals from ores by flotation. Increased interest is being taken in these processes since they have been so successful with the complex silver-lead-zinc ores of Broken Hill, the copper ores at Cobar and Great Fitzroy, the Braden in Chile, Sulitjelma in Norway, and others, the good results obtained and the plant to be erected at the Inspiration mine, Arizona, and experimenting in other districts of the United States. Until recently there was a great deal of litigation in connection with flotation patents, and this pamphlet covers in brief an outline of the principal patents of the 70 registered in Australia. This brings the matter up to date, and later patents may be added to the book by those who are interested.

U. S. Geol. Survey geologic atlas (Washington, 1912):

Kenova Folio. (Kentucky, West Virginia, Ohio.) By W. C. Phalen. No. 184. P. 22. Ill., maps, chart.

Apishapa Folio. (Colorado.) By George W. Stose. No. 186. P. 18. Ill., maps.

U. S. Geological Survey bulletins, Washington, 1913:

Portland Cement Materials and Industry in the United States. By Edwin C. Eckel. With contributions by Ernest F. Burchard and others. No. 522. P. 401. Maps, index.

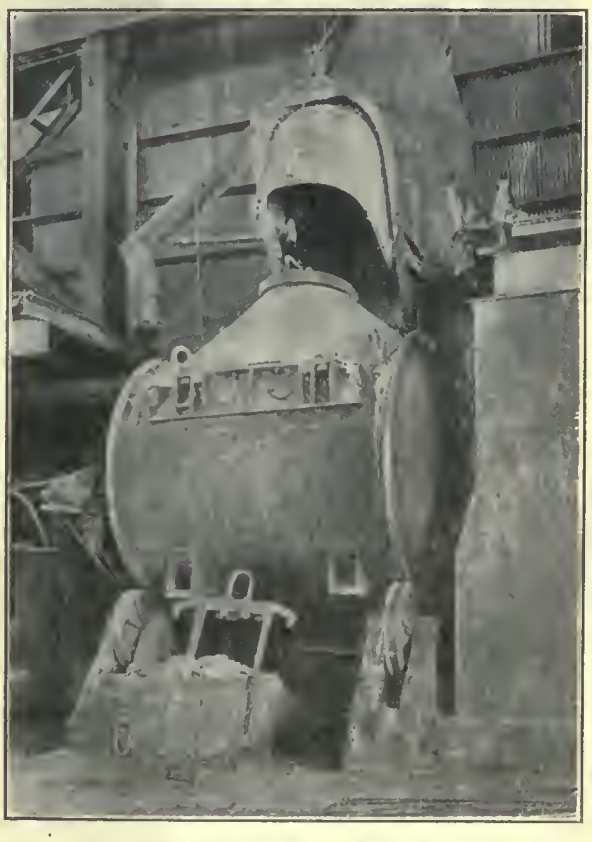
Contributions to Economic Geology, 1911. Part I. Metals and non-metals, except fuels. Waldemar Lindgren, chief geologist. No. 530. P. 400. Ill., maps, index. In this publication there are papers on gold and silver by D. F. MacDonald, W. H. Emmons, E. S. Larsen, J. B. Umpleby, F. C. Calkins, E. L. Jones, Jr., F. C. Schrader, and J. M. Hill; on copper by F. L. Ransome; on rare metals by F. L. Hess and T. L. Watson; on aluminum ores by E. S. Larsen; on structural materials by G. W Stose; on phosphates by A. R. Schultz, R. W. Richards, and J. T. Pardee; on salines by H. S. Gale, W. C. Phalen, and R. B. Dole; on sulphur and pyrite by F. L. Hess, D. F. Hewitt, E. S. Larsen, and J. F. Hunter; and on miscellaneous non-metallic products by W. T. Lee and D. B. Sterrett.

Operating Copper Converters by Electric Motors

By G. B. Rosenblatt

The use of electricity for operating copper converters is coming more and more into vogue in progressive smelters throughout the West, supplanting to a great extent hydraulic operation which used to be the rule in the old days. Electric driving has proved so satisfactory that many installations have been made with converters of all sizes. The largest converter at present electrically operated is the one of 250 tons' capacity recently constructed at the Great Falls plant of the Anaconda Copper Mining Co. The converter proper, not including bearings and gears, weighs about 65 tons, and will take approximately 50 tons of charge. This converter is to be operated by a 100-hp. Westinghouse, type 'MC', direct-current motor.

The first converters to be electrically driven were



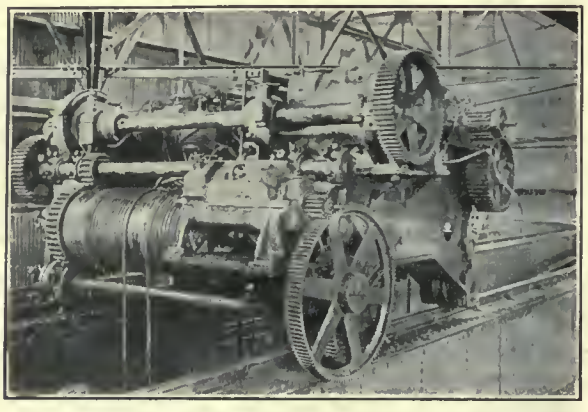
CONVERTER AT I. S. & R. PLANT.

equipped with direct-current motors, but an entirely satisfactory alternating-current motor has now been developed for this service, and a number of installations of this type have recently been made which have proved entirely satisfactory. With either direct or alternating-current motors, the most approved practice is to gear the motor to a jack-shaft which in turn drives the large gear on the converter proper through a worm-gear. This prevents any slippage and eliminates the possibility of the converter pulling the motor past any position desired. Motors for this work are usually totally enclosed so as to make them dust-proof, but in some of the more modern installations it has been the practice to install the motor alongside the converter in a sheet-iron housing of its own, in which case, while there is no disadvantage in having a totally enclosed motor, absolute dust-proofing is not altogether necessary. The accompanying illustration shows a barrel-type converter with basic lining, at the plant of the International Smelting & Refining Co. at Tooele, Utah. A totally enclosed Westinghouse motor is used, but installed in the housing shown at the right of the converter. The type of motor used is the same as that shown in the illustration covering the converter crane.

The chief advantage of motor operation over hydraulic

operation is the smoothness of the motion. The converter starts gently, without halt or jar, and this is bound to increase materially the life of the lining. Smoothness of operation is of particular importance with quartz-lined converters, but is not to be disregarded in the operation of basic-lined machines. The smoothness and ease of motor control also obviates much of the danger from the splashing of molten charge within the converter. An electric brake is usually attached to the motor, and is applied automatically whenever the current is shut off from the motor. It holds the converter dead even in case of failure of power, and makes an entirely satisfactory accessory.

Motors for converter service are usually built with slightly special characteristics. Absolute reliability is of prime importance, as the converter operation must not be interrupted. To secure this, a strong and rugged construction is employed similar in many respects to that employed for motors used in steel mills. A high overload capacity



MOTOR-DRIVEN CRANE.

is provided to take care of emergencies, and the installation is designed to withstand high temperature, so that even a splash of molten metal from the converter mouth on the motor will not burn it out. Totally enclosed dust-proof construction is recommended, but is not an absolute requirement when a separate housing is used over the motor. Ease of inspection or repair in case of some accident should be given great consideration, and these motors for converter service are therefore usually built so that any part can be quickly and efficaciously removed and substituted.

The best practice is to equip the cranes for charging and handling the converter with the same type of motor equipment that is used to operate the converter proper. These motors on the cranes are subjected to much dust, fumes, and high temperatures, so that the rugged construction of the converter motor is not at all out of place. Further, the use of identical motors on the crane and on the converter simplifies the matter of spare parts, an advantage by no means to be overlooked when the absolute necessity of keeping things moving is considered.

A Locomotive Takes an Auto Ride

The International Motor Co. has designed a special type of Saurer truck which has been equipped with certain features, such as very high wheels for sandy country, large radiator capacity, and large reserve oil tank capacity. This Saurer truck has solved some of the most difficult problems of the copper and silver mines in the arid country of the Southwest. About one year ago one of these mining trucks was purchased by the Quenelda Graphite Co. in Clay county, Alabama. J. Warren May, general manager for this company, recently gave the operating conditions and the economy of this truck over the former method of transportation. Quoting Mr. May, he says: "I do not permit our driver to overload. He usually brings four tons of coal and takes four tons of metal, making two trips daily. The comparison of cost of truck with horse teams is as follows: It cost us 10c. per 100 lb. or $2 per ton while we were using teams. In other words, to haul 16 tons daily the cost was $32. The up-keep of truck in the past year, including drivers and helpers, repairs, gasoline, tires, etc., figured about $9 per day. In other words, where we payed $2 per ton for hauling, it now costs us about 50c. When we had a locomotive to bring out and could find no wagon to haul it—shipping weight being 1600 lb.—we loaded it on the truck, which never faltered or stopped once. It hauled the engine over 12% grades for nine miles in three hours. It is needless to say we are well pleased."

Catalogues Received

Joseph Dixon Co., Jersey City, New Jersey. Booklet, 'Graphite for the Boiler.' 16 pages. Illustrated. 3 by 6 inches.

National Tube Co., Pittsburg, Pennsylvania. New edition, 'Matheson' Joint Pipe Booklet. 40 pages. Illustrated. 8 by 10 inches.

C. O. Bartlett & Snow Co., Cleveland, Ohio. Bulletin No. 40, 'Garbage Disposal Machinery.' 20 pages. Illustrated. 6 by 9 inches.

Hyatt Roller Bearing Co., Newark, New Jersey. 'The Hyatt Way,' for May, special Hockensmith number. 8 pages. Illustrated. 6 by 9 inches.

Alberger Pump & Condenser Co., 140 Cedar St., New York. Bulletin No. 100, 'Hammond Water Heaters.' 8 pages. Illustrated. 8 by 11 inches.

Power & Mining Machinery Co., Cudahy, Wisconsin. Bulletin No. 42, 'Crushing Rolls.' Bulletin No. 44, 'Superior Jaw Crushers.' Bulletin No. 48, 'Sampling Machinery.' All Illustrated. 6 by 9 inches.

Sullivan Machinery Co., Peoples Gas Bdg., Chicago. General Catalogue in Spanish. 68 pages. Illustrated. 6 by 9 inches. Also Bulletin No. 65 A, 'Sullivan Diamond Core Drills,' and Bulletin No. 66 G, 'Sullivan Hammer Drills.' 32 pages. Illustrated. 6 by 9 inches.

Denver Fire Clay Co., Denver, Colorado. Bulletin, 'Case Low Pressure Oil Forge, 4 pages. Catalogue A, 'Donaldson Tilting Crucible Furnace,' 12 pages. Catalogue, 'Case Gasoline Furnaces,' 16 pages. Bulletin No. 115, 'Case Oil and Muffle Type Furnaces,' 12 pages. All illustrated. 6 by 9 inches.

Commercial Paragraphs

The Hendrie & Bolthoff Mfg. & Supply Co., Denver, has been appointed sales agents in the states of Colorado, Wyoming, New Mexico, and South Dakota for the Hardinge Conical Mill Co.

The Taylor-Wharton Iron & Steel Co. has acquired the Tioga Steel & Iron Co. of Philadelphia. The Tioga plant makes steel and iron forgings, and an important addition will be the manufacture of forged manganese steel. This is the first time manganese-steel forgings have been made on a commercial basis.

The Hardinge Conical Mill Co., 50 Church St., New York, reports that the Bunker Hill & Sullivan Mining & Concentrating Co. has just placed a repeat order for two 6-ft. Hardinge Conical Pebble mills for installation in its Kellogg plant. Also that the Copper Range Consolidated Co. has just completed the installation of two 8-ft. and one 6-ft. Hardinge mills in its Trimountain plant and four 8-ft. and two 6-ft. Hardinge mills in its Champion plant. These mills are used, as is common in the grinding plants of Lake Superior, for re-grinding the tailing from jigs.

The Bucyrus Co. has recently obtained a large contract for steam-shovels and other machinery from the Government for use on the Panama canal. The company for 1912, after providing for all fixed charges and expenses, had a net surplus of $342,304.04 for dividends. The preferred stock dividend was $186,666.66 and the balance applicable to surplus $155,637.38. The president in his annual report states that the orders in hand at the end of the year showed an increase of 74.8%, while the business done at the close of the year was twice what is was the previous year.

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EDITORIAL STAFF:

San Francisco

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EUGENE H. LESLIE, M. W. von BERNEWITZ - - - - Assistant Editors

New York

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T. A. RICKARD - - - - - - Editorial Contributor
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F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

FIFTY-THREE years ago, May 24, 1860, the first number of the *Mining and Scientific Press* was issued. Contrasting the little eight-page paper then printed with the issue of today gives us a comfortable sense of achievement, but with the continued help of our contributors, readers, and advertisers, we purpose to make the *Mining and Scientific Press* still better, still more useful. We are grateful for the support given us in the past, and we hope to merit, and to receive, an even larger measure of support in the future.

MEMBERS of the Mining and Metallurgical Society voted in favor of affiliation of that organization with the American Institute of Mining Engineers, and, presumably, the formalities will soon be completed. San Francisco members of the Society and of the Institute did not wait on ceremony, but, taking advantage of the presence in the city of Mr. J. A. Holmes, one of the directors of the Institute, planned a joint dinner at Hotel Bellevue for last night.

ADVICE to young engineers from the more experienced members of the profession is of great value, especially when it is given simply and frankly. There are many things to be learned that are not in textbooks, and next to working with a good engineer is a heart to heart talk about methods. The paper on 'Valuation of Mines' that we print this week was prepared by Mr. T. A. Rickard for young engineers, but may be read with profit as well as pleasure by many of the older members of the profession. Incidentally it affords another proof, if one be needed, that technical writing need not be dull to be accurate.

TESTS of the service rendered by steel railroad rails containing one-half to one per cent of copper have been made by the Chicago, Milwaukee & St. Paul railroad, and following the results shown by a year's service of 5000 tons of rails, double that quantity has recently been ordered. It is understood that if further tests prove equally favorable, the company will adopt this alloy as standard in its rail specifications. Since over 3,000,000 tons of rails are made annually in the United States, an important avenue of consumption of copper might result from the adoption of this type of rail alloy by even a few of the larger railroads. Whether this would be reflected directly in the copper market or would merely open the way to the use of iron ores in the blast-furnace that contain small amounts of copper, is less certain. There are many mines that could furnish copper-contaminated iron ore.

PIOCHE is one of the famous pioneer 'camps' that is demonstrating its ability to 'come back.' We are glad to print this week a description of the ore-bodies in its most famous mine. This will be followed with an account of the methods employed in mining them. Both papers are written by Mr. D. W. Jessup, a member of the staff of the United States Smelting, Refining & Mining Company.

COMPANY reports come thick and fast at this time of the year. We have been devoting considerable space to them in recent issues and have more material in stock. The careful review of the year's work of one of the big companies, written by the engineer in charge, is well worth the time taken in reading it even by those who are not stockholders. Mr. D. C. Jackling's summary of work at Ray indicates that Mr. L. S. Cates and his associates are getting that property in shape, and the organization into stride, for fast work.

FIRE is one of the dangers in mining, as in other industries, that all hope to avoid but which comes at some time to most operators. As to its coming, about the only thing safely to be predicted is that it will come unexpectedly. The mine staff must be organized as is an army, to meet the unexpected, and to that end the work of the National Fire Protection Association is to be especially commended. We print this week an instructive address on the subject delivered at the recent fuel conference at Urbana, Illinois, by Mr. Herbert M. Wilson, of the United States Bureau of Mines.

NEVADA mining laws have been amended to prohibit employment underground or in handling explosives above ground of any person who cannot speak and understand English or who cannot readily read and understand an English sign. Another amendment prohibits use of gasoline underground except for engines of not more than eight horse-power, not more than 200 feet below the surface, and even then under restrictions as to exhaust. A third important change requires the use of cages or safety cross-heads or skips of prescribed pattern, in sinking a shaft more than 350 feet deep.

FRICTION with the Forest Service has been so generally reported from mining communities that we are glad to note that a better understanding is rapidly being reached. We understand that Forest Service officials are now advising freely with officers of the United States Bureau of Mines and certain cases of injustice, founded upon misunderstanding of facts, taken up by the California Miners' Association through the Bureau of Mines, were promptly and satisfactorily adjusted. Large organizations engaged in new work open the way to many misunderstandings that may well be irritating beyond all proper relation to their size. The Forest Service has had a large task, and such mistakes as have been made were, we are sure, not of intention. We print this week a statement from Mr. Leroy A. Palmer, connected with the Colorado branch of the Service, on 'What the Forest Service Offers the Prospector.' Reading it reinforces our opinion that the earnest purpose of the officers of the Service is to help rather than hinder the prospector. In our own experience, and with exceptions, it has been the 'claim pegger' rather than the real prospector who has protested most. For the former we have scant sympathy, while for the latter we have the highest respect. The practical problem is to get rid of the one without trameling the other.

LENDING money to China has been the source of so much discussion that a casual observer might easily get the impression that borrowing a few million dollars was an event of international importance. There have been many other loans floated this year, however. The Union of South Africa borrowed $75,000,000; the Madras Presidency, $62,500,000; West Australia, $50,000,000; Grand Trunk Pacific, $50,000,000; Brazil, $27,500,000; New Zealand, $15,000,000; and New South Wales, $15,000,000. Last week Mexico borrowed $25,000,000 in London and Paris for the rehabilitation and upkeep of the national railway system and is said to be endeavoring to secure $50,000,000 more "for other purposes." Recently the first installment on an international loan of $125,000,000 was paid over to the Chinese Government and a host of smaller borrowers have raised the total of loans placed in London so far this year to well over $400,000,000. Much of this was offered at substantial reductions below par, yet less than 10% of the amount was subscribed by the public. Capital is comparatively scarce and the investor, knowing that the underwriting syndicates reap a substantial commission, effectively secures a part of it himself by refusing to buy until the securities are offered in the open market at a rate that will call out the necessary funds. The Brazilian loan, which was offered at 97, sold on exchange at 96 or lower. In some quarters alarm has been expressed over the great increase in production of gold, but a more potent cause for alarm is to be seen in the tremendous increase in bonded indebtedness throughout the world. If by any conceivable general change the earning power of the world were suddenly decreased by even a comparatively few per cent, it would go bankrupt. Public and private expenditure treads so hard on the heels of income that conservative minds may well ask what the end will be.

Copper Mining in Cuba

Copper mines in the United States are so large and numerous that it is not generally known, even among engineers, that the first copper mine in the new world to be worked by the European invaders is still an important producer. At El Cobre, about ten miles west of Santiago bay, in Cuba, the Spanish opened copper mines in 1532 and made extensive workings. Later English capital was interested and about 1830 a joint English and Spanish company acquired the mines, shipping the ore to Swansea for reduction. But shortly after the middle of the nineteenth century revolutions became so frequent in

Cuba that the mines, which had reached a depth of 1200 feet, were shut down. Some ten years ago the property was taken over by the El Cobre Mines Company, which was succeeded five years ago by the Cuba Copper Company, of which Mr. Benjamin B. Lawrence is president. His happy combination of engineering and business ability has produced gratifying results and the company, after overcoming the many difficulties incident to re-opening an abandoned property, is making excellent progress, having maintained a yield of about 6,000,000 pounds of copper per year for the past five years.

The successful concentration of the ores is essential in the case of nearly all copper mines, and the problem in this case was rendered especially difficult by the oxidation of the large low-grade surface orebodies. The entire gamut of oxidation products, from silicified ore containing the red and black oxides of copper to almost unaltered chalcopyrite, had to be dealt with and, as may easily be inferred, much difficulty was experienced in securing a recovery that was satisfactory. A year ago, as mentioned in the review of ore dressing in our issue of January 1911, a 200-ton experimental flotation plant was built and an extensive series of tests undertaken. The ore to be treated, muddy oxidized surface material, yielded the somewhat surprising result of over 90 per cent extraction, not the least unusual feature being that the recovery of the oxides of copper, which offer the greatest difficulty in wet concentration, was even better than in the case of the chalcopyrite; thus reversing the natural rule that oil flotation is better adapted to sulphides than to oxidized ores. Whether this peculiar result is due to the presence of a small amount of pyrite or of chalcopyrite, or whether it is due to some natural characteristic of the oxide minerals of this locality, is not clear. It emphasizes, however, what has become apparent from the tests of oil flotation on a working scale, that the application of flotation methods to copper ore is an individual problem requiring careful study and experiment upon a working scale before the success to be attained by this method of ore concentration can be predicated. Less than a year ago the general belief was that oil flotation could not be successfully applied to copper ores, especially those of oxidized character. It is interesting, therefore, to learn that in some cases at least, even better results can be attained with oxides than with sulphides. It is generally understood that the flotation plant at El Cobre will be increased to 500 or 600 tons capacity, and that ore of as low grade as 1½ per cent copper, of which large reserves are known to exist, can be treated at a profit. At present the ore is ground to 50 mesh in tube-mills before being subjected to flotation, though it is possible that Hardinge mills will be employed for this purpose, as at the Braden and Inspiration.

As an instance that the troubles of a local manager are far from being technical alone, the experiences of Mr. E. H. Emerson, who is in charge of the work at El Cobre, may be mentioned. The revolutionary activity in Cuba during the past year seriously affected operations at the mine, and finally attacks became so frequent that only by fabricating bombs from material available at the plant, burying these at a safe distance and connecting them with the manager's house by a system of firing wires, was capture averted. The opportune arrival of a detachment of United States marines saved the situation, and Mr. Emerson was able to divert his energies from warfare to the peaceful achievements of metallurgy again. Similarly romance and the attainment of commercial profit is interleaved in the lives of many engineers who go out to make the far places productive.

The Mexican Railway Loan

The $25,000,000 loan, which has recently been placed by the Huerta government with London and Paris bankers, for the purpose of putting the railroads into operation again, is an important step in the right direction, provided that traffic, once re-established can be maintained. The lack of railway service throughout a large part of the country has been by far the greatest impediment to industry during the past two years. This has been especially true with the larger mining districts recently, in which mines can be exploited regardless of revolutionary disturbances, if supplies can be obtained and the mine products shipped. In the case of many smaller properties, the work of mining has been impossible because of the unsettled conditions and the repeated attacks of bandits and the so-called revolutionists, together with the lack of communication with the outside world. In the larger districts, however, from which the bulk of Mexico's metal output is produced, the sole impediment to mining has been the lack of railway service. Mexico, to re-establish peace, must not only have the settled conditions that obtained under Don Porfirio Diaz, but must also keep her people occupied and afford them a means of livelihood. The case of the Cananea Consolidated Copper Co., which was closed down because of lack of supplies, due to the cutting of the railway, is an example of the result of throwing three thousand peons out of work for a few days. As the great majority of the laboring class live from one day to the next and take no thought of the morrow, the closing of a large property, depriving a whole community of work and a means of existence is a very serious affair, for without *tortillas* the Mexican peon is no longer the docile creature-of-toil. Instead, he bridles the first pony that crosses his path and is off to the hills to join some 'revolutionary' band. The thousands who are without work through the closing of mines, seem to have but two alternatives, either to join hands with the federal forces or to cast their lot with the revolutionists. As the latter party holds out the most inducements, its forces are on the increase in number, while desertions from the federal ranks are reported almost daily. If the Huerta government can re-establish railway communication, there is no doubt that a great good will be accomplished; mining, which is the backbone of industry in Mexico, will be relieved of the mill-stone that has been such a handicap to the industry for the past two years, and a large portion of the disturbing element will go back to work.

The Valuation of Mines

By T. A. Rickard

*A mine is a hole in the ground; but every hole in the ground is not a mine. The distinction involves economic considerations of the greatest importance.

We may define a mine as an excavation that yields profitable ore. If it does not yield ore from which a profit can be won, then it is fit to be the last resting place of a dead mule. Nothing is so worthless as a mine that cannot be made profitable. On the other hand, no form of property is so remunerative as a generous mine. But all profitable mines are not equally valuable; more money has been lost by buying rich mines at fancy prices than in purchasing poor ones for small sums. Thus we begin to discriminate; discrimination is the essence of mine valuation.

Difficulties of Valuation

The process of valuation is complex. A mine is not like a cheese, to be tasted, weighed, and bought off-hand. It is true that the method of sampling a lode yields an average from which the bulk of ore is judged, but the cheese-taster that a grocer places at your disposal gives a sample incomparably more accurate than the chips of ore that you moil laboriously from a hard vein underground. Moreover, the grocer has his scales, by which, in your presence, he weighs the cheese. He dare not use false scales and he dare not give you short weight, for other scales are available whereby to check any such dishonesty. On the other hand, the masses of ore in the mine cannot be weighed save by elaborate inference; they are not visible in their entirety except by exercise of the constructive imagination; their tonnage is inferred by correlation of facts. When you are in a forest you judge the extent of it by the direction in which the light penetrates, by the vegetation underfoot, by the variation of tree-growth, and by standing on a point of vantage affording an extensive outlook. In most human affairs it is important to have the right standpoint. When you are in a grocer's store, buying the cheese, you stand near the scales. That is an advantageous standpoint.

The purchase of groceries involves no complexities; the purchase of a mine does. It will make a difference whether you are appraising the mine for a rich capitalist willing to take chances or a company with slender resources; it will make a difference whether your examination of the mine is for a buyer or a seller. By this I do not suggest that your finding of the facts in the case will vary according to the status of your client; as scientific men you have only to deal with truth; as university men you are bound to be honorable. Let me put it to you this way: if a man were to ask you to look at a horse that he thinks of buying; you would examine the animal looking for blemishes, knowing well that the owner had emphasized his good points; it is for you to ascertain if there be any hidden reason for the sale. If, on the other hand, a man having a horse to sell asks you in his interest to describe the animal to a possible purchaser, you state the good points, referring to any blemishes only in so far as may be necessary to enable the putative buyer to protect himself. For obvious reasons you will find it more pleasant to act for the buyer, and, for equally obvious reasons, the seller of a horse or of a mine is prone to engaging the services of agents whose moral code is less severe than yours. Mine-sales are not based on the rules of the Sunday school, any more than horse-deals. As the poet has said:

"The ways of a man with a maid be strange, yet simple and tame
To the ways of a man with a mine when buying or selling that same."

The value of a mine is based upon its present and prospective capacity to yield dividends. Those dividends come from the extraction of valuable metal in the ore. Ore is rock containing sufficient metal to be exploited at a profit. When rock cannot be profitably mined, it is waste. Thus to appraise a mine it is necessary to ascertain:

1. The amount of ore in the mine.
2. The average value of the ore.
3. The cost of turning the ore into money.

And then comes another factor of vital importance, namely, what are the prospects of finding more ore when the ore now available has been exhausted?

Estimation of Reserves

In practice, the estimation of ore reserves is approached by reversing the order of enquiry. It is obvious that the amount and value of the ore signify nothing until we know the cost of mining: 10 dwt. gold ore in one locality means loss; in another, 5 dwt. ore ensures a handsome profit. Therefore a definition is required: Ore is metal-bearing rock, which, at a given place and time, can be mined at a profit. Ore that is unprofitable today may yield dividends at a later period, by reason, for example, of a higher price for its metal contents or some improvement in the metallurgical treatment. The contrary may also happen; ore previously profitable becoming unprofitable, as, for instance, by the closing of a custom smelter, the influx of excessive water into the mine, or a rise in the scale of wages. Industrial conditions vary; we do not deal with fixed factors.

The profit is the margin over cost. The cost is the total expenditure involved in the processes by which ore in the mine is turned into money in the bank. This simple truth is not fully recognized. My attention has been called recently to the custom among South African mines of announcing monthly and annual profits, which exhibit a weird discrepancy with the dividends distributed. On adding the divi-

*Being the text of a lecture delivered at the Universities of Harvard and California in April 1912.

dends paid by all the mines of the Rand as announced for three years in succession, I find that the total represents only 68% of the so-called profits. The difference went in expenditures for new plant, for taxes, and debenture interest. In the case of some of the Rhodesian mining companies, I have found that the so-called working cost was only 50% of all the actual expenditure incurred. Such items as taxes, depreciation, administration, and other London expenses, as well as those extraordinary expenses that may not repeat themselves from year to year but are replaced by others equally unusual—all these are omitted in the working cost as assumed by the manager at the mine. But they are an essential part of the business as conducted under the system of joint-stock finance. American mining companies are better in this respect: the operating cost will come within 5 or 10% of the total expenditure; they have fewer overhead expenses and a more economical administration. But everywhere a discrepancy will be found. It is apt to constitute a vital error. I warn you against it. If you examine a mine for a British syndicate or company, and you find, for example, that the ore averages $18 per ton, and the operating cost $10 per ton, you must remember that the profit will not be $8 per ton. Other deductions must be made before the dividends can be calculated. You know—I tell you so now, and you can confirm the fact for yourselves later on—that from 10 to 30% must be added to the operating cost in order to cover other expenses inevitable in the conduct of the enterprise. Companies often fail to fulfil the expectations of a prospectus, despite reports by experienced engineers, simply because the basis of their capitalization is a quick-sand of make-believe. That quick-sand is a fallacious estimate of the total cost per ton.

Operating Experience Required

You will now appreciate more readily that the determination of the cost is a problem requiring experience. Young men who can sample and measure ore have been known to come to grief at this initial stage of the inquiry. Some older men have fared no better, for experience is not a matter merely of age, it involves variety of observation, the vital contact with men and things under diverse conditions. Speaking broadly, no man ought to undertake the examination of a mine who has not been a mine superintendent. I am aware that some young men have exhibited meteoric success by jumping from the class-room of a college to the position of experts, willing to value mines at short order. Some of them have done well, but I venture to advise you to serve your apprenticeship, by first becoming assistants to older men, by going through the graduation of practical work on a mine and in a mine, before you assume the difficult pose of the mine appraiser. Two reasons will suffice: It is a mistake to incur responsibility before you have to do so; take a duty when it falls upon you, don't shirk, but don't invite responsibilities for which you are unfitted. Youth is glorious; nothing blights youth like the burden of premature responsibility. Another reason is based on my observation of over 25 years, namely, that a mining engineer who has never been superintendent of a mine is pretty sure to make a serious blunder in mine valuation, sooner or later; and if later, so much the worse.

In ascertaining the average cost of turning the ore of a mine into the money of the mint, an engineer will encounter conditions varying between extremes. On the one hand, he may find a well established mine constituting a going concern, having detailed accounts covering a period long enough to afford reliable data; on the other hand, he may have to ascertain the average cost to be debited against the operation of an undeveloped mine in a new region where no precedent has been established.

Getting the True Cost

In the case of a mine that has been worked systematically for several years, it is possible to obtain full information; if not, the lack of it will be due to falsification on the part of the operator or carelessness on the part of the investigator. Both have happened, more than once, and the combination of the two is even more common; for such owners and managers as are prone to deception are more likely to mis-state the facts to an engineer whom they find careless or incompetent than to one who puts them on their mettle to play a square game. A little knowledge of book-keeping will stand a man in good stead when examining accounts. Outlays on improvements are apt to be treated as extraordinary expenditure, and in the case of a new plant the item of repairs is often overlooked. Errors may arise from the adoption of figures applying to exceptional periods; for instance, at high altitudes and in northern latitudes the cost in summer is less than in winter, by reason of cheaper transport, better water-supply, and other causes connected with the difference of the seasons. In some parts of the world, as in Alaska and the Yukon, the active season lasts only four or five months; the period of idleness, covering nearly two-thirds of the year, increases the cost of operation because salaries have to be paid during an unproductive interval and a new gang of workmen has to be broken in when work is resumed. Stops increase the cost. On the Gold Coast of West Africa, for instance, the devitalizing climate renders it necessary for a manager to come away for a few months in every year, and even the most healthy cannot remain efficient after three or four years of uninterrupted sojourn in the country. The staff at a mine is continually changing, owing to sickness or resignation, so that a heavy expense is incurred in sending new men to fill vacant posts. Incorrect data as to mining costs may be accepted through overlooking the fact that during a given period the amount of dead work has been less than is normally required to keep step with the stoping operations. Speaking broadly, the safest way to avoid pitfalls is to quote costs covering a period long enough to include the vicissitudes of seasons and of markets. As a warning, I shall quote a few figures from the accounts of the Bunker Hill & Sullivan mine, in Idaho. In the course of 22 years the cost of new equipment averaged 80 cents per ton on a total output of 3,591,880 tons. Thus while the cost of min-

ing alone was $1.93, of milling 31 cents, and the total operating cost $2.66, this item of 80 cents for betterments represents a large addition to the operating cost. During the first six years the cost of betterments averaged $3.40 per ton, in the future it is expected to be 30 cents. Here is a wide range, enough to make or mar an enterprise. All mines need plant and machinery; such plant and machinery is no asset when either discarded or idle; therefore the cost of it is a tax on the receipts. Many serious blunders have been made through obtuse thinking on this matter. Be not deceived, learn the meaning of amortization.

Mines are rarely in a fixed stage of development; like men, they are either growing or declining in productiveness. The figures applicable to a mine today may prove erroneous a year or two later by reason of either the contraction or the expansion of the enterprise. The engineer valuing a mine must assure himself that his figures do not refer to a passing phase in the life of the undertaking; he assumes a risk if he estimates the average costs of the future by simply dividing the tonnage by the expenditure, as derived from the records of the past.

Why Mines Are Bought

Mines are usually bought by capitalists on the expectation of so enlarging the scheme of operations as to lower the cost per ton or with the idea of so improving the metallurgical treatment through the erection of new reduction works as to augment the extraction. Such plans entail a sweeping change in the conduct of the enterprise; they involve a large staff and bigger salaries; they mean a lessening of the personal equation and an increase of organization. Another result follows, and it is a result often under-estimated, namely, a larger width of ore is stoped underground, the bigger scale of operation and the lower average cost tempting the superintendent to stope 8 feet where he previously stoped 5 feet, or 15 feet where he formerly broke only 10. From this radical departure spring results that modify the whole enterprise, and not always in the manner expected. Lower costs usually do ensue from a larger scale of work, provided it be intelligently planned, but increased profits are not the invariable concomitant of lower costs. You may reduce the cost by increasing the output, but unless you find more ore of the same kind as before, your profit may wilt faster than your cost is decreased. In other words, the beneficial effect of lowering the cost depends on two other factors, tonnage and yield, either of which may vary. Experience has shown that the sanguine expectations of companies and other new purchasers of old mines are not always fulfilled. In such cases, and in other matters, avoid conceit.

An example will illustrate. In 1900 I examined the celebrated Camp Bird mine, in Colorado. The owner was Thomas F. Walsh, an experienced operator. He had extracted $2,535,000 worth of ore at a cost of $6.50 per ton. I estimated the assured ore at a little over $6,000,000, and I suggested that the cost could be cut down to $5.25 per ton, as the result of improved equipment and larger operations. The mine fulfilled every expectation; it has yielded $22,785,500 gross, of which $11,400,000 has been profit. But the total cost per ton has been $10. Instead of lowering the cost, the exploitation of the mine by a British company has raised it. The reasons are more obvious now than they were 13 years ago. Walsh did not debit the mine with his salary, but he was an excellent general manager. His superintendent was as good a man as the company's, and cost less. The directors, offices, taxes, and general expenses in London were an additional burden on the mine. A consulting engineer was a further luxury incurred by the company. Moreover, the necessity for having a big reserve of ore, a large part of it actually broken and left in the stopes, in order to make the shareholders comfortable, all entailed the use of capital unproductively. In short, the company had small reason to observe the minor economies that come naturally to an individual owner. An increase in the scale of operations is not advantageous if it transcends the economic unit. The economic unit is that rate of production most profitable to the owner of the mine.

Where the Optimist Erred

In the case of an undeveloped mine in a new district, reliable figures concerning cost are not available. The position is honeycombed with pit-falls for the unwary. Most boom camps are new, and many of them are so isolated as to afford unfamiliar conditions. The youthful and careless among engineers are apt to accept the figures of cost affirmed locally by flamboyant individuals eager to make the best showing, or else they assume data quoted from old and established districts. This was well illustrated during the West Australian boom in 1897. For instance, I was at a place called Earlston in August of that year to examine a series of prospects that had been described by the pseudomorph of an expert as highly promising mines. After carefully sampling a number of shallow workings, I satisfied myself that the quartz contained about 4½ dwt. gold per ton, and that Mr. Optimist had either taken his samples from dumps that had been salted for him, or he had salted himself by selecting rich spots. However, even if his average of 14 dwt. had been confirmed, I should have advised my clients to drop the business. The value of a mine is not measured by the assay-value of the ore, but by the profit it will yield. These holes in the ground offered no promise of paying a dividend. The cost of operation then, and for several years thereafter, was more than 1 oz., or $20 per ton. The nearest railway was at Coolgardie, 175 miles distant. Supplies had to be brought on camels. Even timbers for a shaft were transported on the 'oont, as Kipling calls that ungainly animal. No drinking water was available in the locality; we slaked our thirst on water distilled from the brackish liquor found at a depth of 50 feet. The salty water available could be used for milling purposes, but its density made it a poor medium in any concentration process. Skilled labor was scarce and expensive. The veins were small. On a careful estimate I proved easily that the total cost of turning the gold in the ore into bars of fine bullion ready

for shipment would be fully 30 dwt. or $30 per ton. The same ore in California or New Zealand, on the basis of a correct sampling, would afford the making of a mine; in the desert of West Australia at that time it assured a first-class financial funeral.

Grade Versus Cost

In boom camps one hears much concerning the grade of the ore and little concerning the cost of handling it. Here the expert evolved *per saltum* gets into trouble, while the man who has been a mine manager is in his element. To estimate the figure to be deducted from the yield in order to arrive at the profit, it is necessary to know the costs of stoping, timbering, milling, road-making, erection of machinery, general expenses, item by item. The other method is just to guess twice and divide by two for the sake of accuracy. Many have blundered just in this way. In a new district most of the information obtainable will be furnished by prospectors, diggers, and local promoters, most of whom have no accurate knowledge on these points; and when they have it, they do not feel impelled to donate it to the novice who happens along.

If, then, you find yourself in such a dilemma, what are you to do? If you own to yourself that you don't know what the cost of mining will be in this new district, you are ahead of the man who thinks he knows, when he does *not*. For you admit a void and are anxious to fill it. Having this saving grace, you are likely to anticipate my advice: Go to the best mining engineer in the camp and ask him to tell you at what figure he places the average cost of mining. If he is a true professional man he will be glad to help you, remembering the time when he himself was in the same fix. Don't bluff, go frankly and ask him for the information; and if you can get data from several men, so much the better.

Average Yield

Thus at first hand or at second hand you have ascertained the average cost per ton of operations at a given mine; the next step is to find out what is the average yield of the ore; which is done by taking representative fragments and subjecting them to assay. This is 'sampling.' The methods of sampling vary. Twenty-five years ago it was the custom for engineers to visit a mine, examine the records and maps, and then take a turn underground, where they obtained one or two specimens of the ore and took a few grab samples. On this slender and dangerous evidence they based an opinion on the value of the mine. It seems absurd today, when sampling is almost a fine art, and many of the younger generation will be inclined to sneer at the unsystematic methods of their own grandfathers. Of course, it was wrong, and as much inferior to current practice as rule of thumb is inferior to technical science. Many mistakes were made and mine valuation was frequently mere guesswork. Nevertheless, some of the engineers of twenty and thirty years ago passed remarkably correct judgment on mines upon the basis of apparently inadequate evidence. It is also fair to say that some of the moderns, with elaborate assay-plans, have made egregious errors of inference.

Obviously, the right method and the right man must be conjoined to yield the best results. As a matter of fact, the old method was not always as haphazard as it seemed. For instance, a man examining a copper deposit, the richness of which was dependent on the presence of chalcopyrite, and knowing that mineral when pure contained 32% of copper, could gauge the approximate value of the ore by the proportion of chalcopyrite visible. An experienced man will learn more about a mine in an hour's visit than a novice in a week. The 'old timer' notes where the stopes are; from these stopes he learns the look of the good ore; then he can see for himself where else in the mine similar ore exists; or he observes that a specific mineral marks the valuable part of the lode, and having noted this indicative mineral, he infers the richness of the ore in the various workings; he goes to the bottom of the mine and ascertains whether any change is manifest in depth; he walks to the ends of the levels and sees for himself whether the orebodies are persistent in strike, and he takes the distribution of the stopes as signs of profitable ground. One or two samples will check his deductions, and while his judgment will not be as safe as if he himself had caused the workings to be sampled thoroughly, he is still ahead of many young men whose moils are sharper than their intelligence. In course of time, the profession learned that grab samples and casual inferences were risky, and thus the sampling of mines developed until it became a laborious undertaking involving the expenditure of much time and money. As one no longer a practitioner, I confess that what is wanted is a combination of the insight exhibited by the grandfathers and the system shown by their grandsons. You cannot value a mine with a moil, it needs brains also; nor can you appraise a mine by inference only, you require facts, first.

When You Arrive

On arrival at the mine the engineer will present his letter of introduction to the superintendent or manager. Much will depend upon this first interview. Possible friction can be avoided by courtesy and tact. Even if you do not trust the manager, looking upon him as the representative of an opposing or a diverse interest, you need not make your distrust unpleasantly evident. Ordinarily the manager will meet politeness with politeness, and promise any assistance in his power. Take him at his word and keep your weather eye open. Don't be in a hurry to go underground; talk with the manager and the foreman, feeling your way, and getting your bearings. A false start may prejudice your position and lead to needless complications. Above all, make friends with the foreman of the mine; give him your cigars; give him credit for his good work underground; humor him. He can expedite your examination in a dozen ways for he must necessarily possess an intimate knowledge of the mine. Get him to talk about it. You need not believe all he says, you can test his statements by your own observation, but don't show distrust. Obvious lack of confidence will either make him an enemy or drive him to circumstantial lying. The average foreman is a

good sensible fellow; many a time have I received hints from him that were worth a hundred samples. The proper study of mankind is man; the examination of a mine involves the examination of men. Be inquisitive, but not suspicious; write over your notebook "*Caveat emptor*", and go ahead.

Before laying down any plan of sampling, go underground. Get an idea of the mine and its workings. In the evening, study the maps. Next day a second visit underground will indicate whether the bottom of the mine looks healthy, whether the ends of levels are in ore, whether the ore-shoots are numerous and small; or few in number, while large in size; you will also ascertain whether the stopes are extensive; whether they have been carried far above the levels, and whether they are so timbered as to facilitate sampling. Thus you obtain fairly definite impressions of the character of the mine. Adapt your method of sampling accordingly.

I shall not go into the details of sampling. That is another story. A few hints must suffice. Avoid sampling a mine without a trustworthy assistant. The obtaining of reliable results will depend more on the accuracy of the individual samples than upon the multiplicity of them. Time is money; both are valuable to the engineer. Remember that the ore will be removed by drilling and blasting, not by the method used in sampling.

As to Salting

Time prevents me from saying much concerning 'salting,' that is, the tampering with samples. Such trickery is rare, but you must be on your guard against it. One of the simplest precautions is to fill one or two sacks with waste rock, so that if all of the samples are doctored, the deed will be detected. Another scheme is to fill some sacks with ore of known metallic contents. For this reason do not label your sacks outside. Another useful check is to break lump samples of representative ore and assay them separately, having brushed or even washed them to be sure they are clean. At the close of every big mine sampling, the engineer with his most trusty assistant should go through the mine and break a number of check samples, which should be reduced and assayed separately from all the other samples.

So, you have completed the sampling, recorded the results on a map, and are now ready to appraise the mine. This is where real trouble begins. To take a simile: You are a physician about to diagnose the condition of a patient. You have taken his pulse; you have measured his temperature with a clinical thermometer. You have watched his symptoms. Can you diagnose the trouble; and, what is much more, can you give a prognosis or forecast of the disease with which he is afflicted. I confess that any of our energetic samplers and fussy assayers are no better than nurses who record the the celebrated owner was Thom pulse of a patient, without the ator. He had ext to diagnose his real condition. a cost of $6.50 per ans to an end, it is not the end at a little over $6.0 he evidence, not the verdict; it cost could be cut d aim. To hit the bull's-eye of a sult of improved eq an appraisal that will look like a true prediction five or ten years hence, it is necessary, besides sampling, to ascertain the size of the orebodies, the total cost of exploitation, the percentage of recovery, and then having calculated the profit to be extracted, it remains for the engineer to infer therefrom the present value of the mine. To do this successfully three factors are urgently required: The first of these is judgment, the second is judgment, and the third is judgment. This is neither inherited nor purchased, it comes neither from the forefather nor the university, it is the crowning quality of the *genus homo* and the *species sapiens*.

Selling Better Than Buying

More money is made in selling than in buying mines; which is the same thing as saying that most mines are over-valued. A mine is not necessarily worth the net profit assured; *per contra*, a mine may be worth a dozen times the value of the ore exposed. It may not be worth a sum equal to the net profit assured, because it takes time to extract the ore, and during that time the property should yield not only the sum paid for it, but also interest on the money involved. Mining is a business, not a scientific pursuit; business demands interest on capital. To be a sound venture a mine during its life must return the price paid for it, plus interest, the rate of which depends upon the risk, from 5 to 20%. Therefore $1,000,000 in a low-grade orebody is worth less than $1,000,000 in a high-grade mass, because even though the sum of money realized be the same, the low-grade stuff represents a greater tonnage, requiring, other things being equal, a longer time for the operation of mining or a heavier expenditure in plant. A mine that yields $1,000,000 in 50 years, in a community where money fetches 5%, is worth today no more than $85,000. On the other hand, a mine having only $100,000 in reserve may, on account of its future prospects, be worth $500,000 in cash. Moreover, the value of a mine fluctuates with the market price of its metallic product, for a mine yielding tin at a cost of 15 cents per pound is worth twice as much when the metal is quoted at $1000 per ton as when the price is $750. Similarly, a copper mine that may be worth $1,000,000 with copper at 20 cents per pound may be unprofitable, and therefore no longer a liquid asset, when copper is at 10 cents. These are simple illustrations, but they suffice to suggest the complexities of mine valuation.

Depending on the Unexpected

Time was when people bought mines on possibilities, not on facts or assured ore; they drew the bow at a venture, they played the fool and expected miracles to happen—things did happen, but they were sad. Then came an era of caution, of overcautiousness, when operators wanted mines with the price 'in sight.' They expected to eliminate risk—they did *not*. Dead things will crawl. The investor who expects to cut out all risk in mining is like a man who wants to learn how to swim without getting wet. Risk is of the essence of mining, as it is of any business that yields high returns. All you should expect is reasonable security and a 'run for your money.'

As for prospects—new discoveries with no ore measurable but rich in the promise of development—these are the hardest of all to appraise. To judge them a man must have an instinct, not communicable by teaching nor acquired from books. It is remarkable how old miners will know when to leave well enough alone—when to stop the drift just before the orebody ends. They recognize the psychological moment. There is a time for buying and there is a time for selling a mine—and blessed be he who knows one from the other.

Judging Prospects

Prospects are potentialities; there is no rule for appraising them, and there is no scale on which to measure them. They are infants, with a brief past and an unknown future. In fact, babies and prospect-holes have much in common. A premature blast may blow out all the ore now visible in the one, and the whooping cough may end the precarious existence of the other. Refractory ore, like the measles, may blight the promise of early days, and too much water may spoil the development of the natural prospect, as too much alcohol may stunt the unfolding of the human prospect. An actuary will estimate the chances for life of a human unit by its parents, by its environment, and by its constitutional vigor; a weak child may become strong with care and nourishment, a strong child may be starved or stunted by the lack of food and attention; surroundings mean more than inheritance. So with the mining unit, the prospect-hole that may have the making of a mine; the expert judges it by the district in which it lies, by the character of its mineral associations and geological structure. A poor prospect may be developed to a productive mine; a rich one may be killed by ignorant handling.

When a prospect develops to the next stage and becomes a mine, the simile still holds good. A child becomes a man. The young man, with great powers and the promise of a fine career answers to the fairly developed mine, with some rich ore, and a good showing in depth. On the other hand the adult man with mis-spent youth, bankrupt of character, and burdened with bad habits, resembles the mine that becomes refractory in depth, whose ore proves patchy, and whose vein is faulted. Finally, the mine and man alike become old. Men think all men mortal but themselves; mine-owners expect all mines to peter out some day except their own. One mine may be like a man of advanced years with a fine record of achievement and great capacities apparently unimpaired, but still certain to come to an end; while another old mine may continue in operation, without earning profits, keeping a worthy population employed and affording a nice billet for a worthy superintendent, but without gain to its shareholders; so also an old man no longer active may lag superfluous, his energies waning so gently that the decline is scarcely noted. Fortunately most men outlive most mines. But both eventually cease to be units in the economy of the world. At last the seeker for mineral wealth crosses that range from which the explorer ne'er returns. The prospector sleeps in the prospect hole.

What the Forest Service Offers the Prospector

By Leroy A. Palmer

So much has been said and written about the relation of the Forest Service of the United States Department of Agriculture to the mining industry, and so many misconceptions have been formed, that a few facts on the subject should be of interest to those actually engaged in mining.

In the first place, let it be understood that the fact that land is included in a National Forest is no bar to mining or prospecting thereon. Paragraph 114 of the regulations under the United States mining laws published by the General Land Office, states: "The act of June 4, 1897, provides that 'any mineral lands in any forest reservation which have been or which may be shown to be such, and subject to entry under the existing mining laws of the United States and the rules and regulations applying thereto, shall continue to be subject to such location and entry' notwithstanding the reservation." In this connection it is of interest to note that an investigation by the Forest Service showed that during 1912 there were 2560 prospectors within the National Forests of Colorado, as compared with 1475 on unreserved public lands immediately adjacent.

Forest Service and Patents

The relation of the Forest Service toward the possession of or acquisition of title to mining claims is confined to requiring that compliance shall be had with the mining laws of the United States, and is never asserted unless and until application is made to patent, except where improper use is made of a claim which actively interferes with the administration of the forest. The Forest Service has no authority to supplement the federal laws with regulations of its own making, as can be done by states or mining districts, such as to require that a discovery shaft be sunk on the claim or that the discovery of mineral shall be made in the discovery shaft, as provided by the Colorado statutes, nor can it issue or refuse patent, this being exclusively the function of the Secretary of the Interior. When the owner of a mining claim desires a patent, the procedure is as follows:

The Surveyor General notifies the Forest Service when order for mineral survey is issued, and if possible the ranger accompanies the surveyor and makes his examination coincident with the survey, in order to obviate possibility of delay and make sure of the position of claim lines and extent of improvements. If unable to be present when the survey is made, he makes his examination as soon as possible after application to patent is filed, and, except in occasional instances, this report is submitted to the General Land Office before the expiration of the 60-day period of publication, so that the examination by the Forest Service does not delay the issuance of patent, except in case the required expenditure has not been made upon the development work.

Section 2320 of the Revised Statutes states that "no location of a mining claim shall be made until the discovery of the vein or lode within the limits of the claim located". But the ranger does not inquire into whether a discovery has been made. If the claim is in a recognized mineral locality, if the requisite expenditure of $500 has been made, and if the indications are that it is being held in good faith and not as a subterfuge to acquire ground for other than mining purposes, he will make a favorable report. In most cases, compliance with the second condition carries the third with it, and in this connection it might be well to quote from the National Forest Manual: "It is not the purpose or the intent of the department to initiate contests against claimants who have entered lands in the National Forests in good faith to secure a home or for other purposes recognized by law, and in such cases no contest should be initiated on slight, technical non-compliance with the law."

Rangers and Mining Claims

An opinion seems to prevail generally that contests against supposedly invalid claims are initiated on the report of the ranger, who, it is true, sometimes has little or no knowledge of mining. This is incorrect. On receipt of a report from a ranger showing the non-compliance with the above conditions, the mineral examiner is detailed to the case. The mineral examiner is a man who must have had actual mining experience. He qualifies for his position by submitting to the Civil Service Commission a detailed account of his experience, with references to five previous employers and signed statements by two persons personally able to testify as to his fitness for the position, which application, if satisfactory, admits him to a competitive examination which consists chiefly of questions on geology and mineralogy.

The mineral examiner makes an exhaustive investigation of the claim, measuring and estimating the work and also considering the question of character and extent of discovery, and if it develops that no discovery has been made, as well as the claim being deficient in other respects, the facts are reported to the General Land Office. If the Commissioner considers the facts sufficient to justify cancellation of the application for patent, the claimant is informed of the charges against the claim and given an opportunity to present his evidence at a hearing. At the hearing, both sides are represented by counsel and introduce witnesses as in a suit before a court of law. The evidence is submitted to the Register and Receiver of the Land Office of the district in which the claim is situated, and they render a decision for or against issuance of patent, subject to approval by the Commissioner of the General Land Office. Appeal may be taken to the Secretary of the Interior.

Free Use of Timber

A prospector engaged in working his claim is entitled to such timber found thereon as may be necessary for its development, which includes timber for buildings, fuel, and similar purposes, as well as the actual support of excavations, and need make no application therefor. If there is no timber on the claim, he sends word to the ranger, who calls on him and issues a free use permit for any amount necessary, up to $20 stumpage value. In case of an emergency, he can take such timber as he may need immediately, and notify the ranger at his first opportunity.

Prices and Quantity

Probably a fair average of the prices computed for free uses in the second district, which includes Colorado, Wyoming, South Dakota, Minnesota, and Michigan, would be $2 per thousand feet board measure for green saw-timber, $1.25 per thousand lineal feet for lagging, and 25c. per cord for firewood. If a prospector were living on his claim and working it the year round, 20 cords of firewood, $5 worth, should be ample for his needs. This would leave him $15 worth of timber for his workings. A post 8 inches in diameter and 8 ft. long is scaled as 10 board feet. Such a timber cut to 6½-ft. lengths has a safe working load (Western yellow pine) of 46 tons for well seasoned timber, and half that amount for green timber. A post 10 inches in diameter and 12 ft. long, sufficient for two caps, and some over, scales as 30 ft., so that two drift sets would scale 70 board feet, 14c. worth of timber, a cost of 1¾c. per foot of drift, if the sets are placed on 4-ft. centres. To lag a 5 by 7-ft. drift on top and sides with 6-in. split lagging, would require 19 ft. of lagging per foot of drift, or 2⅜c. per foot, so that the total cost at which the timber for a 5 by 7-ft. drift would be figured would be 4⅛c. per foot. On this basis the $15 mentioned, after allowing for firewood, would furnish timber for 364 ft. of drift and leave plenty of scraps for blocking, fuel, and other uses. All this, under free use permit, the miner obtains for nothing. Of course, a shaft would require more timber per foot, but less work is accomplished in the same time. Few prospectors require that amount of timber in a year, but a prospector may cut as much timber as he wishes from his claims without permit, if the use to which it is put tends to develop the claim from which it is cut; and in cases of unusual need, the Forest Supervisor may extend the free use permit to an amount not exceeding $100.

Much more detail could be entered into along these lines, but I trust that the above facts may correct some of the prevailing misconceptions of the attitude of the Forest Service toward the mining industry, and show that it is the desire of the Service to promote and not retard the development of the mineral lands.

The total value of the mine output of gold, silver, copper, lead, and zinc in the Eastern or Appalachian states in 1912, according to H. D. McCaskey, of the United States Geological Survey, was $13,470,276, against $11,787,942 in 1911 and $10,127,304 in 1910. The figures for 1912 represent the production of 93 mines, of which 50 were gold placer mines, many of them small. The total gold output from all mines was 10,763.24 fine ounces, valued at $222,496, an increase over the production of 1911 of 3053.72 oz. in quantity and of $63,126 in value.

Ore Deposits of the Prince Consolidated Mines

By D. W. Jessup

The property of the Prince Consolidated Mining & Smelting Co. is situated in the Ely mining district, adjoining the Highland district on the east, and is three miles southwest from Pioche, Lincoln county, Nevada. It consists of four full claims, one fraction, and an unpatented claim, and has been located since the early sixties. It has shipped many a car of fluxing ores to the old Pioche smelters and an occasional car of high-grade ore to the Utah plants. It was not until the past few years when prominent Salt Lake interests assumed control, that extensive development began. A railroad to Pioche was surveyed and completed, ore-bins were built, the claims patented, and the whole property rounded into shape for a large production of ore.

Geology of the District

The country rocks of the district are of a sedimentary origin, but have been altered by metamorphism. They dip about 17° to the east and are of a varying thickness. The base or underlying formation consists of a thick Cambrian quartzite. Overlying this is a bed of altered shale about 400 ft. thick. Above the shale and interbedded with it is the predominant blue Cambrian limestone, highly metamorphosed, with a thickness that varies from a hundred to several hundred feet. The district covers a small range of mountains running east and west and at right angles to the Ely range. Heavy faulting and displacements have taken place, but the district has not suffered the intense geological disturbances that occurred at Bristol, 15 miles distant in the northern part of the range. The sedimentary rocks have been intruded by dikes of a fine grained rhyolite porphyry that appeared to the northeast, in the vicinity of Pioche, and subsequent to this intrusion, fissures had been formed in which the emanations from the porphyries in the form of mineralizing solutions, deposited the ores. The primary ores were chiefly the sulphides of iron and lead, associated with manganese, silver, and a little gold. These ores have been largely oxidized to water level, the distance varying from 500 to 1400 feet.

The Orebodies and Their Genesis

These orebodies consist of two separate and distinct divisions and are mined from the one shaft (Fig. 1). The first division consists of four beds of an iron-manganese deposit, containing lead and silver, the principal bed being the upper one, which is 180 ft. thick. The second division is a high-grade lead-silver ore deposited in two fissures trending northwest.

The bedded deposits occur as strata lying between similar beds of shale and underlain by the Cambrian quartzite. Roughly, these beds form a synclinal trough, and dip to the centre at an angle of 15°.

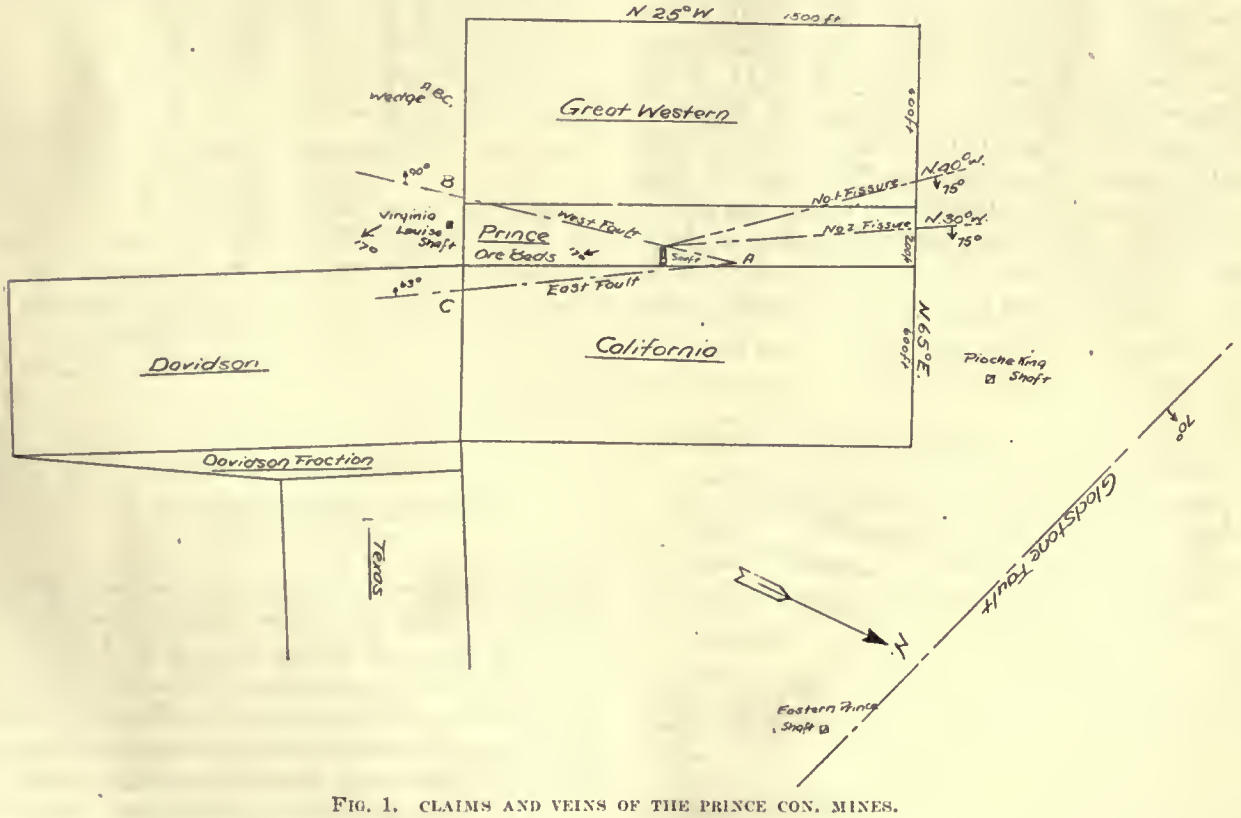


Fig. 1. Claims and veins of the Prince Con. Mines.

There is a sharp break, illustrated in Fig. 2, at the bottom of the syncline, the origin probably being a thrust or lateral compression. Longitudinally the beds form a wedge with the apex to the north and gradually diverge to the south. The ore has been blocked out to a length of 250 ft., with a width at the base of 170 ft., and a depth of 500 ft. A remaining distance of 300 ft. to the end line has been prospected but not blocked out. At water-level, a depth

PRINCE CON. HEAD-FRAME, LEFT CENTRE, WITH VIRGINIA LOUISE SHAFT TO FAR LEFT. ORE-BINS AT RIGHT.

of 550 ft., diamond-drills have shown the presence of sulphides in the quartzite and indicate a continuance of the orebodies. The alternate beds of ore and shale lie between two fault planes, the intersection of which forms the apex of the wedge (Fig. 1, A, B, C). The west fault plane strikes north and south and has a nearly vertical dip; the east fault plane strikes about N.25°W. and dips to the west. They both extend to the south, but have not been definitely traced. On the east and west they are bounded by the blue limestone and altered shale which constitute what is termed the hanging and foot-walls, though in reality the walls are the underlying and overlying beds. Below the 300-ft. level the shale walls are of more prominence and give greater evidence of alteration. The beds all have a uniform dip of 17° to the southeast and extend in a north-south direction. The upper bed of ore, 180 ft. thick, is the one principally mined. It outcrops at the surface at only one point, near the inclined shaft, and is overlain by a variable amount of capping that increases in thickness to the south and at the end line is about 65 ft. thick. Under this bed of ore is a bed of shale, below

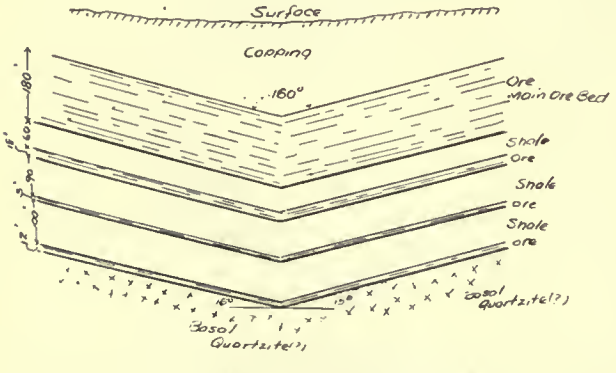


FIG. 2. SECTION OF SYNCLINE, SHOWING ALTERNATION OF BEDS AND STRUCTURE.

which are alternate beds of ore with thicknesses of 18, 4, and 11 ft., and beds of shale 60, 90, and 100 ft. thick (see Fig. 2).

The second division of the mine consists of two well defined prominent fissures that intersect at a point on the line of the west fault, a short distance south of the apex. The westerly fissure has a strike of N.40°W. and the easterly fissure has a strike of N.30°W. Both dip to the east at an angle of 75° and cut through the various formations without a break. They are not clearly defined at the surface, but continue into the quartzite. In the ore-beds the fissures lose their identity and their southerly extension is doubtful. At their contact with the lower beds they have faulted the strata by normal faults, forming steep faults, as shown in Fig. 3. Here the 12-ft. bed on the lowest level has suffered vertical displacements of 12 ft. The fissures vary in width from 6 in. to 4½ feet.

The genesis of the ore was ascribed by J. E. Spurr to replacement. Later developments have proved

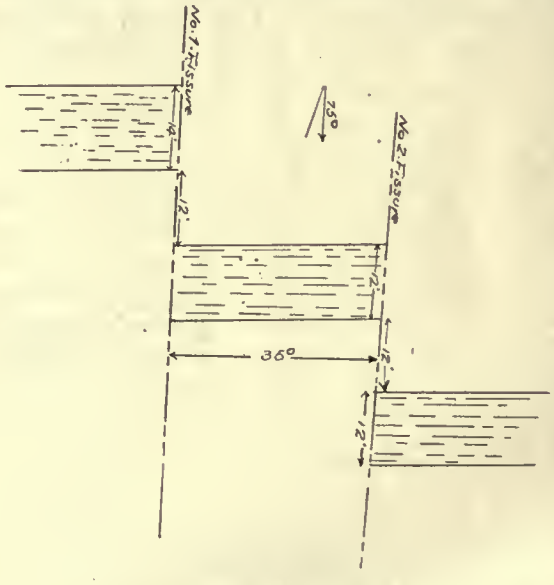


FIG. 3. STEP FAULTS WHERE NO. 1 AND NO. 2 FISSURES CROSS THE LOWER BEDS.

this theory correct, though there is some diversity of opinion as to the channel passage for the solutions. Subsequent to the intrusions of porphyry, the sedimentary rocks suffered from the geological disturbances that resulted in the formation of the northwest-southeast fissure extending through the different sedimentary formations, stronger in the quartzite and less definite in the shales. The mineralizing solutions emanating from the deep seated porphyries appear to have ascended through the two prominent fissures, and on entering the alternate beds of limestone and shale, part of the solutions left their channels and circulated along certain of the beds, gradually replacing them. On reaching the thick limestone bed above the shales, the solutions spread out laterally from the fissures, replacing the limestone and forming the present large ore-bed. The fact that the fissures lose their identity in the ore-

beds would indicate their use as channels by the ore solutions. The zone of replacement was probably one of a crushed and fractured condition, as shown by the trough-shaped ore-bearing series of beds, and indicates a lateral compression between the fault planes that would crush the beds. A few horses of unreplaced limestone are found in the beds showing a broken formation. The horses vary in size from a small body to one that measures 12 by 20 by 50 ft. They are found in the vicinity of the walls and not in the centre of the beds.

Faulting After Ore Deposition

After the ore deposition there followed further faulting, as evidenced by the displacement of the lower ore-beds along the plane of the fissures, but this movement did not seriously affect the main ore-bed. If relations found in similar conditions at Pioche caused the same results here, it is expected that the fissures in the quartzite will prove much stronger than in the shale, and that they may be expected to continue in depth carrying ore of good grade. The theory is that the limestone and shale capping was eroded in the Pioche district, exposing the quartzite and ores, and that the same ores exist in the Prince mine, but under the existing capping of limestone and shale. It is not logical to expect that the underlying massive quartzite will contain large orebodies, because of its insolubility, though there may be additional replacements in limestone in depth if the quartzite is not the basal ore of the district. Further developments with the diamond-drill will prove of immense interest. The Pioche fissures in the quartzite are similar to the Prince fissures and have yielded 200,000 tons of silver ore that assayed $100 per ton.

The Gladstone fault, just north of the property, may have had some bearing on the ore deposition, but the fault has not been prospected or developed in any way. It strikes about N.45°W. and dips 70° to the northeast. The surface is not heavily mineralized and only small fissures and bedding planes with a calcite filling are exposed. To the south of the mine there is a quantity of 'float' that had its origin in the outcrop of the manganese bed.

Limits of the Orebody

The southerly limits of the orebodies are not known. Adjoining the property on the south is the Virginia Louise claim and mine, which contains a shaft 320 ft. deep. At the bottom, drifts have been driven 50 ft. to the west and 100 ft. to the south without reaching the limits of the ore. The capping is 70 ft. thick. The formation, nature of the ore, and its mineral content are similar to those in the Prince mine.

The peculiar wedge-shaped structure of the orebodies and their relation to the faults has but lately been defined, and it explains why the Centennial Pioche Mining Co. failed to find the Prince ore. The company sank a shaft to a depth of 500 ft. to the south and east of the Prince mine, expecting to find the same bedded deposits, but were disappointed. The Pioche King, adjoining the Prince property on the north, has also failed in prospecting for ore. A three-compartment shaft was sunk 300 ft., driving was done to the west for 500 ft. and 1000 ft. to the south and southeast, but without results.

Nature of the Ores

The ores are practically all oxidized, with the exception of some lead sulphide, and are known as iron-manganese ores. They are of low grade and their value lies in their service for fluxing purposes at the smelters. Because of the excess of iron and manganese, they command a bonus over and above the cost of smelting, leaving the gold, silver, and lead as a profit. The large orebody contains approximately: iron 30%, manganese 12%, insoluble 10%, lime 6%, lead 4%, silver 3 oz., and gold 20c. These amounts are fairly uniform throughout the bed, with the exception of a central core, which contains an excess of silica, with a corresponding decrease in iron and manganese. Water courses occur which mark spots of secondary enrichment. They are filled with calcite and lead sulphate, the latter containing silver chloride. These courses are not open and do not form channels for the circulation of surface waters. The underlying ore-beds show an increase in the amount of lead, silver, iron, and manganese, the last two increasing to a 40% excess. The manganese occurs as a manganese oxide, the iron as hematite and limonite, the lead as a sulphate and sulphide, and the silver as a chloride. The lowering of the water-level has brought about the oxidization of the ores.

The ore in the fissure veins occurs in shoots or pipes. They may occupy the whole vein or may be of smaller size, following one wall and then diverging to the other, or they may occupy the centre of the vein. The ore contains from 10 to 25% lead, 35 oz. silver, $2.50 in gold, 60% silica, and will average about $30 per ton. It is shipped to the open market and is not covered by smelter contracts. The fissures are also filled with a gangue or gouge matter that is similar in composition to the neighboring walls. They have not been disturbed by displacements, as no movements are shown on the walls or vein matter.

Cost of Milling at Tonopah

The following comparison of costs at the Tonopah and Millers plants of the Tonopah Belmont Development Co. is taken from the annual report of Frederick Bradshaw, general manager.

	Cost per ton.	
	Tonopah.	Millers.
Crushing and conveying	$0.100	$0.111
Stamping	0.322	0.541
Tube-milling	0.415	0.111
Concentrating	0.078	0.111
Classifying	0.040	....
Elevating and separating	....	0.039
Leaching sand	....	0.230
Thickening	0.042	....
Conveying and discharging sand	....	0.067
Agitating slime	1.269	1.171
Filtering and discharging slime	0.198	0.218
Precipitating	0.200	0.227
Assaying, refining, lighting	0.131	0.234
Shift bosses and watchmen	0.054	0.114
Surface and plant	0.060	0.042
Sand dump	....	0.028
Total direct cost	$2.909	$3.379

Fire Protection and Fire-Proofing in Mines

By Herbert M. Wilson

*Mine fires are of more frequent occurrence and are more destructive of property than are explosions, and take nearly as great a toll of life. It is an unfortunate commentary on the foresight of the people that some great holocaust, as the Monongah mine explosion, or the Cherry mine fire, is necessary to arouse a sense of the dangers and cause a search for the remedies. As the Monongah, Darr, and Naomi mine disasters of 1907 led to the United States Bureau of Mines, with its resultant tests of permissible explosives, investigations of explosibility of coal dust, and a generally aroused public sentiment which has reduced the frequency of great explosions, so the Cherry mine fire aroused the country to the extent of the fire hazard in mines, and has set in motion efforts already showing important results toward the prevention of fires in mines and the protection of mines from fires.

Fires in an anthracite mine near Carbondale, Pennsylvania, have raged for ten years and still rage with the resulting destruction of underground and surface property. There has been destroyed $25,000,000 worth of coal in the past five years in a mine fire still burning near Summit Hill, Pennsylvania. The mine fire at Cherry, Illinois, and the Pancoast mine fire near Scranton, Pennsylvania, have recently been most destructive to life. Fires in mines are not, however, confined only to coal mines, but have been almost equally destructive in metal mines. Fires have been raging in the deep mines of the Anaconda Copper Co. at Butte, Montana, among the old timbers since 1889, and for many years in the Comstock lode, in Nevada, thousands of feet of timber was burned out, with consequent caving of roof, dislocation of metal-bearing ground, and loss of ore. A million dollars has been spent in fighting a mine fire at the Homestake mine at Deadwood, South Dakota, and there has been great loss of life in recent fires in metal mines at Tonopah, Nevada, and Copper Hill, Tennessee.

Fires Due to Minor Accidents

But more shocking than all is the fact, evidenced by the records, that the greater number of these disastrous fires had their origin in trivial causes, and had proper safety regulations been in force, had proper means been at hand for fighting fires, and had reasonable practice and enforcement of the rules obtained, the fires might have been quickly extinguished. This subject of careless and preventable fires is one regarding which I cannot speak too strongly. Your attention, and that of all concerned in mine regulations and management, should be fixed and held by the distinction between fire prevention, which is recommended as a slogan, and fire protection, which is vastly more expensive in the long run and concerns only the abatement of the evil after fire has been given lodgment. Fire prevention, with reasonable protection, will go a long way toward reducing the enormous waste in life and property resulting from mine fires.

Those who are concerned in operating mines and directing village governments in mining towns, should adopt systems of fire inspection and of fire protection, clearly separating the agencies for fire prevention from those of fire-fighting. The careless and preventable fire might soon become a memory of the past were the school-children in mining towns and the miners themselves taught, as is done in the schools of Ohio, the dangers in the careless use of non-safety matches, the throwing away of cigarettes, lighted candle stumps, lamp wicks, the danger in handling inflammables, lubricants, and greasy waste —in other words, all uncleanliness. The first precaution toward fire prevention is, therefore, not only rules and regulations, but a firm and consistent enforcement of them by mine officials and state authorities. So, too, a large measure of prevention will be furnished by proper drills to test the condition of preparedness.

State Legislation

Reviewing recent activity toward solving the mine-fire problem, I find, first, admirable laws enacted in the state of Illinois, in March 1910 and June 1911. These provide a model statute for the guidance of other states, relating especially to fire-fighting equipment and preventive measures. Much in the way of detail yet remains to be worked out regarding fire-proof construction. In May 1911 the powerful organization known as the National Fire Protection Association appointed a special committee on mine fires, the personnel of which includes a number of prominent mining engineers and fire-protection engineers representing various portions of the country. This committee presented a preliminary report in 1912, which outlines clearly those topics which can best be investigated by states and federal bureaus and those which can best be handled by the mine operators. The United States Bureau of Mines issued in 1912 a preliminary circular concerning mine fires and how to fight them, which was followed shortly by a technical paper, constituting a preliminary study of mine fires.

Meanwhile the mining industry has not been idle. There are many mines in this country and abroad where fire rules are posted in the mining towns, in the office, and in the mines. Adequate water-supply, reel, and hose are provided for protection of surface structures. There has been great activity in the last decade in the replacement of inflammable mine buildings—and especially head-houses and tipples—by steel or other non-inflammable construction. Underground, too, in a number of cases, shafts, tunnels, and main haulage-ways, as well as stables and other danger points, are being lined with fire-resistant material, and reasonable care is being exercised in the handling of material, in preventive measures, and in provision of fire-fighting appliances.

So far, papers on mine fires in technical journals,

*Address before the mining and fuel conference at the University of Illinois, Urbana, May 10, 1913.

the preliminary bulletins of the Bureau of Mines, and the bulk of the state laws, are concerned with fire-fighting and protection against carelessness. Little consideration has been given in technical literature to the more permanent and effective preventive measure of fire-proof construction. The second of the recent Illinois laws—that of June 1911—devotes several sections to this most important subject. It limits the conditions under which inflammable construction may be used in mine stables, it details fire-proofing measures necessary in and about the stables, the hay, and feed-storage receptacles, and directs that hoisting shafts and air-escapement shafts shall be fire-proof in construction, as well as roofs, walls, and passageways leading from the bottom of the hoisting shaft. This is a long step in the right direction, but lacks details. These are pointed out in some measure in the last annual report of the Committee on Mine Fires of the National Fire Protection Association. This report deals first with the surface plant, which should be capable of the same treatment as other surface industrial plants, and recommends that all mine openings should unquestionably be non-combustible and be protected, preferably by automatic sprinklers; it classifies building materials, their conditions as to combustibility; recommends that no inflammables be permitted within 100 ft. of mine openings; suggests the character and amount of water-supplies, and the grouping of buildings depending on inflammability, and takes up the question of special devices for preventing spread of fires from the surface to underground workings. It next takes up the mine openings and the importance of making them incombustible. Finally, in underground works, it suggests classification of linings, timbering, overcasts, and stopings, by their fire resistance.

Methods of Fire-Proofing

There has been developed in recent years a large volume of detailed information concerning methods and costs of permanent underground construction. As long ago as fifty years a steel shaft lining was placed in the Shireoaks colliery, England, and this is reported still to be in good condition. Steel props and lagging have been in use in England, in the Norfolk mine, since 1885. Structural steel sets were perhaps used in the United States first in 1897 by the Susquehanna Coal Co., of Nanticoke, Pennsylvania. At an early date brick linings—around shaft and tunnels—were introduced in Europe, and more recently in this country. Still more recently concrete and reinforced concrete linings, mine posts, beams, and timber sets have been adopted.

Taking up the shaft lining: this should unquestionably be of fire-proof construction. It may be of brick, of monolithic or reinforced concrete, or of structural steel backed by steel lagging or reinforced concrete slab or curtain wall; the choice depending upon local conditions, availability of materials, and cost. Numerous admirable examples are available to the designer for shafts of circular, elliptical, and rectangular cross-sections. These have been constructed in the metal mines in Nevada, Montana, Michigan, and elsewhere, as well as in coal mines from Colorado to eastern Pennsylvania.

In like manner there are many instances throughout the country, and innumerable ones abroad, where the roof and walls of the passage-ways leading from the bottom of the hoisting shaft and escapement shaft are of fire-proof construction. These, like shafts, are usually lined with brick, reinforced concrete, or steel timber sets supporting non-combustible lagging.

It will be a long time ere wooden mine timbers are displaced to any appreciable extent by those of metal or reinforced concrete. Yet the endeavor should constantly be to bring about this substitution, not only on account of greater protection from fire, but also because of greater permanency in construction and consequent ultimate less cost.

But of all the elements in the mine, the stable or the underground engine-room should demand first attention. I have seen several examples of excellent and cheap fire-proof construction in stables in the coal mines of Pennsylvania and elsewhere. Old iron pipe of small diameter furnishes excellent structural material for posts and partitions separating stalls. For sanitary reasons and the preservation of the health and efficiency of the animals, wooden floors should be furnished in a portion of the stalls, but these should be so laid in concrete as to render them slow burning, if not fire-proof. The laws of Illinois require separating a limited number of stalls by fire-proof partitions, and require the provision of fire-proof storage places for hay and other inflammables. Such stables should furnish at a minimum ultimate expenditure the maximum of protection.

Returning to the shaft and main haulage-way: there is a large field for experimental work in the design and construction of these in concrete, the cost of which shall be kept at a minimum by the use of local mine rock and refuse as aggregate. Where considerable pressure is to be resisted, the best materials, mixed and laid in the most approved manner, are essential. Nevertheless, there are many mines where the essential is rather protection from seepage and inflammability and where a minimum of compressive strength will suffice. Under such circumstances mine rock and other mine waste, sand, or other fine material locally available may greatly reduce the cost of material.

Comparative Tests of Materials

The following compressive tests were made by the engineers of the Bureau of Mines on large-sized cubes of concrete made with mine rock, culm, ashes, sand, and gravel gathered in and about the anthracite mines of Pennsylvania. The proportion of cement used was low in order to secure results on the cheapest mixture: (1) 1 cement, 3 anthracite cinders, and 6 breaker refuse, 425 lb. per sq. in.; (2) 1 cement and 7 anthracite culm, 430 lb. per sq. in.; (3) 1 cement, 3 sand, and 7 breaker refuse, 455 lb. per sq. in.; (4) 1 cement, 3 sand, and 7 mine rock, 594 lb. per sq. in. Compare these results with 1 cement, 2 sand, and 5 cinders, 1300 lb. per sq. in., and 1 cement, 2 sand, and 4 gravel, 4600 lb. per square inch.

With proper preliminary designing, it may be possible to keep in stock a few permanent forms for molding concrete. With such forms, shafts and tunnels can be more cheaply constructed after the manner in which concrete sewers and water-supply tunnels are now built. There is abundant published data regarding the cost per linear foot of permanent and non-inflammable shaft and entry lining, showing, in many cases, that in a period of say 10 or 15 years such lining is measurably cheaper than timber lining, which latter may have to be renewed several times.

Use of Steel and Concrete

Probably no part of a coal mine should be so carefully constructed as stopings and overcasts. Here concrete has the advantage over timber because of the less resistance to air-currents and the great importance of having them fire-proof. With mine timbers, as with shaft and entry linings, there are many excellent examples reported in detail where steel and where reinforced concrete have been used to replace wooden timbers. The mine-timber problem is one of the most urgent confronting the mine operators. The forests of the United States are rapidly disappearing, and the cost of timber is rapidly increasing until a point has been reached for many forms of construction where in those portions of the country most distant from timber resources either steel or reinforced concrete is cheaper even at the first cost. In many wet mines, wooden timbers have to be renewed as frequently as every three years. Steel and concrete timbers may last indefinitely. Wooden sets, according to their dimensions, may cost, in place, $10 to $30, though there are records of steel sets costing about the same sum under similar conditions, whereas after a period of 15 years the permanent timbering will have cost one-third or one-fourth the price of the wooden sets. Reinforced concrete is not well adapted to mine timbers, especially when laid in place, because of the difficulty in placing forms and pouring, and the slowness in setting and in developing maximum resistance. Such timbers have, however, been satisfactorily molded and seasoned in required lengths in the open and then conveyed underground and placed much as are wooden timbers.

Steel timbers may be of many forms, **H** and **I** forms of beams being more common. There is a record of a mine in France where steel props, after having been deflected by weight of the overburden, have been pulled and straightened out and re-used as often as 1 or 200 times. The form of metal mine post recently adopted in Belgium consists of old light metal pipe filled a portion of the way with compressed peat; on top of that a packing of coal dust and broken stone; and above all a short wooden plunger. The effect is to produce a telescoping prop which gives gradually under the roof pressures.

There is every reason to anticipate with confidence that the time is rapidly approaching when, due not only to an awakened public sentiment demanding greater safety in mines, and in some measure also because of the greater safety demanded by the enactment of workmen's compensation laws, but more especially because of the relatively increasing cost of wooden timbers as compared with metal and concrete and the greater permanence of the latter, fireproof construction within our mines will henceforth rapidly supersede the more prevalent inflammable construction.

Difficulties of Mine Operators

In closing, and in justice to the American mine-operator, it is but fair to point out the fallacy of unfair comparison of the more elaborate and permanent mine construction adopted in European countries, with the more perishable and unsightly wooden construction most prevalent in this country. In Europe, and especially in Germany and France, mine-operators are allowed to combine under reasonable governmental regulations in the fixing of the price of their product, especially coal, at such a figure as will enable them to adopt all the more safe devices not only in construction but in maintenance and operation. In the United States, while the price of nearly every other commodity has risen rapidly in the last 15 or 20 years, the price of coal at the mine has hardly increased one cent per ton. It is not reasonable to expect great expenditure in safety measures and in permanent and fire-resistant construction when the price which may be had for coal at the mine is such that many operations are run at little or no profit to the owners.

Metal-Mine Accidents in the World

*Comparison of the number of men employed in metal mines of the principal countries showing the fatality rate per 1000 men employed.[1]

Year.	Country.	Number employed.	Fatalities per 1000 employed.
	Australia:		
1911	New South Wales	19,363	1.81
1911	New Zealand	7,400	0.67
1911	Queensland	13,202	0.90
1909	Tasmania	6,054	0.99
1909	[2]Victoria	26,473	1.16
1911	Western Australia	16,596	2.23
1910	Austria	20,664	0.82
1910	France	18,542	3.16
1910	Germany	109,359	1.39
1910	German West Africa	6,933	1.30
1911	Great Britain	46,341	1.64
1911	[3]India	143,336	1.18
1910	Japan	86,770	1.59
1909	[3]Mexico	81,438	5.78
1910	[3]Peru	20,410	5.78
1910	Portugal	6,554	1.68
1908	Russia	181,334	0.98
1909	Spain	96,901	2.25
1910	Sweden	13,775	1.23
1910	Transvaal	218,109	4.29
1911	United States	165,979	4.19

[1]Compiled from official reports.
[2]Average for 20 years.
[3]Includes coal mines.

The Eastern production of lead in 1912 was 561,026 lb., valued at $25,246, according to the U. S. Geological Survey; a decrease of 273,716 lb. in quantity and of $12,317 in value. The greater part of the production was derived from the lead-zinc mines of Wythe county, Virginia.

*Compiled by Albert H. Fay, Bureau of Mines, Technical Paper 40.

Operations of the Ray Consolidated

By D. C. Jackling

*The principal change and the only one of consequence in the acreage of claims and lands owned by the Ray Consolidated Copper Co. came through the acquisition of the Ray Central Mining Co.'s properties, which was undertaken during the year 1911, the physical property having been conveyed to the Ray Consolidated Copper Co. early in the year 1912.

The additional area of mining claims thus acquired was 207.138 acres, and the total area of mining claims now owned is 2144.9 acres, comprising the following groups of claims which lie in one connected body without interior or adverse ownership by others in so far as the known mineral-bearing area is concerned:

	Acres.
Original Ray Consolidated group	1012.486
Original Gila Copper Co. group	925.276
Original Ray-Central group	207.138
Total	2144.900

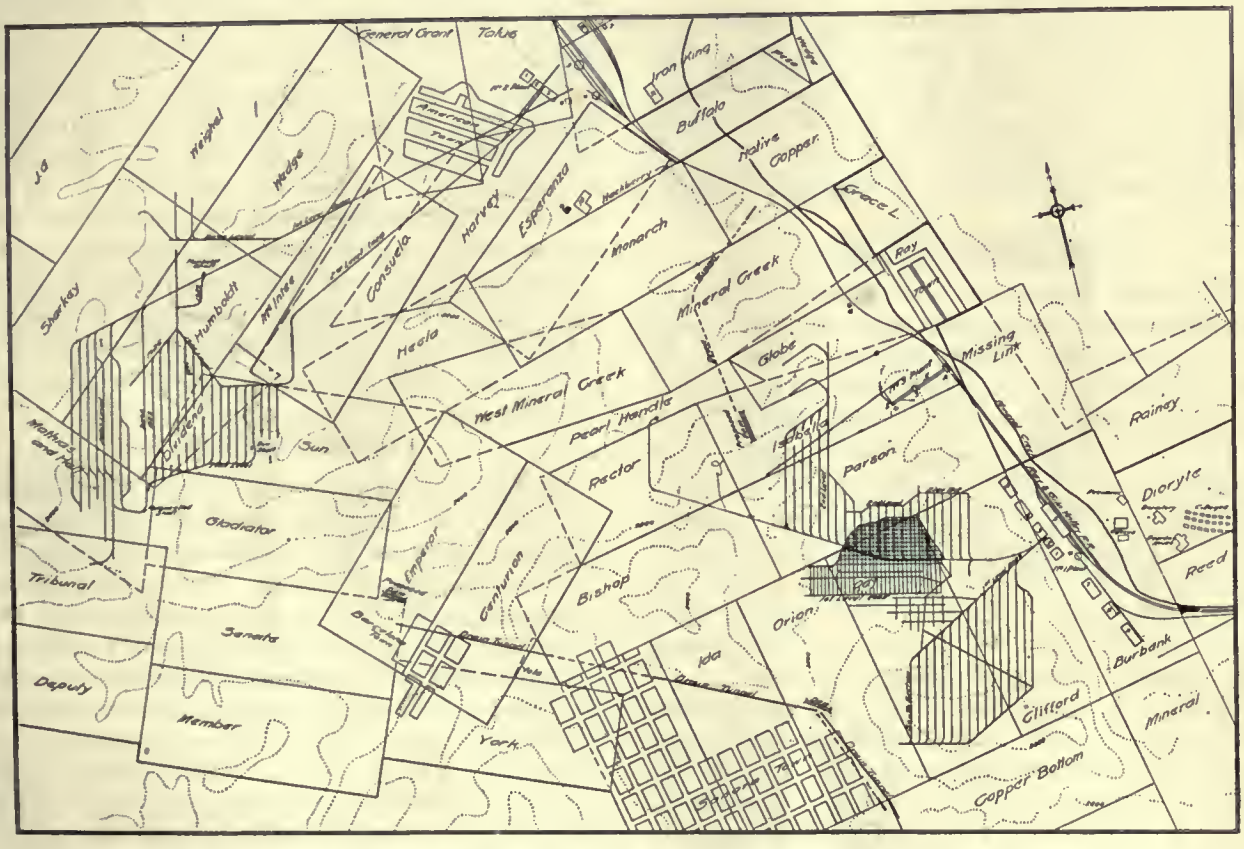
At Ray Junction, the connecting point between the Ray & Gila Valley railroad and the Arizona Eastern railroad, the company owns 129.896 acres of mill-sites and other lands. This property was acquired in the early history of the property and used by the predecessors of the Ray Consolidated Copper Co. for mill-site, residence, and business purposes. It is now used for terminals of the Ray & Gila Valley railroad and for residence and business purposes by a portion of the town of Kelvin.

The lands owned at Hayden form a solid body consisting of 3684.22 acres, in addition to which the company holds leases on certain school lands, bringing the total area owned and controlled at this point up to about 4000 acres. The water rights and the improvements of them owned by the company at Ray and Hayden have proved adequate for all requirements.

Ore Developments and Reserves

No drilling or work of any character was done during the year for the purpose of developing additional ore reserves, and no changes have been made therefore in the figures of developed tonnage as shown in the last annual report, except in the additions that have resulted through the purchase of the Ray Central mines.

At the time the Ray Central property was acquired, its engineers estimated available ore reserves to the amount of 7,384,000 tons, averaging 2.51% copper, of which quantity 673,000 tons was shown to be of relatively high grade, containing 5.83% copper. Our engineers, considering some of this tonnage not sufficiently well developed to be classed as positive ore, and questioning the practicability of economically mining certain parts of this orebody, recalculated these ore reserves and arrived at a figure of 5,589,898 tons as representing fully developed ore, having an average copper content of 2.51%.



HAULAGE LEVELS AND SURFACE EQUIPMENT OF THE RAY CONSOLIDATED COPPER CO., RAY, ARIZONA.

*Annual report to the president and board of directors.

Of this total, 446,000 tons is of the relatively higher grade, averaging 5.3% copper.

The total tonnage of developed and partly developed ore as previously reported in original Ray Consolidated and Gila ground was 77,314,470 tons, averaging 2.17% copper. Adding to this the recalculated tonnage of the Ray Central group brings the grand total to 82,904,368 tons, averaging 2.19% copper.

As pointed out in the last annual report, there is positive indication that further development work will result in substantial additions to the tonnage stated. Some lateral extensions of developed orebodies are known to exist. It is likewise known that in certain areas development by drilling was not carried to sufficient depths to determine the entire thickness of the orebodies, and this statement is true of the Ray Central area as well as that of the original property.

The total tonnage mined from the beginning of operations up to the end of 1912 was 2,247,395 tons, averaging 1.72% copper; the total known tonnage remaining in the developed area is accordingly 80,656,973 tons averaging 2.2% copper. The total area developed and included in tonnage calculations is 205.2 acres.

Underground Development

The original property was opened for underground mining through two vertical shafts nearly a mile apart, one in the easterly portion of the property known as No. 1 shaft, and one in the westerly area designated as No. 2 shaft. After the acquisition of the Ray Central property, and in the interest of its most economical operation, it was necessary to sink a third shaft, known as No. 3, this being intended more particularly for the extraction of the relatively high-grade orebody previously referred to. This shaft was not completed until near the close of the year, and no tonnage was produced through it during the year.

During the early part of the year, development work was prosecuted most actively in opening main levels and laterals in the area served by both No. 1 and No. 2 shafts. Toward the end of the year the No. 1 area was so far developed as to permit of materially decreasing the rate of work in that area, but development in the territory tributary to the No. 2 shaft, which was started nearly a year later than that in the No. 1 area, was continued at the maximum rate possible in an effort to increase the production from that section to its proper proportion of the full tonnage for which the property has been equipped.

No development of consequence in the way of main workings was done from the No. 3 shaft during the year, but some of the principal laterals from the No. 1 shaft were extended into the normal grade orebodies of Ray Central territory, although a limited amount of tonnage was produced from that section. Most, if not all, of this grade of ore from the Ray Central property will be mined by the regular system now applying to our operations and delivered to the surface through No. 1 shaft. The high grade ore will, however, be mined by a method requiring some timbering and back-filling with waste, this being necessary to prevent breaking the surface adjacent to Mineral creek where a portion of the high-grade orebody lies.

The total amount of underground development for the year in main laterals, drifts, shafts, and raises amounted to 133,345 ft., bringing the total since the beginning of operations up to 292,243 ft., or nearly 55½ miles. It must be remembered, however, that a large part of this underground work consists of relatively small drifts and raises driven in connection with the necessary preparation for the methods of mining employed, and that as actual mining progresses in the areas so prepared, these workings are destroyed. The total length of workings that have been destroyed or rendered inaccessible in this way amounts to about 75,000 ft., or a little more than one-quarter of the whole. This does not mean, however, that the usefulness of such work is lost in so short a time, as it is often enlarged or merged into stopes which are filled with broken ore awaiting withdrawal by gravity through chutes into cars on the main levels, the expense of loading and transporting such ore from the mine to the bins amounting to only a few cents per ton. The amount of ore so broken in stopes and ready for use at the end of the year was estimated at over 2,500,000 tons, and as larger stoping areas are developed for the production of ore from this so-called 'reserve drawing' and a correspondingly smaller percentage of the tonnage is produced from direct development or mining, the costs of mining are decreasing proportionately.

Mining Operations

Mining operations for the year were continued along lines as originally planned, and were advanced to such an extent that the tonnage for the year was derived as follows: Development, 29.3%; active stopes, 44.7%; reserve drawing, 26%. During the coming year the percentage of tonnage obtained from reserve drawing will increase rapidly, and, as previously stated, mining costs will decrease accordingly. The ideal, or most economical stage, will not be reached until 50 to 75% of the ore, depending on varying local conditions, is derived from such reserve sources. Any doubt as to the probable percentage of ore and copper recoverable when using the present system of mining has been largely eliminated, owing to the fact that during the year all of the available ore in two small sections of the mine was extracted, producing 92.6% of the copper previously shown by drill and underground development. The percentage of tonnage, based in the same way, produced from these areas, was somewhat greater than the percentage of copper, on account of some low-grade material being unavoidably included.

This result is particularly satisfactory because the ore in the sections from which it was obtained was comparatively thin, being only about 50 ft. thick. The orebodies as a whole average much thicker, and in the future, higher extractions should obtain, as it will be possible to remove a much larger tonnage of ore with no greater amount of dilution, due to the mixture of waste with the ore from along the plane of division of ore and capping.

The total direct cost of mining for the year, including crushing of the ore through a 1-in. mesh screen and delivery of it on board cars, together with a proper apportionment of all general and fixed charges, was 77.55c. per ton. This average cost was considerably higher than the costs in those parts of the mine which have been sufficiently opened to permit of economical working, and is accordingly higher than it will be in the future.

Active mining did not begin in the No. 2 area until early in the year, and until late in the year the tonnage procurable from this area was not only small, but on account of the limited area and uncompleted working arrangements, the handling of it was expensive. As this area is opened to a producing capacity more nearly comparable with the No. 1, the costs here will be even lower than those of the No. 1 because the ground is of equally as favorable a character, and the orebodies are, generally speaking, thicker. The mining costs for the last quarter of the year on the same basis as previously stated, were 71.05c. per ton. The costs stated here do not, however, include the regular charge of 12½c. per ton against operation for the retirement of mine development suspense account.

Grade of Ore Mined

The grade of the ore during the year was below the average for the property, as in fact it has been since the beginning of operations. The reasons for this have been frequently mentioned in previous reports, but it may be briefly stated again, that in the system of mining employed, it is imperative that the topmost zones of the orebodies as well as thin outlying portions of it should be mined first or at the commencement of operations; otherwise such tonnage would be lost entirely or become so intermixed with moving overburden that it would be worthless for future recovery. A large part of the so-called 'fringe ore,' meaning outlying thin and fragmentary bodies, around the No. 1 area has been removed and mining operations are accordingly being more and more confined to areas in which the ore occurrence is more nearly typical of the entire body. There still remains some outlying ore to be recovered in both the No. 1 and No. 2 areas, and this feature will have to be dealt with for some time to come. Furthermore, as stoping areas are extended, we will continue to produce some lower grade and at times partly oxidized material lying at or near the rather indefinite dividing plane between ore and capping. Nevertheless, production is gradually increasing in grade and a closer approximation to the normal average may be expected before the end of the current year.

Surface Improvements at the Mines

The photographs accompanying the report with what has been said regarding these in previous reports, leave little to be added. During the year the installation of a new compressor at the No. 1 plant was completed. This large machine, having a capacity of 5000 cu. ft. of free air per minute, has been in successful operation for several months. The entire compressor plant has a capacity of 11,000 cu. ft. per minute—all that will be required for the maximum operations now contemplated. The sinking of the new shaft on Ray Central ground has been previously referred to. This shaft is equipped with adequate hoisting machinery, and in connection with it a small crushing plant and ore-bins have been provided, of a capacity sufficient to accommodate the tonnage of high-grade ore to be produced.

The crushing installation at the No. 2 shaft is now being completed by the addition of a duplicate set of crushers and rolls, intended principally as a protection against delays in case of accident or necessity of repairs. Commodious and completely equipped change-houses have been erected at the No. 1 and No. 2 shafts for the use and benefit of employees, and a modern type of hospital ample accommodations for the care of workmen has been provided.

Construction, Improvements, and Operation of the Mill

Construction and improvements at Hayden. As described in former reports, the Hayden mill consists of eight independent units, each having a rated capacity of 1000 tons per day. At the beginning of the year the shipments had only reached a point where it was necessary to complete and operate five units. During the past year, the tonnage was gradually increased, each month showing an advance over the previous one, until at the end of the year seven units were complete, six of them in continuous operation, and the seventh running intermittently as required. The equipment of the remaining section is over half completed; all of the material is on the ground, and when conditions require, it can be made ready for use within thirty days.

Some improvements have been made in the plant during the year, both along lines of increasing capacity and of improving operating results, but nothing of consequence has been done or is necessary in the way of alteration in either design or arrangement.

In connection with power plant, pumping station, and other accessories, nothing more than incidental additions and improvements has been made during the year, and all these continue to give satisfactory and economical service in every respect.

Aside from the construction of some necessary dwellings and other living and community accommodations, no new construction has been undertaken during the year outside of the completion of mill units as they were required, and except as to this, very little construction of any kind will be necessary in the future so far as can now be foreseen. During the year the American Smelting & Refining Co. completed its smelting plant sufficiently to accommodate the present output and it has been in continuous operation since May, having commenced to receive the entire output of concentrate in February.

Operation of the Mill

The total ore treated during the year was 1,565,875 tons, as compared to 681,519 tons for the nine months of the year 1911, during which the mill was running. The increase of this year over last year was 884,355 tons, or approximately 130%. The rate of increase in tonnage by quarters is shown in

the following table, in which the figures are given.

	Tons.
First quarter	301,674
Second quarter	374,609
Third quarter	429,411
Fourth quarter	460,181
Total	1,565,875

Average tonnage per day for the year, 4278.

The average copper content of the ore treated was 1.677%, as compared with 1.83% for the year 1911. The average recovery for the year, based upon the total copper contained in concentrate produced, was 68.2783%, corresponding to a recovery of 22.9 lb. of copper per ton of ore. The average recovery for the year 1911 was 63.01 per cent.

The cost of milling was 46.878c. per ton as compared with 59.45c. for the previous year. This reduction in costs reflects in a measure the natural result of handling increased tonnages without suffering a directly proportional increase in the cost of supervision, general and fixed charges, and in many of the larger items of operating cost such as power and water-supply. The units of the mill, as operated during the year, have shown an economical capacity of at least 1000 tons per day. As the full capacity of the plant is approached, further decreases in milling costs will be realized.

Production and Costs

The total production during the year of copper contained in concentrate was 35,861,496 lb., as compared to 15,721,520 lb. for the nine months of the previous year, indicating again an increase of nearly 130%. The average grade of concentrate produced was 18.944% copper as compared to 22.044% for the year 1911. The difference in grade was due in a measure to the treatment of some relatively low-grade and partly oxidized ore from the upper zones of the No. 1 area, and in part to the increase of tonnage from the No. 2 area of the mine where the ores being worked contain a somewhat higher percentage of iron than is present in the orebodies of the No. 1 area. The production of copper contained in concentrate for the year by quarters was as follows:

	Pounds.
First quarter	7,122,943
Second quarter	8,952,074
Third quarter	9,295,818
Fourth quarter	10,490,661
Total	35,861,496

The average cost per pound of copper produced, based on the net copper returns from concentrate after smelting and refining deductions were made and after applying the dividends from the Ray & Gila Valley railroad, but not other miscellaneous earnings, as a reduction in cost, was 9.828c., as compared to 10.765c. per pound for the previous year.

The average total cost for the year for mining and milling, exclusive of transportation charges on ore, but including for the second, third, and fourth quarters of the year a charge of 12½c. per ton of ore treated for extinguishment of mine development costs, was $1.345 per ton. The per pound cost previously stated covers all charges of every nature, including the extinguishment charge above referred to. This charge amounted to 0.46c. per pound of copper for the entire year's production. The cost per pound for the month of December arrived at as above, was 9.075c., including the same per ton charge for the retirement of development expense, which amounted in this month to 0.56c. per pound. The average tonnage treated for the month of December was about 5000 per day.

Preliminary figures for the month of February 1913, available at the time of writing this report, indicate that on an average daily rate of approximately 6300 tons for that month, the cost per pound, deduced as above described, was slightly under 9c., and as not only the tonnage but the grade of ore will increase uniformly until full capacity is reached during the current year, there is every assurance that the cost per pound for the year 1913 will be well within the last-named figure.

Ray & Gila Valley Railroad

No additions as to trackage were made during the year, although some moderate expenditures were incurred in the application of betterments, such as ballasting and the improvement of yards. Of equipment, only a few additional cars were purchased as needed.

Conclusion

The operating department in Arizona is well organized, complete, and efficient, and the officials and members of it are deserving of special commendation for the energy and skill exercised in the improvements in general and economic results of operation which were applied uniformly month by month throughout the year. At this time all phases of the company's operations and business have reached a systematic and orderly basis. All the usual problems incident to the development of a new industry have been satisfactorily and permanently solved, and there only remains now the work of development and expansion in mining operations necessary to bring the output up to the contemplated rate of 8000 tons per day. This should be accomplished during the current year, and results will then more than fulfill all predictions that have been made by the operating department, not only as to the volume of production, but as to the cost of it.

Eastern Copper Production

The copper production of the Eastern or Appalachian states in 1912, according to figures compiled by H. D. McCaskey of the U. S. Geological Survey, was 19,265,945 lb., valued at $3,178,882—a decrease of 339,441 lb. in quantity, but an increase of $728,208 in value. Of the total output, 18,483,173 lb. came from the Ducktown district of eastern Tennessee, from 603,229 short tons of pyritic copper ore treated. The remainder was chiefly from Pennsylvania, where, at the Cornwall iron mines, magnetic separation of large tonnages of magnetite ores results in the recovery of copper-bearing pyrite. Maryland, Virgina, and North Carolina also contributed to the copper output.

Blanket Concentration of Cyanide Solutions

By John Gross

It sometimes becomes advisable to attempt the saving of a portion of the precious metals in an ore that are too coarse for the ordinary system of cyanidation, under conditions where amalgamation is not advisable, owing to the high strength of cyanide solution carried, or an excess of lime in the solution. I have seen plates almost entirely eaten through in the course of several months, using a battery solution containing two pounds of KCN and carrying a protective alkalinity of about one pound of lime. In some late operations it was found that there was a certain discrepancy between the amount of gold in the heading and that shown by the production plus the tailing. An investigation disclosed the fact that a considerable amount of coarse gold was retained in the mortars, and quite a little was found in the sump of the elevator that delivered the pulp from the batteries to the classifier. It was also found that losses occurred due to coarse gold in the sand tailing, and that concentrates produced from sand tailing in testing work sometimes carried a large proportion of gold that often did not show in the regular assays of the sand tailing.

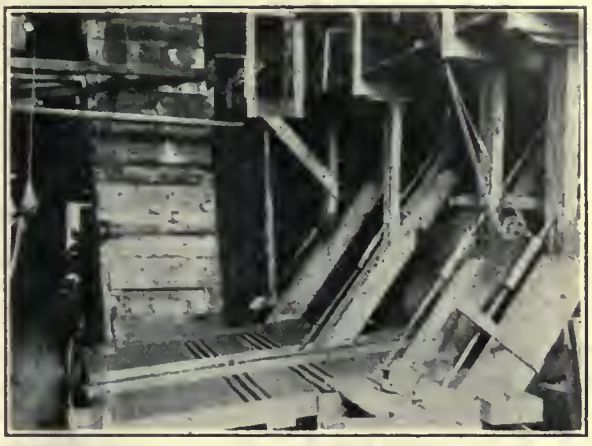


Fig. 2. Canvas Tables in Place.

An experimental table, 4 ft. 6 in. wide and 10 ft. long, with a grade of about 1½ in. per foot, was placed after one of the batteries and covered with a wool blanket. The first test was for a period of 20 hours. The blanket was then taken up and washed in an ordinary tub; the concentrate, which was rather dirty, collected, and panned to a clean concentrate weighing 0.8 lb., assaying $12 gold per pound. A number of further tests were made and gave approximately the same results, producing a daily average of 12 lb. of concentrate (not cleaned by panning) assaying slightly more than $1 per pound. The concentrate was then passed over a silver-plated amalgamated plate, 30 in. wide by 6 ft. long, and fitted with a mercury trap. The amalgamation was conducted in water and operated by hand. It was found that a large proportion of the gold could be obtained easily as amalgam and could be converted into bullion of sufficiently high gold tenor to be accepted by the Mint, the difference between $20.67 per ounce as paid by the Mint and $20 or less paid by the smelter, being a matter well worthy of careful consideration.

The 30 stamps in the mill were at once equipped with blanket tables. The construction of these is shown in the sketches, Fig. 1 and Fig. 3, and in the view, Fig. 2. In the construction of these tables it is necessary to bear in mind: (1) strength and rigidity; (2) leak-proof. The surface must be a true plane of sufficient rigidity to avoid warping. Any irregularity causes undue rapid currents and the formation of sand banks. It is necessary to avoid leakage of gold and silver-bearing cyanide solutions.

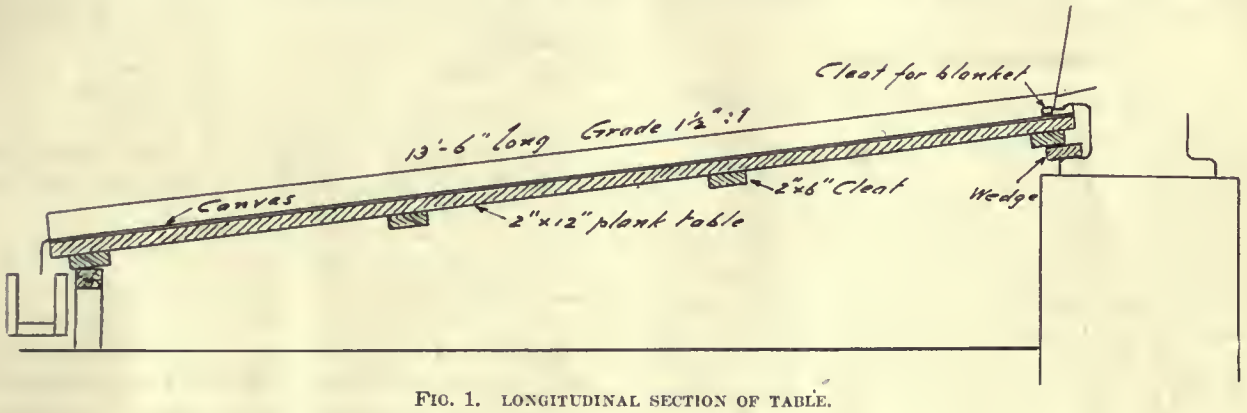


Fig. 1. Longitudinal Section of Table.

The first condition was obtained by constructing

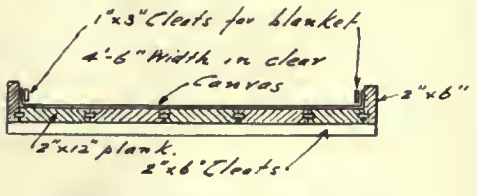


Fig. 3. Cross-Section of Table.

the table of 2 by 12-in. pine, carefully fitted with tongue and groove joints to make up the proper width. These planks were clamped tightly together and 2 by 6-in. cleats were nailed in place, the nails being driven at angles opposing each other and thereby giving a hold probably more efficient than screws. The table was then unclamped and the top surface planed to a true plane, after which the side pieces of 2 by 6-in. were nailed on, the same system of nail driving being employed as in the cleats. This construction is light and very satisfactory. The table was then placed in position,

supported at the lower end, and wedged loosely under the mortar lip at the upper. Such a table can be tilted to any desired angle from the lower end.

The second condition was obtained, but not by depending entirely upon the tightness of the joints of the table proper. After the table had been placed it was given a heavy coat of P. & B. paint and 10-oz. canvas laid over this, coming well up the sides and extending 6 in. below the lower end. This canvas was pressed smooth and tight against the table, to which it adhered nicely, making an entirely waterproof surface and an excellent foundation for the blanket. The latter is held in place by being pushed under the lip of the mortar and light cleats nailed loosely along the side pieces of the table and against the mortar lip. Originally pure wool blankets were used, but these were replaced by half wool and half cotton, which gave as good service and were considerably cheaper. A blanket lasted from one month to six weeks when washed daily. The tables had a fall of 1½ in. to each foot in length, with a pulp composed of 6 solution to 1 ore, crushing to 20 mesh; the pulp had an even flow.

Operations and Results

The blankets were washed each morning, two men taking about two hours to remove, wash, and replace the six blankets. With the use of an extra blanket kept on hand, a battery would not be hung up for more than 5 minutes during the replacement. At first the blankets were washed in an ordinary tub, but later the washing was done in the receptacle which consisted simply of a rectangular sheet-iron box, to which was attached a sloping back of a width sufficient to take the full width of the blanket, which was spread over the sloping back and washed off with a stream of solution from a small hose, the overflow solution going into the mill circuit.

The concentrate collected in the box was shoveled out and passed over the amalgamated plate, producing amalgam and plate tailing, the former being retorted and sent to the Mint, and the latter being saved, dried, and shipped to the smelter. This tailing contained the bulk of the silver. This method of handling the concentrate could have been improved by making the amalgamation automatic and by treating the plate tailing by regrinding and in the mill. However, the scale of operations did not warrant the installation of the expensive equipment necessary.

Before the installation of the blankets, a clean-up from the elevator sump, from two months' run, gave a retort of 10 oz., fineness 550 gold. After two months of use of the blanket, the sump yielded by 0.2 oz. retort. The effect of the blankets was also noticed in a very marked degree in the sand tailing by their freedom from erratic high concentrate. Especially interesting are the results obtained in the treatment of several lots of high-grade ore, the results of which are given below:

Weight of lot, 1888 lb. net; assay, $162.40 gold; 80.04 oz. silver, contents of lot, $153.30 gold, 75.56 oz. silver. The products were accounted for as in the table following.

		Assays.	
Product.	Weight.	Gold.	Oz. Silver.
Amalgam	14 oz.	$ 5.00	0.20
Plate tailing	9 lb.	349.40	1998.32*
Battery cleanings	40 lb.	19.60	39.30*
Solution	4 tons	10.60	2.00*
Blanket tailing	1840 lb.	43.20	61.44*

*Per ton.

Summary of contents:

	Contents:		Per cent:	
	Gold.	Silver, oz.	Gold.	Silver.
Amalgam	$ 70.00	2.80	45.7	3.7
Plate tailing	1.57	9.00	1.0	11.9
Battery cleanings	0.39	0.78	0.2	0.1
Solution	42.40	8.00	27.6	10.6
Blanket tailing	39.74	57.52	26.0	76.1
Total	$154.10	78.10	100.5	102.4

Another lot of 4266 lb., assaying $328.80 gold, 17.68 oz. silver, produced:

	Gold, %.	Silver, %.
In amalgam	35.1	19.5
In plate tailing	2.6	10.4
Total	37.7	29.9

Another lot of 1820 lb., assaying $225.60 gold, 30.84 oz. silver, produced:

	Gold, %.	Silver, %.
In amalgam	41.2	8.6
In plate tailing	3.0	3.6
Total	44.2	12.2

The products from a little over four months' run of this blanket plant, figured on the entire mill production, was:

	Gold, %.	Silver, %.
From amalgam	22.48	0.62
From plate tailing	4.65	1.71
Total	27.13	2.33

The above results show 82.8% gold and 26.6% silver of the total contents of blanket concentrate put into bullion.

Costs at the Ivanhoe Mine, Kalgoorlie

During 1912 the production was 237,266 tons of ore to a depth of 2420 ft., at a cost of $529,000, divided as follows:

Ore-breaking, per ton	$1.38
Filling stopes, per ton	0.27
Tramming and hoisting, per ton	0.58
Total ore extraction	$2.23
Mine development, per ton	0.52
Total underground	$2.75

The 100-stamp mill had an average duty of 6.88 tons per stamp per 24 hours. Amalgamation saved gold worth $560,000, and $1,680,000 by cyanidation of 105,892 tons of sand by percolation, 108,285 tons of slime by filter-pressing, and 23,089 tons of concentrate by roasting, grinding in pans, and filter pressing, with the following costs:

Cost per Ton			
Rock-crusher	$0.09	Cyaniding sand	0.19
Ore transport	0.03	Agitating slime	0.36
Stamping	0.42	Filter-pressing	0.14
Concentrating	0.12	Precip. and clean-up	0.09
Roasting concentrate	0.14	Disposal of residue	0.11
Fine grinding	0.04	Bullion expenses	0.09
Cyaniding concentrate	0.10		
Fine grinding sand	$0.19	Total	$2.11

Sinking a Circular Shaft at the New Modderfontein Mine

*In 1910 it was decided to sink a new shaft at this property on the Rand, one in which six tons of ore or waste could be hoisted each trip, the time required for loading, hoisting, and unloading not to exceed one minute. A shaft 18 ft. diam. was sunk 2158 ft. where the 'reef' was cut. In sinking operations, the shift consisted of the master sinker in charge, the leading sinker, his helper, and native crew. The day was divided into three 8-hour shifts, 6 a.m. to 2 p.m., 2 p.m. to 10 p.m., 10 p.m. to 6 a.m., these times being closely adhered to.

To take a typical shift: at 6 a.m. the night shift is sent up with the exception of the leading sinker and his helper, who stay behind to light up. After lighting up, these men ascend and report to the succeeding shift any matter of interest, such as loose rock in the shaft, a misfired hole, or any change in the ground. Meanwhile the rigger, or failing him, the master sinker, examines the bucket and its attachments, and the collar doors. Of chief interest in the attachments to the bucket is the rider, which in the case of an overwind is opened automatically, and is put out of action, allowing the King safety-hook to pass through its supports and hold the bucket. The collar doors are also interesting, as they were steam operated and were opened and closed without any exertion on the part of the top man. After allowing sufficient time for the powder fume to become dispersed, the leading sinker and his helper go to the bottom of the shaft and are followed by their shift of natives. The next process is to shovel out the rock broken by the preceding shift. The amount of rock broken per shift naturally varied, and as a rule, if one shift broke an unusually large amount, the succeeding shift would be a poor one, owing to the time taken in 'mucking.' A fair average shift would break about 30 to 40 buckets, or a little under 60 to 80 tons, and this would take 22 boys two or three hours to clean-up. At 27 tons to the foot, this represents 2 or 3 ft. per shift.

The shaft was making a little water, but not sufficient to warrant baling-skips being used, the ordinary bucket being filled by hand and tipped into a 'runway' on the surface. Several small streams of water were passed through, but these were successfully kept back by closely walling the shaft, where encountered. After cleaning out, the leading sinker would arrange the position for drilling holes. In the centre were the cut or sump holes. Six holes were drilled around an 8-ft. circle, and pointing toward the centre of the circle. Around this was the second lot of 10 holes drilled around a 16-ft. circle, that is, 4 ft. from the cut holes, and finally about 16 holes were used to round off the sides. In all about 32 holes were drilled per shift. This latter operation took about four hours, the remaining hour of the shift being occupied in charging holes and blasting. After the shaft was down some distance, machine-drills of the small type were successfully used. At a depth of 1000 ft., a chamber was cut in the side of the shaft, and arched in order to catch all water made above this level. The sump was capable of holding 35,000 gal., and a 3-throw pump was installed. Especial precautions were taken to deal with any influx of water that might occur. A small fan connected to a 2-ft. pipe provided ample ventilation, and kept the atmosphere at the bottom of the shaft fresh. The solid quality of the work can be well judged from the collar, the concrete in no place being less than 3 ft. in thickness, and widening at the corners to 9 ft. The concrete collar and surface arragements being completed, a start was made at sinking proper on January 2, 1911. The pilot shaft was widened out to its full dimensions, and in order to keep up the sides of the shaft, temporary cribbing was resorted to. Crib rings were put in every 4 ft., and were closely lagged, the size of lagging being 1½ by 9 in. by 5 ft. On reaching the bottom of the pilot shaft, the first curb ring was put in position, and the shaft was then bricked up to the concrete collar. To start with, a layer of cribbing would be removed, and the shaft lined with watertight walling. Concrete, made of 6 parts stone, 1 sand, 1 cement, was grouted in behind the bricks, the amount of grouting naturally depending on the smoothness and regularity of the exeavation. Down to the second curb, 100 ft., the bricking was 2 ft. thick, and was then reduced to 1 ft. The bricks used were good, well-burnt bricks, of standard size, and were bonded together with a mixture of 4 of sand to 1 of cement. A circular platform was used for the bricklayers, it being made to the size of the shaft in two halves, and worked successfully. When the brickwork reached the collar, the shaft was cleared for sinking and was sunk down to the second curb. The shaft was alternately sunk and bricked to a depth of 1600 ft., and was then sunk to its final depth, bricking being completed later. The bricking was in charge of the master sinker, and the day was divided into three 8-hr. shifts. On each shift were employed the sinker and his helper, two masons, and six natives, a good shift bricking up to 9 ft. On reaching a depth of about 700 ft., concrete blocks were used in place of bricks. These blocks were made on the property.

As the permanent equipment of the shaft simply consists of steel-rope guides and no timber, it can be seen that the cost of maintenanee will be low. Sinking was started on January 2, 1911, the 'reef' was cut on October 29, 1912, and shaft-sinking was stopped November 16, 1912, the shaft then being 2285 ft. deep. Sinking and walling, therefore, took over 22½ months, or at an average monthly speed of practically 100 ft. The cost of sinking averaged $69.46 per foot, and of bricking $36.52 per foot, or a total of $105.98 per foot. The total cost of the surface equipment, exclusive of quarters, amounted to $144,100.

*Abstract from *South African Mining Journal.*

The Canadian mint at Ottawa produced the following coins in 1912: 284,000 fifty-cent pieces, 2,500,000 twenty-five cent pieces, 3,000,000 ten-cent pieces, 5,000,000 five-cent pieces, 5,000,000 one-cent pieces, 88,000 ten-dollar gold pieces, and 155,000 five-dollar gold pieces.

Death Valley Potash Investigations

The United States Geological Survey reeently completed the drilling of four wells in Death Valley, California, with a view to testing the possibility of the oeeurrence of commereial deposits of potash. Samples of 11 brines were analyzed, with the result that 0.51 to 1.27% KCl was found in the original brine. The average was 0.94%. These were essentially saturated brines, the prineipal dissolved eonstituent being sodium chloride. The potash eontent is not unusual in any way, being about the average generally found in natural brines or saline residues in the desert basins.

The following general conclusions were drawn by the officers of the Survey: No shore markings or other evidence of former deep submergence of Death Valley have yet been discovered. It appears that the deposits laid down in this valley have been chiefly the results of temporary shallow submergences and alternate desiecations. Thus, the deposits that make up the floor of this valley are supposed to have been built up layer by layer, the salts having crystallized from the water evaporated from the temporary shallow lakes and having been oeeasionally buried in mixtures of sand and silt, including more or less saline material swept in by oeeasional floods. This is the process that is going on at the present day.

A vast amount of saline material is aeeumulated in the bottom of this valley, but the mode of its deposition probably is not favorable to selective erystallization on a large seale. Segregation of potash or any other portion of the soluble eonstituents of the waters may have taken plaee to a slight extent in the individual salt crust layers, but under the conditions described any such differentiation is likely to have been restricted to the individual layers as units, and therefore has occurred on a scale so small as to be of doubtful practical importance. It seems evident that unless a vast body of saline material has been deposited at one time during a single period of desiceation that there would be little chance for the various dissolved constituents to become segregated one from another on a large scale. There is no record of the drying up of a single large lake of saline waters in Death Valley. Although it is possible that the shores of such a lake might have been eompletely buried, the assumption that this may have happened must be purely a matter of speculation.

Similar reasoning may well apply to many other areas in the desert basin region. Great interior lakes have existed in eertain areas and may have dried up under such conditions that the salts they contained were deposited in a great body and that the potash and other minerals in the waters were to a eertain extent segregated in some portion of the deposits by crystallization. Searles lake contains a deposit of salt evidently produced in this way, and others may be found, although they are not now exposed at the surface. It does not appear that there is much theoretical justification for the belief that such deposits must be present in Death Valley. It is, of course, possible that the present conelusions are based on insufficient negative evidence, and for this reason any further drilling that may be earried on by private claimants in the Death Valley region should afford a record of mueh importance and interest in this connection, and it is hoped that good records will be kept.

Making Dredge Spuds

In the manufacture of new forward spuds for the dipper dredges *Mindi* and *Chagres*, used on the Atlantic division of the Panama canal, it has been found necessary to resort temporarily to the use of native wood, owing to lack of other timber of suitable size in stoek. The native timber is obtained from large trees found here and there in the vieinity of Gatun dam. They are cut down, hauled by rail to the Cristobal marine shops, where they are shaped to the required size. The wood is fairly close grained, slightly resembles oak, but is full of sap and does not have the resisting power of Douglas fir or yellow pine, the wood eommonly used for this purpose. Spuds made of native wood have been tried, but it has been found that they do not last long, and only serve as a temporary substitute. In order to strengthen and keep them in service as long as possible, the plan has been adopted of encasing the timbers, American as well as native stock, in iron plates made into a continuous piece by welding the short lengths together in the smith shop at the drydock plant. Each of these plates, when finished, is ¾ in. thick, 36 in. wide, and 48 ft. long, and is fastened to the spud timbers by 1⅛-in. rivets. When the heads of the bolts are sunk in the timber, the holes are capped with pieees of wood to prevent the exposed surfaces from eorroding. The plan of using plates has also been tried on some of the spuds on the dredges in the Pacific entrance to the canal, but the welding in this case was done in the United States and shipment made in the proper lengths.

The plates, four to each timber, will give an added weight to each of the new spuds of about nine tons. making the total weight of the longer pieces over 20 tons each. The spuds used on the dredge *Mindi* are 40 by 40 in. square and 57 ft. long; those on the *Chagres* are 36 by 36 in. square and 68 ft. long. New spuds for these two dredges are being formed out of four timbers, cut from native stock, and securely bolted together. In addition, a spud is being made for the *Chagres* out of a single piece shipped from the United States.

The life of a spud timber varies, and depends in a great measure on the strain to whieh it may be subjeeted. During the past two years, the *Mindi* has broken 9 and the *Chagres* 19 spuds. The greater breakage in the ease of the *Chagres* is mainly due to the fact that its spuds are eonsiderably longer than those of the *Mindi*, and, in eonsequence, are subjeeted to a greater strain; also, that the sectional area of its spuds is smaller. When unfitted for further use, the old spuds are stripped of their ironwork and piled up in one part of the marine shops yard. An effort is being made at the Mount Hope depot to work them up into smaller pieees.—*The Canal Record.*

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Drilling Records

The Editor:

Sir—I noticed recently in the *Press* a request for hand-drilling records and am enclosing herewith a copy of some I have just found in a clipping file, which may satisfy your correspondent.

HAND-DRILLING RECORDS*

	Time, min.	Inches drilled.		
Single	10	19 11/32	E. F. Durham, Grass Valley, California	Midwinter Fair, San Francisco, 1894.
"	10	19 6/16	T. J. Ahearn, Grass Valley, California	Midwinter Fair, San Francisco, 1894.
"	10	18 11/16	D. L. Jones, Denver, Colorado	Midwinter Fair, San Francisco, 1894.
Double	10(?)	32	Moore and Butler	Pony, Montana, July 4, 1898.
"	10(?)	37 15/16	Page and Wainwright, Sonora	Stent, California, Sept. 9, 1899.
"	15	55	Bradshaw and Freethey, Butte	Spokane, Washington, Sept. 24, 1901.
"	15	51	Ross and McLeod, British Columbia	Spokane, Washington, Sept. 24, 1901.
"	15	45 7/16	Page and Pickens[1]	Tonopah, Nevada, July 4, 1912.
"	15	41 7/16	Lindquist and Dahlen, Victor, Colorado	Tonopah, Nevada, July 4, 1912.
"	15	38 3/16	Porter and Goddard, Oatman, Arizona	Tonopah, Nevada, July 4, 1912.
"	15	46 plus	Stewart and Carmack, Leadville, Colorado[2]	Quarto-Centennial, Colorado Springs, Aug. 1901.
"	15	43 6/8	Hupps and Lindquist, Ouray, Colorado	Quarto-Centennial, Colorado Springs, Aug. 1901.
"	15	41 1/4	Chamberlin and Malley, Leadville, Colorado	Quarto-Centennial, Colorado Springs, Aug. 1901.
"	15	40 3/8	McNichols and Lamb, Victor, Colorado (Previous local record said to be 39½ in.)	Quarto-Centennial, Colorado Springs, Aug. 1901.
"	15	49	Names not given[3]	Calumet, Michigan, Aug. 24, 1912.
3-hand	15	41 1/8—43	Page, Kitto, and Dingle, Grass Valley	Jubilee Fair, San Francisco, Feb. 22, 1898.
"	15	36 3/4	Feeney Brothers and Larkin, Grass Valley	Jubilee Fair, San Francisco, Feb. 22, 1898.
"	15	42	Page, Kitto, and Harvey, Amador[4]	Midwinter Fair, San Francisco, 1894.
"	15	39	Feeney Brothers and Lynch	Midwinter Fair, San Francisco, 1894.
"	15	59(?)	Amalgamated team, Butte	Hancock, Michigan, July 4, 1911.
"	15	59 1/2	Amalgamated team, Butte	Calumet, Michigan, Aug. 4, 1911.

**Mining and Scientific Press*, October 1, 1898; September 16, 1899; July 13 and August 3, 1912. *Eng. & Min. Jour.*, September 14, 1912.

[1]In Roklin granite, 66 blows per minute.

[2]Drilled through block of Gunnison granite in 14 minutes 30 seconds.

[3]In Cape Ann granite, starting with 1¼-in. and finishing with ¾-in. bit. This was in a contest against a hand-hammer machine operator, who drilled through the rock, 60 inches, in 14 minutes, starting with a 2-in. and finishing with a 1⅛-in. bit.

[4]Forty inches through a block and 2 inches in a fresh hole.

It seems to me that by getting together the official records for similiar contests at various mining centres, a very interesting table might be compiled which would save these data from being lost and help avoid disputes that arise at nearly every contest as to 'the record' at that time.

TIMEKEEPER.

Deadwood, South Dakota, May 2.

Continuous Agitation at the West End Mill

The Editor:

Sir—I am writing to clear up an incorrect impression evidently entertained by Jay A. Carpenter at the time he prepared his excellent paper on 'Continuous Agitation at the West End Mill, Tonopah.' In the article Mr. Carpenter writes: "The old-style arm agitators, with the aid of peripheral air-lifts, are in successful use for continuous agitation at the old Belmont mill in the Tonopah district, yet the same method was tried and discontinued at its neighbor, the Desert mill of the Tonopah Mining Co. Why such opposite results should be obtained is difficult to understand."

Previous to July 1912 the Desert mill was not equipped with any mechanical slime-thickeners, with the result that when continuous agitation was tried some time ago, it was impossible to continuously draw slime pulp of the proper specific gravity from the ordinary settling vats in use. Within a few days after putting the continuous system in operation it was found that the pulp contained so much moisture that the filters showed a decrease in the amount of dry slime treated, with the result that continuous agitation had to be abondoned until Dorr thickeners were installed. Since the installation of the Dorr thickeners in the slime collection vats, continuous agitation has been in successful operation; however, there has been no improvement in extraction with continuous agitation over that obtained with the intermittent charge system. The advantages of the continuous system, in this instance, accrue through a reduction of operating costs. The continuous system requires less power, as the pulp is lifted against a lower head, and the services of one operator per shift have been dispensed with since it was installed.

A. R. PARSONS.

Monrovia, California, May 13.

Whim Well Copper Mines and the Murex Process

The Editor:

Sir—In the *Mining and Scientific Press* of April 2, under the heading 'Australia,' I note the following: "It is stated that the Murex process at the Whim Creek copper mine is a failure and the recently appointed metallurgist returned to Kalgoorlie." I en-

close for your information a circular recently sent the shareholders of the company. Mr. Sleeman, the general manager, wrote on February 26 last: "As you know, Mr. Connor came here for this purpose but proved unsuitable for the position. As you also know, Mr. Green of the Murex company has highly recommended Leroy Clapp of Broken Hill." This accounts for Mr. Connor's return to Kalgoorlie. It is certainly not a fact that the Murex process has proved a failure at Whim Creek, and I should esteem it a favor if you would correct the statement.

EDGAR ANDERSON.

London, May 5.

[We are glad to print this correction from the chairman of the Whim Well Copper Mines, Ltd. Evidently our correspondent was in error in forwarding an unverified report even though it was not stated as an ascertained fact. From the enclosed circular we abstract the following: "You have from time to time received information regarding the installation of the Murex process concentrating plant with a capacity of 200 tons per day. The erection of this plant was completed last autumn and reference was made to it by the chairman in his speech at the general meeting in December when he stated that a series of trial runs had commenced. A number of minor mechanical difficulties in relation to the crushing portion of the plant were encountered in the early stages, although good extractions were even then obtained by the process on low-grade ores which hitherto the company had not been able to treat profitably. As you were informed at the meeting, the plant was designed as a wet-treatment plant. Owing, however, to the presence of kaolin in the ore, difficulties were encountered in dewatering and screening, and experience has proved that the extraction by dry-crushing methods is a great improvement on the wet crushing. This change to a dry-crushing plant has involved some inexpensive alterations and the installation of a Hardinge conical pebble mill. This additional plant has been shipped to the mine and its erection should entirely overcome the difficulties and raise the extraction to the original estimate. The advices from our general manager and from the experts of the Murex company who have supervised the operations, are to the effect that the Murex part of the plant is in excellent running order and undoubtedly satisfactory."—EDITOR.]

Extralateral Rights and the Prospector

The Editor:

Sir—In your issue of March 29, there appeared a letter from Theo. F. Van Wagenen on 'Extralateral Rights and the Prospector,' in which he asks himself the question "can anyone give the name and address of a prospector (of the class with which we are so familiar in the West or anything like him) that is at work in Canada," etc., and replies without hesitation: "No. He does not exist in those lands. They have not even a name for him, for the mental conception of his occupation has not yet been formed." Might I venture to suggest that he try the word 'prospector' on a Canadian. Also being a good Westerner it might accord with his humor to ante two-bits a name. Under such conditions, the Mining Recorders of Canada would no doubt delight to introduce him to some of their clients, among whom he would surely recognize many of his old Western prospecting friends whom he supposed had passed over the Great Divide. It is only fair, however, to warn him that it would cost him something, more perhaps than could be secured from the sale of one of his extralateral claims with its overshadowing cloud of litigation.

It is quite right to say that to attract prospectors a mining title must be acquirable in a simple and inexpensive way, but quite wrong to say that it is also necessary or even desirable to extend extralateral rights. British Columbia discarded extralateral laws and for the next decade was overrun with Western prospectors. Cobalt was prospected and developed probably faster and more thoroughly than any other mining camp in North America. Over 12,000 claims were staked in the Porcupine district in its first year. In northern Ontario and Quebec I do not suppose there has been a year since 1903 that there have not been from 5000 to 10,000 prospectors at work. It would be safe to say there is more prospecting being done in British Columbia than in Colorado, and that you can meet as many of your old 'telecums' in the bush of northern Ontario as in the Sierras. They have learned to tie the tumpline with the dexterity with which they used to 'throw the diamond', and to handle the canoe as they used to 'bust the broncho.' Lawyers and technical experts that look to court work may be interested in the retention of the extralateral law, but prospectors can flourish without it.

In the long discussions regarding a mining law for Canada, so far as I can remember not a voice was raised for extralateral rights. In fact, it strikes one as an anachronism to have the subject of extralateral rights debated.

R. W. BROCK.

Ottawa, May 12.

The Editor:

Sir—Messrs. Sam Otisse, Harry Holland, Ernie Holland, Alex. Gillies, 'Pop' Tebener, Peter McDonough, Dave Moore, and others, all experienced prospectors, passed through here this week for Ungava on a general prospecting expedition. Please call Mr. Van Wagenen's attention to this.

CANADIAN.

Cobalt, Ontario, May 6.

The first section of the permanent oil pipe-line across the isthmus will be laid along the Panama railroad re-located line. It will begin at a point near Paraiso Cabin and continue for the present as far as pipe of proper size, now on the isthmus, is available. It is estimated that there is about 16,000 ft. of this pipe in the various storehouses. The pipe will be 8 in. diam., strong enough to withstand a regular working pressure of about 420 lb. per square inch.

Special Correspondence

NORTHERN CALIFORNIA

TRINITY COUNTY MINES AND DISCOVERIES.—SHASTA COUNTY TIRED OF SMELTER LITIGATION.—YELLOW BUTTE MINE TO RESUME.—DRIFT MINING IN BUTTE COUNTY.

In the East Fork district of Trinity county, W. N. Clute and P. Petersen have bonded the Yellow Jacket group of claims from H. L. Boyd, R. L. Carter, and J. Tourtuloutte, the owners, and have nine men at work on development. About three years ago some rich ore was taken from these claims. On the same side of the hill and adjoining the Yellow Jacket group, is the Oversight group, now being developed by A. H. Wolfe, the owner. On the west side of the hill is the Trinity group of eight claims, on which W. McClaren is carrying on development. Nearby is the Bonanza, owned by J. L. Johnston, and on which there is an excellent showing, and the Golden Chest, owned by T. J. Rocheford and associates. The veins in this district are of high value for the gold and silver content,

NORTHERN CALIFORNIA.

and are well worthy of persistent development. The owners have been handicapped by their isolation and the high cost of supplies, but on the other hand labor is cheap and readily obtainable. Farther down toward North Fork are the Yellowstone and Enterprize mines, now bonded and being developed by R. A. Skinner, J. D. Day, and F. C. Meckel, from Boston people who are the owners. Eleven men are working and the 10-stamp mill is running. On May 12, $5300 was cleaned up from 306 tons of ore, and $4500 was cleaned up in April. This mine has produced about half a million dollars. For a long time the ore milled $100 per ton and then the pay-shoot was lost. The Yellowstone has produced about $160,000. The Ozark and North Star mines are now shut down, but will probably be bonded and in operation before long. Production figures are not obtainable, but one clean-up on the Ozark was $8000 and one clean-up on the North Star was $7000. The North Star has a 10-stamp mill on the property. At Dedrick, the Globe Consolidated M. Co. is working 130 men. A modern 100-ton plant is going in and is expected to be ready to run by August 1. J. B. Goodhue is president of the company, and Wallace MacGregor is superintendent. The Chloride-Bailey and the Mason and Thayer mines are also under bond to the Globe people. The operations of this company have greatly stimulated mining in this district.

The famous Brown Bear mine at Deadwood, owned by Tom McDonald, is under option to the Globe company. This mine has produced approximately $8,000,000, and has only been worked to a depth of about 450 ft. vertical. At present J. C. Lease & Sons have a lease on the China and are now running the 10-stamp mill on ore taken from there. They have 250 tons of ore in the bins that will run from $10 to $100 per ton. Several other lessees are working. A discovery is reported at Grizzly Creek, about 12 miles from Cecilville. There is still considerable snow in the vicinity, but about 15 men have hurried in to stake claims. Fred Molitor and E. Garrison made the original discovery in an ancient river channel there and are reported to have taken out $2000 in placer gold in three weeks.

In the French Gulch district, H. D. Lacey, who owns the Brunswick mine, is now working a small force of men. There is a 5-stamp mill on the property fully equipped. A good ore-shoot has been opened in the mine, and the mill will be started soon. At the Black Tom (Old Niagara) work is being carried on steadily, and the 10-stamp mill is kept busy. The Milkmaid, owned by Fred Conlan and H. F. Mercer, is now working ten men. The 10-stamp mill on the property will soon be started, to work the ore now being opened. The Hyland mine is working eight men. A 2-stamp mill is on the property. The Summit mine, owned by Tony & Allen, is now shipping ore to the Washington mill for reduction.

In Shasta county, the Gladstone mine recently entered a rich shoot of ore, and to celebrate the event, I. L. Gilson, the manager, gave a 'rag' dance at the mine the evening of May 10. Seventeen auto-loads of merrymakers went up from Redding. The Gladstone has 120 men working, and the 30-stamp mill is operating steadily. The concentrate is shipped to San Francisco. The Shasta Monarch M. Co. (old Gambrinus mine) is working 17 men. This property is near Whiskey Town. The lowest workings are about 250 ft. from the surface. The lower shaft is down 80 ft. The vein is 4½ ft. wide in the lower workings, with 2 ft. of $30 ore reported. A fully equipped 5-stamp mill, run by water power, is on the property, and has been running intermittently, but was started regularly last week. Boston, Canton, and Freehold, New Jersey, people own the property, and H. W. Rodgers is superintendent. The old Mount Shasta mine, which has produced about $700,000 to date, is working 12 men. The mine has been opened to a depth of about 450 ft. A 10-stamp mill is on the property. H. O. Cummins is manager. Considerable feeling over the smelter question is manifested at Redding. It is apparent that any further attempts to blackmail the smelting companies will be met with determined opposition on the part of the people of Redding. The curtailment of the smelting industry in that region has reacted heavily on Redding, and the people are getting tired of it. The population and business of Redding would be doubled in a short time if all the smelters were allowed to resume operations.

In Siskiyou county, the Yellow Butte Copper Co. has the only deposit of granite exposed in that district. It is a unique asset for a mining company, as a great quantity of granite will be necessary for top dressing the state highway that is to go through that region. Evan J. Evans has taken a ten-year lease on this granite deposit on terms favorable to the Yellow Butte company and also advantageous to himself. This deposit is on the Klamath Falls railroad and a spur track is to go in at once. Mr. Evans will have a force of men employed steadily, and the company will also start development shortly. This property has a shaft down 365 ft. and about 900 ft. of drifts. The mine contains a silicious gold-silver-copper ore, and is most conveniently situated for shipment to the smelters in the locality. This is a stock company owned principally by San Francisco, San Jose, and Oakland people. J. D. Hubbard is general manager.

In Butte county, a revival of interest is taking place in the drift gravel mines in the Magalia district. This district has been a famous producer of gold bullion in days past, and only a small proportion of the gravels have been worked. Levi Cohn and W. P. Moody, who own the Mineral Slide drift gravel mine, are working this property in a small way, but are making a steady bullion production.

AUSTRALIA—EASTERN STATES

QUEENSLAND'S PRODUCTION IN 1912.—NEW ZEALAND'S RESOURCES. — COMMONWEALTH OIL CORPORATION. — LABOR TROUBLES.

An advance copy of the annual report of the Queensland Secretary for Mines for the year 1912 has been published. It shows that the value of last year's mineral output was slightly over $20,250,000, an increase on the value of the previous year's output of about $2,500,000. The remarkable feature of the year has been the advance of copper.

The government geologist of New Zealand recently put some interesting facts before the Dominion's Royal Commission which has been visiting Australia and New Zealand to inquire into their trade and resources. One or two witnesses had given high estimates of the possibilities of New Zealand in regard to coal, oil, and iron. These estimates have been disputed by P. G. Morgan, the geologist. Much of the iron ore he considered inaccessible and difficult of treatment, and the amount of workable coal of all classes he put down at less than 250,000,000 tons, about 100,000,000 tons being bituminous. The oil resources he treated somewhat with scorn, but not without reference to a British company which is erecting a refinery at New Plymouth with a capacity of 10,000 gal. per day to treat a production of 689 gal. per day. The views of Mr. Morgan in regard to coal and oil were confirmed by James Park, professor at the Otago University, who remarked that the popular idea of the greatness of New Zealand as a coal-producing area was due to the wide distribution of the minerals, which, however, occurred in small mines.

The Commonwealth Oil Corporation, floated in England a few years ago with a great flourish of trumpets, is on its last legs. In seven years it has expended $6,320,000, and was already in difficulties at the beginning of last year, when receivers were appointed. Since then a sum of $567,000 has been expended. Shareholders have over $3,600,000 involved, and both they and the debenture-holders are now ready to efface themselves in order to save their money, but there seems to be very little chance of their getting the capital they need. A three months' suspension of the labor conditions has been granted for the fifth time, but it is to be feared that it means nothing more than a deferring of the evil day when operations must finally cease. Initially, the corporation wasted money recklessly, being filled with an inflated idea of the value of its property. The shareholders know better now. The chief events of the past few weeks have been strikes, all of them occurring in New South Wales. They have all been in mining and engineering concerns, and are the direct result of the fact that the Labor Party is in control of the government, and that the general election is near at hand. In these circumstances, the workers have said to themselves, "Now is our time, the ministry dare not oppose us, especially in view of the near approach of the dissolution of Parliament; and if we wait till after the election we may have in power a ministry that will not knuckle down to us." So they have put their party in a hole by strike after strike. Every one of these industrial disturbances has cost the government certainly hundreds and perhaps thousands of votes, from men, who, without being 'laborites,' prefer to see this party rather than the Liberals in power. As may be imagined, the ministers are very angry at the way their supporters have treated them, but are powerless to hold them in check. The latest strike is at Broken Hill, where the whole silver-lead industry has been brought to a standstill because the Barrier Labor Federation insisted that all but the officials of the Silverton Tramway Co. should become unionists. The company wanted the list of exemptions extended by seven, but to this the Federation would not agree, and for this paltry reason the great industry of an important field was laid idle, for of course the stopping of the tramway means the closing down of the mines. In explanation of this, it may be pointed out that the Silverton Tramway Co. is the connecting link between the South Australian railway system and Broken Hill district. At present the New South Wales lines have no direct connection with this important centre, and all its mineral export and inward traffic is from South Australia.

ST. LOUIS, MISSOURI

ST. JOSEPH AND DOE RUN LEAD COMPANIES.—STATE APPROPRIATIONS FOR GEOLOGY.—FUEL CONFERENCE AT URBANA. —LOCAL SECTION OF A. I. M. E.

Much interest centred in the annual meetings of the St. Joseph and the Doe Run lead companies scheduled for May 15. These two great concerns have been under fire for more than a year, and a determined effort has been made by Robert Holmes, a minority stockholder, to force a change in management. In a pamphlet of 88 pages, distributed to the stockholders shortly before the meeting, Mr. Holmes gave long extracts from the testimony of Messrs. Jones, Parsons, and Camp, the president, manager, and treasurer, respectively, of the St. Joseph Lead Co. A surprising state of ignorance was discovered, and, aside from Mr. Jones, the officers showed little knowledge of the true condition of the affairs of the company. No criticism has been directed at O. M. Bilharz, the engineer, or at any of the technical staff, but the business of the two companies seems to have been run with little regard for any but the chief stockholders. It was frankly stated to be regarded as a "family affair." While unearned dividends have been paid and it became necessary a year ago to fund the debts of the Doe Run company, the properties themselves have increased greatly in value. It was brought out in the course of a hearing in court that mining costs had been brought down to 78c. per ton, and milling was being done for 14c. The report of the St. Joseph Lead Co. for the year that ended on April 30, 1913, showed a net income, after charges and depreciation, of $637,910, against $598,082 the previous year. Dividends of $597,300 were paid, leaving a surplus of $40,610. The condensed balance-sheet as of April 30, 1913, shows assets as follows: Land, $6,725,342; buildings and equipment, $3,238,337; capital stock owned, $3,480,645; working and trading assets, $738,660; current assets, $1,980,435; due from affiliated companies, $319,430; deferred accounts, $227,156; total, $16,710,007. Liabilities: capital stock, $10,000,000; loan due October 31, 1931, $2,447,931; current liabilities, $1,834,242; reserve for depreciation, $122,903; profit and loss surplus, $2,304,930; total, $16,710,007. There is a contingent liability at April 30, 1913, of $139,012 for notes receivable discounted. Production of lead for the year was 66,847 tons. Average price received was $87 per ton. No one doubts but that with more careful and economical management in the higher offices, both companies can easily be put into good condition.

Geological work in Missouri and Illinois seems likely to be well cared for in the next two years despite political revolutions in both states. In Missouri, $50,000 has been appropriated for the geological work and $15,000 for topographic surveys under the State Bureau of Geology and Mines. In Illinois, final action has not been taken, but presumably the figures will stand as for the past two years. The legislative committee was disposed to increase the allotment, but the new Governor, having waged an active campaign on the basis of great economies to be effected, found it necessary to object to any increase. It was at first proposed to assess the Survey work hereafter on the State University, but apparently that plan has failed, and Mr. DeWolf and his associates will have their independent funds as heretofore. The recent fuel conference at Urbana, Illinois, was well attended, and seems likely to prove of much value. Among other resolutions approved was one for the revival of the Illinois Mining Institute, which once was an active and influential organization. In the meantime, Illinois and Missouri members of the American Institute of Mining Engineers have coöperated in organizing a St. Louis section. The meeting was well attended and brought together the leading men in local mining circles. Among other speakers were R. W. Hunt, D. R. Francis, and C. F. Rand, who came from New York.

JOHANNESBURG, TRANSVAAL

SIMMER DEEP DISAPPOINTING.—H. H. WEBB TO ADVISE.—SELECTIVE MINING IMPOSSIBLE.—LARGE SCALE WORK NECESSARY.

Notwithstanding the disappointing results obtained at the Simmer Deep, it transpires that the directors are not by any means disheartened and are determined to make another effort to put the earnings of the mine on a better footing. With this object, H. H. Webb has been asked by the Consolidated Gold Fields to look into the underground affairs of the mine and report whether by adopting selective mining, conditions may be bettered. The Simmer Deep is an extensive property to the dip and east of the Simmer & Jack Proprietary and is noted as being of unusually low grade. So far it has never succeeded in earning a dividend for the ordinary shareholders. Last year it made what is called a working profit of £35,546, but debenture interest and other expenses converted this working profit and an additional sundry revenue amounting to £16,548 into a net loss for the year of £4230. The Simmer & Jack is one of the deepest mines on the Rand and at the same time is one of the best equipped and handled both above and below ground, with the result that its working costs are about 2s. below the average for the whole of the Rand. What is wrong with the Simmer Deep is the grade. Last year the consulting engineer advised that an average of 18s. per ton was all that could be relied upon for 1912. Even that proved illusionary, for at the end of the year it only came out at 17s. 6d. per ton. Fortunately the management was able to reduce the working costs from 16s. 7d. in 1911 to 16s. 4d. last year and to reduce the effects of the fall in grade by at least one-half. There is little wonder, therefore, that shareholders should ask that selective mining be given a trial. Selective mining is extensively practised on the Rand, where the profitable ore only forms from 40 to 60% of the total ore developed, and under these conditions many of the mines on the Rand are at present paying fair dividends. At the Simmer Deep it is pointed out that the profitable ore reserves only average about 4 dwt. per ton, and that out of a tonnage of ore developed in the mine amounting to a million and a half tons only 6% of that total has a value as high as 4.75 dwt. This is barely sufficient to last the mill for two months' full run. It is clear, therefore, that the Simmer Deep is one of the few mines on the Rand where selective mining of some kind cannot be practised with at least a temporary advantage, and the mine to produce the best results needs to be worked on the largest scale possible, with the object of reducing the average working cost to its lowest limit. This fact has been recognized for some time, but the scarcity of native labor and the need of available capital wherewith to increase the output has prevented hitherto any attempts in this direction. Recent increases in the labor supply have resulted in the mine being worked on a larger scale, and the anticipations formed regarding the beneficial results of large scale working having been more than confirmed, it has been decided at the earliest opportunity to increase the tonnage crushed from 60,000 to 75,000 tons per month. How that increase in the capacity of the plant is to be brought about has not yet transpired, for at the present time, with 160 stamps, there are 9 tube-mills running, making the stamp duty already in the neighborhood of 15 tons per stamp. As an illustration of the advantages of large scale working, it may be mentioned that in November 1912, with 51,400 tons crushed during that month, the costs averaged 16s. 3d. per ton, while in April, with 60,150 tons crushed, the costs came out at 14s. 4d. per ton. To what extent large scale working can bring down the cost, it is difficult to say, but with large scale working and wholesale mining combined, it does not seem too much to expect the working costs, including development, to be reduced to 12s. Anything above that would not be of much assistance to the shareholders, and no mine on the Rand has yet been able to allow two or three shillings per ton for development and come out at such a low figure, a cost, however, which seems likely to be necessary if the low-grade deep-level mines are to be worked.

CANANEA, MEXICO

CANANEA WORKING 2200 MEN.—DEMOCRATA OPERATING ON NORMAL SCALE.—CALUMET & SONORA RESUMES.—OTHER MINES WORKING.

Operations of the Cananea Consolidated Copper Co. are being gradually increased, and at the present time there are about 2200 or 2300 men employed. A month ago there were only 1500 or 1600. Work has been resumed in a number of the mines on a small scale, and the number employed will be gradually increased. The Puertecitos mine was reopened last week, and shipments to the smelter are now being made. There is but a small force of men employed there, but the number is to be larger in the near future. The work is in charge of Henry Bollweg, who was superintendent of the Superior-Bonanza mine, near Imuris, which was being operated by the Cananea company, but operations were discontinued on account of the unsettled conditions preventing the receipt of supplies. This week work was resumed at the Veta No. 5 mine, one shift being employed. A shift of men was also put at work in the low-grade orebody in the Capote mine. During last week the concentrator was again placed in operation, with one section.

The Democrata Mining Co., of Cananea, is operating on an almost normal scale, and has about 300 men at work in the mine and smelter. The reduction division is making a good grade of matte which averages an output of 25,000 lb. of copper per day. The matte is converted in the smelter of the Cananea Consolidated company. The Democrata is operating with one furnace, the new one, and it is probable that in a short time the old furnace, of 125 tons' capacity, will be blown in. The mine is producing at the rate of 450 tons of ore per day. The ore carries gold and silver to an extent which adds one-fourth to the output. Operations are in charge of C. E. Hoffman, manager, and H. S. McKay, superintendent.

The Calumet & Sonora of Cananea company was recently forced to suspend operations temporarily for the reason that it was unable to market its output, due to shortage of cars. This has been remedied and work resumed. Shipments are again being made, and as soon as the returns are received, operations will be renewed. Developments on the 400-ft. level of the mine are exceedingly gratifying. In the south drift some good ore has been found which averages 15% lead, 11% zinc, and 1% copper. The drift has penetrated 50 ft. of the ore and the extent of the body is as yet unknown. No cross-cutting has yet been done.

Chenowith brothers, of Nogales, Arizona, have begun shipping ore from their Josefina property, in the Santa Cruz mining district. The property is near the Del Pilar mine of the Arnold Mining Co. The ore is shipped to a Douglas smelter. Because of the interruption in the railroad service, the owners of the property were unable to ship when they were ready two or three months ago. The Del Pilar mine is operating steadily, notwithstanding the unsettled conditions which have interfered with many other properties recently. A. O. Koppes is in charge of the property, which is a copper mine of considerable merit. The Cerro de Plata mine, Holt Bros., of Magdalena, managers, has made another shipment of silver bullion recently. This last consignment amounted to 1330 ounces. The mill of the Penn-Sonora company has been installed and is now in operation. The property lies to the west of the Sonora railroad and is a short distance southwest of Nogales, Arizona. It is known as the old Durazno property.

Owing to the fact that the management of the Moctezuma Copper Co. refused to accede to the demands of the miners that two American foremen be removed, a strike was called on May 17. Three thousand workmen and 150 Americans have been affected by the walk-out. It is stated that the management is making an attempt to settle the difficulty as soon as possible, and there is little doubt but what the strike will be of very short duration, but it illustrates the local spirit of unrest.

NEW YORK

AMALGAMATED REPORT.—I. S. & R. EARNINGS.—NEW SMELTER AT GLOBE PROPOSED.—FARRELL AND THE STEEL CORPORATION.—TRUST PROFITS AND PRICES.

The report of the Amalgamated Copper Co. has divided interest this week with the testimony given by the president of the United States Steel Corporation before the Federal investigating commission. The Amalgamated report only covers the period from April 30 to December 31, 1912, so that it is somewhat difficult to make comparisons with preceding years, especially as three Anaconda dividends and only two Amalgamated dividends are included. The actual earnings, as computed by the *Boston News Bureau*, were $11,654,160 as dividends upon the 73½% of Anaconda's stock which is held by the Amalgamated; $475,580 from the 43% of the stock of the International Smelting & Refining which it holds; $115,500 from 154,000 shares of Greene-Cananea; and $1,000,000 from copper sales. Deducting $626,350 interest upon notes, its net earning for 1912 appears to be $12,618,890, or at the rate of about $8 per share. Computations based upon earnings for the eight months indicate a rate of 6.42% per year. Cash assets amount to about $8,000,000. An interesting feature of the report was its disclosure that Amalgamated now owns 150,000 shares of Inspiration stock. It has been known all along that Amalgamated had a finger in the Inspiration pie, but the extent of its holdings was not known. About $3,000,000 was paid for the Inspiration stock. The report of the International Smelting & Refining Co. which accompanies the Amalgamated report, shows a net income of $11,106,047. Dividends paid amounted to $800,000, the surplus now amounting to $1,863,000. The International did not get full service from its lead plants in 1912, these having been affected by the Utah strike. Earnings should be high this year, as the Tooele plant is in full blast, concentrate from Miami having been diverted there from Cananea. It is said that the International will build a new plant at Globe to handle both the Inspiration and Miami concentrate. The smelting situation at Globe is an interesting one, as the ores of the district are oxidized to such an extent that a smelting charge is rather short of sulphur to provide for the matte. In reverberatory smelting of the concentrate, however, it is computed that a sulphur balance can be struck. There has been another possible outlet for the Globe district concentrate at the A. S. & R. smelter at Hayden, but unless the connection between Winkelman and the line to Globe is built, which seems doubtful, as the line crosses an area which the Government has reserved as the site for a reclamation project dam, this will not even be a possibility. The Old Dominion already has a smelter at Globe, but it only has blast-furnaces, and with characteristic conservatism, does not care to build reverberatory furnaces to handle custom business.

The testimony given by John A. Farrell, president of the United States Steel Corporation, in the suit which has been instituted by the federal Government for the dissolution of that corporation, has much of broad general interest. Mr. Farrell testified for five days, stating facts and figures with an accuracy and freedom that has astonished the public, which has grown accustomed to financiers and captains of industry who are unable to remember the simplest details of business transactions when brought upon the witness stand. He evidenced a complete familiarity, not only with the details of the business of the Steel Corporation, but of its principal competitors, and his manly and frank attitude has made a good impression upon the public, which is too ready to believe the worst concerning any trust. Much of the detail brought out is already known to those who are familiar with the iron and steel situation, but will interest those whose work lies in other directions. The United States Steel Corporation is far from having a monopoly of the business. The American Bridge Co., its bridge-building subsidiary, has 30% of the total business in its line, or 8% less than seven years ago; the National Tube Co. has 37% of the business in its line, or almost 20% less than at the time of formation of the corporation; the American Sheet & Tinplate Co. has only 56% of the business in its field, and the Steel Corporation has only 27% of the total business in iron and steel bars. Thus since the formation of the 'Trust' it has lost rather than gained ground as a monopoly. The price of steel now, as for many years, is based upon the price f.o.b. Pittsburg, plus the freight to the point in question, except in the case of the Colorado Fuel & Iron Co., which maintains a price f.o.b. Pueblo, and a similar tendency is beginning to appear at Chicago and Buffalo. The 'Jackson pools' for maintaining the price of wire were, according to Mr. Farrell, entirely an outside affair in which his corporation had refused to join. Not the least interesting of Mr. Farrell's testimony was in regard to the United States Steel Products Co., of which he was formerly the president. This is the subsidiary of the Steel Corporation which carries on its export trade, a phase of the steel business in which the corporation has a practical monopoly. The reason for the dominance in the foreign trade was brought out in the testimony, which showed that the cost of doing foreign business had been decreased from nearly 10% at the beginning to less than 1% of the bill of lading value at present. The operations of the company extend to Sumatra, Bombay, Egypt, and all parts of the world, it having recently sold 50,000 tons of steel rails for the Transcontinental railway in Australia, and yearly selling about $6,000,000 worth of steel products in Buenos Ayres, while China annually takes about $4,000,000, chiefly scrap and defective steel. The exports of the Steel Corporation have increased from $31,000,000 in 1904 to $92,000,000 in 1912. Evidently the foreign producer should worry rather than the public in the United States. It is evident that this large corporation with its superior facilities, has greatly increased its export business, while, not unnaturally, its domestic business has failed to increase at a corresponding rate.

Speaking of the relations of the Corporation to its employees, Mr. Farrell stated that at present 23,786 of them are holders of its shares, and 21,630 are paying for them in installments. During the past two years the Corporation has spent nearly $1,400,000 on safety devices, the percentage of fatal accidents having been reduced to 40% in the past six years, corresponding to 8000 lives saved. Since 1910 about $2,500,000 has been spent upon welfare work, providing playgrounds, club-houses, swimming pools, looking after sanitation, and even teaching the foreign employees how to cook wholesome food. Mr. Farrell rightly remarked that this was not philanthropy but enlightened business. A pension system for male employees over 60 years and women over 50 has been adopted and is just beginning to come into effect. On the whole, Mr. Farrell's testimony has pictured the 'Steel Trust' as a most beneficent ogre, and his testimony rings true. He is to be followed by Charles Schwab, and perhaps the curious may be rewarded by some disclosures as to corporation finance. Mr. Farrell's testimony as to this was distinctly disappointing, as he showed that since the purchase of the Tennessee Coal, Iron & Railway Co., $23,000,000 has been spent upon reconstructing the plant, and, though its output has greatly increased, it has not yet paid any dividends.

As a counterblast to this testimony, Francis Walker, of the Bureau of Corporations, has given out a report showing that the Steel Corporation made a profit of 16½% on its steel rails in 1910, and 10½% on steel plates; the actual profits being obscured by methods of bookkeeping whereby each subsidiary made a profit. Thus the inter-company profit on ore in 1910 was $1.30 per ton on an average price of $4.18, to which must be added a profit in transportation. Comparing these figures with those given for the Tennessee Coal, Iron & Railway Co., one is not tremendously impressed, but the bookkeeping methods of large corporations, like the ways of Providence, are past finding out.

The mid-monthly copper statistics as cabled from London showed an increase of 206 tons in stocks abroad and a decrease of 1127 tons in the total visible supply. The visible supply in England, France, and afloat May 15 was 30,273 tons, a decrease of 194 tons in the fortnight.

General Mining News

ALASKA

Cordova

A United States Government party of surveyors and geologists has arrived at Katalla, to make further investigations into the Bering River coalfields. The coal mined last year from the Cunningham claims has been transported to the head of navigation on Stillwater. There is about 650 tons of coal to be taken to tidewater.

Fairbanks

Break-up of the ice at Fairbanks occurred on April 29 last year, but it is expected to be two or three weeks later this present season. To cut the Gladstone vein in the Jupiter-Mars group, a shaft is being sunk on the right limit of Chatham creek, about 2000 ft. from the Pioneer mill. The shaft should cut the formation between 125 and 150 ft. depth. During last fall, 400 tons of ore from the Gladstone claim yielded $20 per ton, from an average width of 20 in. The report of the Tanana Valley Railroad Co. for the fiscal year ended June 30, 1912, states that the year was favorable for business.

Passenger traffic, persons carried	38,915
Freight traffic, tons	16,842
Total mileage run	39,375
Earnings per train mile	$4.70
Operating expenses per train mile	$2.55
Total revenue	$186,868
Expenses	$100,702
Net	$ 86,166

At the United States experimental farm at Fairbanks, crops grown produced 115 bushels of oats, 67.5 bushels of wheat, and 8 tons of potatoes per acre. There is a large area of rich soil in the Tanana valley.

Juneau

(Special Correspondence.)—The territorial legislature adjourned after passing more than 80 bills. Those affecting mining provide for a Territorial Inspector of Mines, to be appointed by the Governor and to work under direction of the United States Mine Inspector; an eight-hour day in mills, cyanide plants, and reduction works, and underground in lode mines; a mining code; the recording of both lode and placer claims; and defining the manner in which assessment and location work must be performed and recorded. There is some dissatisfaction over the fact that the eight-hour law applies only to lode mines, as regards underground work, but the pressure from Nome and Fairbanks, where it was maintained that an eight-hour law would force the closing of many mines, prevented its extension to cover placers. Anti-alien labor bills were defeated. It is reported that the Government expedition to the Matanuska coalfields is about to sail. A lot of 1000 tons of coal is to be mined for testing on one of the cruisers of the Navy, as was done in the Bering River fields last winter.

Juneau, May 13.

ARIZONA

In the recent discussion of mine taxation in this state, W. M. Whipple, a representative, stated that the gross output of the mines of Arizona in 1912 was $61,468,527, and net profit $24,735,511.

Cochise County

An important mining suit is being heard at Phoenix, dealing with the case of John Gleeson *v.* the Martin Costello estate. The former originally brought suit to quiet his title to rich mineral property, the latter holding adversely to him, and the district court decided in favor of the Costello people. An appeal was made to the Supreme Court, and is now being heard.

Two blast-furnaces at the new smelter of the Calumet & Arizona company, at Douglas, will be blown in on June 2.

W. G. Hansen has staked 27 acres of ground just northeast of Warren, which has been overlooked by surveyors of other mining companies.

Gila County

(Special Correspondence.)—At present, the Black Warrior is shipping about 125 tons of ore per day to the Hayden smelter, where the ore has been sent since labor troubles rendered the El Paso smelter inoperative. The Warrior management expects to ship 4000 tons during the present month. Braley and Henderson have succeeded Coffey as contractors for haulage of Warrior ores. At the South Live Oak property, drilling in the schist continues steadily, although results have not been given out by the management of late. No. 8 hole is now about 350 ft. in depth, and is being sunk at a satisfactory rate.

Miami, May 17.

Mohave County

During April the Tom Reed mine produced bullion worth $90,000. At the Copper Giant mine, development has been started. Machinery is being hauled from the railway, a distance of five miles. The old Yellow Jacket, in the Aubrey district, has opened rich gold ore in the 90-ft. shaft. The Tennessee mine, at Chloride, is supplying the Needles smelter with a large tonnage of lead ore.

Pinal County

(Special Correspondence.)—At the Magma Copper Co.'s property, diamond-drill exploration is proving satisfactory, the three shifts of drillers having made exceptionally rapid progress to date. They have already drilled three holes with a total depth of 2000 ft. No. 4 hole, which is being drilled at an angle of 50°, is cutting across the mineralized zone in a southwest direction. On account of labor troubles at the El Paso smelter, shipments from the Magma have been temporarily transferred to the Hayden smelter. Haulage of ore and freight between the Magma and the railroad station at Florence, 30 miles distant, has been greatly facilitated by the addition of two motor trucks.

Superior, May 17.

The quarterly report of the London-Arizona Copper Co. states that during March the mine at Winkleman was sufficiently developed to warrant starting of ore shipments and 13 carloads were sent to the El Paso smelter. For a time further shipments were held up by a strike at the smelter. Five carloads have been settled for, averaging 27.25% lead and 3.24 oz. silver per ton. Ore from No. 1 workings has averaged 40 to 45% lead, and from No. 2 workings, 43% lead and 12 oz. silver. E. W. Brooks, the consulting engineer, reports that the geological survey of ground near the Curtin shaft and the workings of the Calumet claim is now complete. The cross-cut from the Curtin shaft has opened lead ore in limestone; and should cut the orebody in a short time. On the Calumet claim, copper ore has been opened along a contact of porphyry and limestone. Although irregular, the ore-shoots are of a promising character, and a shipment has been made to the smelter.

CALIFORNIA

Amador County

The South Eureka company paid a dividend amounting to $21,000 on April 15. The main shaft and other workings have been unwatered, save a deep winze. A good deal of ore has been opened on the various levels, and the other 40 stamps will soon be in operation. Cross-cutting has been started on the 2600-ft. level of the Keystone. This will be driven westerly to cut the ore-shoot worked on the upper levels.

The reports of important discoveries in the lower levels of the Plymouth mine are now amply confirmed and the old mine is developing rapidly and satisfactorily.

Butte County

The present strike of employees of the Pacific Gas & Electric Co. has caused a suspension of work at the Natomas Consolidated rock-crushing plant.

Mono County

The St. Ives mine is operated by the Lone Star Consolidated Co. of Goldfield, Nevada. It is situated in the

Chicago district, 32 miles northwest of Bishop, Inyo county. The mine produces a white free-milling quartz which has returned good profits to lessees. The main shaft has been sunk to 200 ft. on the incline. On the 125-ft. level south drift, the vein is 1 to 3 ft. wide, assaying $8.80 to $16.40 gold, and $3.50 to $3.90 silver per ton. A south drift is being driven on the 200-ft. level, ore being opened at 175 ft. by lessees.

Nevada County

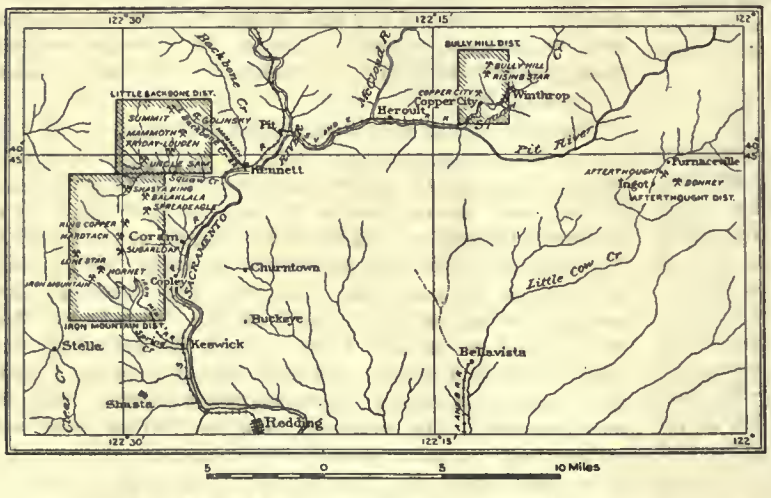
Two applications for permits to operate gravel properties, the first received at the office of the California Débris Commission at San Francisco for several years, have been filed. A permit was issued last week to Latchem & Pollock to work the Blue Danube mine, near French Corral, above Nevada City. Tailing will be stored in an old pit. Los Angeles people have examined the Jerry Goodwin claims at You Bet. They will probably get a permit to operate the Bird's Eye mine there.

San Francisco County

Exports of oil and other products from San Francisco during March were as follows: crude oil, 777,050 gal.; lubricating oil, 103,613 gal.; gasoline, 125,412 gal.; distillate. 12,897 gal.; fuel oil, 15,033,962 gal.; residuum, 3,885,000 gal.; and manufactured asphalt, 1165 tons, the whole valued at $652,523. Of the liquid products exports, 21,091,010 gal. went to foreign countries. Oil-well machinery and pipe to Australia, India, and Japan was worth $145,555, of which $139,791 went to Japan. Imports of crude oil and benzine from Peru were 1,873,835 and 1,473,323 gal. respectively..

Shasta County

The Southern Oregon and Northern California Mining Congress was in session at Redding, from May 20 to 24.



SHOWING PRINCIPAL DISTRICTS IN SHASTA COUNTY.

There were numerous papers read, and discussions, and excursions to various mining districts.

The Donkey and Baker mines, near Ingot, have been bonded to W. H. Eardley, and Kirk & Lavall of Utah, and W. F. Manning of Reno, Nevada. The Donkey has been developed to 200-ft. depth, and contains a good tonnage of ore, in which zinc has been a trouble. The Baker contains silver-zinc ores. A new process to deal with this ore is being tried. The Afterthought Copper Co. will build a new smelter at Ingot.

Sierra County

In boring for water at Loyalton, S. W. Sims has found native copper. After drilling all day on May 17, no progress was made.

Siskiyou County

There is on exhibition at the Scott Valley bank, gold specimens valued at $5000, found in a 'pocket' at Scott Bar by D. McCarthy. Another rich sample was found at Callahans, and Noonan Bros., at Scott Bar, cleaned up $4000 in gold from their claim last week.

Tuolumne County

(Special Correspondence.)—Preparations are being made for the development of the deep orebodies in the Dutch mine, at Quartz. Work will be started at the bottom of the mine as soon as the shaft, 1700 ft. deep, is unwatered. The company has expended a good deal of money during the past few months, in an adequate equipment for carrying out the present deep-mining campaign. Electricity is now the motive power used at the property. The Tuolumne Syndicate has uncovered some excellent ore at the Wheal Rough mine, near Soulsbyville, which it is operating under a bond. Another contract has been let for driving the adit at the McCormick mine, near Jacksonville, an additional 100 ft., which will make its length 1540 ft. It is reported that operations will be resumed at once at the Tarantula, near Jacksonville, with A. P. Dumas as superintendent. The mill at the Shawmut is again in operation.

Sonora, May 17.

Yuba County

The Yuba Construction Co. will construct a 15-ft. capacity dredge for the Yuba Consolidated Gold Fields Co. This is No. 14, and will be built a mile from Hammonton.

COLORADO

Clear Creek County

At the Capital mine there is little new development, and the mill is running full time. The drift on No. 7 level is in 315 ft., and later on, it is thought that the drill-hole sunk about a year ago will be found, and lost tools recovered. The Ruler Mining Co. has made arrangements with the Capital company to develop its property through the Capital tunnel. An electric system of tramming will be installed. The Little Giant Gold Mining & Milling Co. has acquired the Commodore claims on Red Elephant mountain, near Lawson. The Alco Mining & Milling Co., which has secured a group of claims in the Cascade district, near the Lamartine mine, is commencing development.

Gilpin County

An electric hoist is being installed at the Pozo mine, at Nevadaville, to replace the air-driven hoist. The shaft is 400 ft. deep, and the raise from the Newhouse tunnel is up 400 ft., leaving between 700 and 800 ft. to be driven to make connections.

Lake County (Leadville)

The Western Mining Co. is the largest producer of carbonate of zinc in Colorado, mining about 11,000 tons per month. This is raised through the Wolftone shaft. The Iron-Silver mines are producing 200 tons, the Yak tunnel 200 tons, and the Colonel Sellers 150 tons per day of zinc ore. During the coming summer a good deal of prospecting will be done in Lackawanna and Half Moon gulches, and Leadville people are greatly interested in the section. The Louisville, Iron Hill, is producing 50 tons of sulphide ore per day from the 365-ft. level, below the Yak tunnel. The Colorado Power Co. is installing a large electric motor to work the blower at the Arkansas Valley plant, and if satisfactory, other parts of the smelter will be electrically driven.

The San Juan

The Tomboy mill, in April, crushed 11,000 tons of ore, yielding $78,000 from local treatment and shipment of concentrate. The profit was $29,500. The Brown Mountain Smelting Co., at Ouray, has made a contract with the Wanakah Mining Co. to smelt 40 to 50 tons of ore per day. The smelting company has arranged for a supply of 2000 tons of limestone from the Cassiday quarry. No. 3 shaft of the Camp Bird is to be sunk another 100 ft. The first lease granted by the Camp Bird company was recently let to D. Reed, of Denver, who will prospect in the west section of the property.

IDAHO

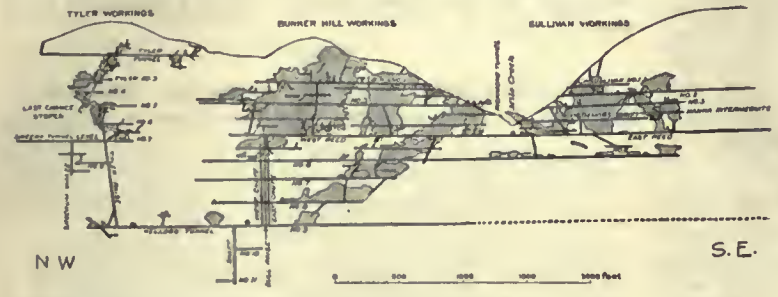
Owyhee County

Renewed interest is being taken in mining in this county

on account of developments in the Banner mine, on Florida mountain. During April a rich narrow vein was cut in the mill-level adit, and on driving 60 ft. it widened to four feet, averaging $42.50 per ton. This development is at a depth of 750 ft. from the apex of the mountain. The company has a modern mill of 30-ton capacity, and other equipment electrically driven.

Shoshone County

The Bunker Hill & Sullivan company has completed the tunnel which connects the Bunker Hill workings with the Silver King tunnel, a distance of two miles. It is now possible to enter the Last Chance mine at Wardner, and traverse a series of tunnels into Government gulch, through the Bunker Hill & Sullivan, Caledonia, Stewart, and Ontario properties. Ventilation and tramming will be benefited by this tunnel.



LONGITUDINAL VERTICAL SECTION OF BUNKER HILL & SULLIVAN MINE.

MONTANA

Silverbow County

The first annual report of the Butte & Superior company shows that the ore reserves total 1,200,000 tons, averaging 21.7% zinc and 7.9 oz. silver per ton. This has been developed between the 1000 and 1400-ft. levels. The 800, 900, and 1600-ft. levels have not been opened to any extent, but contain a fair tonnage. Cash on hand is $519,558, and surplus $1,488,664.

The Davis-Daly company's Colorado mine is producing from 140 to 170 tons of 6% copper per day. Development on the 1200, 1400, and 1700-ft. levels has opened rich ore.

NEVADA

Elko County

The Elko Prince property, at Gold Circle, has been sold for $900,000. The mine has been opened by 1600 ft. of development, and the vein is 600 ft. long to a depth of 600 ft. Ore reserves were estimated as 36,000 tons, worth $1,800,000. A large stamp-mill and cyanide plant will be erected to treat this gold-bearing ore.

Esmeralda County

At the Goldfield Oro mine, new equipment is nearly ready for sinking the shaft from 350 to 1000 ft. The 100 and 200-ft. levels are to be thoroughly prospected. The report of the Lone Star Consolidated Co. for the term ended April 30, 1913, shows that the shaft was sunk from 115 to 323 ft., and 1419 ft. of development was done. At 323-ft. depth, shale was cut, similar to that being prospected by the Merger Mines Co. at 1300 ft., and by the Goldfield Consolidated at 1300 and 1400 ft. The shale underlies the dacite and latite, and is uneven in contour. Ore-bearing strata occur in the formation just above the shale, and operations are being conducted with this fact in view.

The Goldfield Kewanas Mining Co. will be reorganized by George Wingfield. The present company has a capital of 1,100,000 shares, under the laws of Arizona. Its property is centrally situated at Goldfield, and has a shaft 500 ft. deep, with good equipment.

Mineral County

The 500-ton mill for the Aurora Consolidated Mines Co. is being constructed at Aurora, and 180 men will be employed. It will consist of 40 heavy stamps, 6 tube-mills, and cyanide plant. Material for the plant will be shipped by the Copper Belt railroad.

Nye County

Tonopah mines treated 11,322 tons of ore, valued at $249,140, during the week ended May 17. In April the Belmont treated 12,940 tons, yielding 335,482 oz. of bullion, with a net profit of $161,449. The Tonopah Mining Co. treated 14,572 tons, yielding 225,230 oz. bullion and 118 tons of concentrate, the total value being $213,200. Profits were $109,733. The Extension has declared a dividend of 5c. per share, amounting to $47,500, making $442,500 to date. The vein on the 950-ft. level of the North Star has been opened for 150 ft., the width being from 6 to 12 ft. The rich shoot at No. 3 level of the MacNamara has been proved for 60 feet.

Storey County

The Comstock-Phoenix company is adding a Kinkead mill to its 5-stamp mill, also a Wilfley and a Frue vanner. The daily capacity will be 30 tons of ore.

White Pine County

A new company with a capital of $8,000,000 is being formed to consolidate the properties of the Giroux Consolidated, the Coppermines Co., and the Chainman Consolidated Copper Co., and the Butte & Ely Co., in the Ely district.

NEW MEXICO

Eddy County

The Pecos Valley Oil & Gas Co. is pumping oil from the Everest well. This was drilled to 926 ft., the water shut off, 2.5-in. casing put down, and a pump installed. From 25 to 50 bbl. of high-grade oil is produced per day. The Dayton Petroleum Co. is down 900 ft., and cut off water at 800 ft., putting down 10-in. casing. Oil is expected within 50 ft. The oil companies have secured a reduction on oil-freight rates charged by the Santa Fe company.

OREGON

Malheur County

The following is the state of mining activity in this county: Development is under way at the Drexel group of five claims, Banks group of 3 claims, Lone Pine, Lone Pine Extension, and Golden Eagle; Rainbow operating 15 stamps, cyanide plant, and 80 men; Humboldt, 10 stamps and 40 men; Red, White & Blue, 6 stamps and 9 men; Lynn placer, 2 giants and 12 men; Clarks Creek placer, one giant working and a dredge ordered; and Uncle Sam placer, 2 giants and 7 men.

UTAH

Beaver County

The Sheep Rock mill is producing about $3000 per month from $20 ore, and 30 tons of $60 concentrate is on hand. Both the 110 and 190-ft. levels show rich ore. This mine has produced some good ore for several years. The 400-ft. level raise of the Hub mine has cut ore below 350 ft. Ore is being loaded into wagons. The Moscow mine, in the North Star district, shipped 18 cars of ore in April, which should return $20,000. Work is being done from the 300 to 700-ft. levels, inclusive, and a winze is being sunk below the latter level. Ore shipped carries 30 oz. silver and 7 to 10% lead.

Juab County

Ore shipments from the Chief Consolidated at Tintic are averaging 25 cars per week. A station has been cut at the 1800-ft. level. There are two vein systems in this property. One has been proved to be continuous from the 800 to 1400-ft. level, and the other from the 800 to the 1600-ft. level. From the latter ore is being mined from No. 10, 12, 14, and 16 levels. The drift on the 1600-ft. level is being driven toward the Gemini ground, and connection should be made during June. This will result in another exit from the mine, and better ventilation.

Forty feet below the 1300-ft. level of the Eagle & Blue

Bell, ore has been opened assaying from 1 to 3.49 oz. gold, and 20 to 230 oz. silver per ton. Generally, this property is opening well. A portion of the Beck Tunnel property is to be let to lessees, this being the first of the Knight mines to adopt the leasing system. A raise above the 1500-ft. level of the Lower Mammoth mine has opened ore containing 10 to 14% lead and 15 oz. silver per ton. Developments in the Opohongo have not been too promising of late. The upper section of the property will be prospected from the main adit of the Gold Chain.

SALT LAKE COUNTY

The Utah Copper Co. treated 1,460,707 tons of 1.25% ore, yielding 23,884,467 lb. of copper during the first quarter of 1913. Both plants were in operation, but cold weather hampered the handling of ore. This also interfered with stripping work at the mines, although 822,246 cu. yd. was removed. The Bingham & Garfield railway carried 10,602 tons of ore and 623 tons of miscellaneous freight daily.

SAN JUAN COUNTY

The San Juan oilfields in southeastern Utah will probably be worked to some extent during this summer, and it is stated that two railroads are being planned to pass through the district. A number of Salt Lake people are examining the country around Monticello, Grayson, and the Bluff, with a view to locating farm land. The Arcola oil well, not in operation at present, has produced about $100,000 worth of oil. The Galloway well is 1800 ft. deep. At present there are 30 'rigs' in the field, mostly inactive on account of lack of transport facilities and heavy cost of supplies.

WASHINGTON

CHELAN COUNTY

It is reported that a large deposit of cinnabar has been opened on Squaw Saddle mountain, three miles from Wenatchee.

FERRY COUNTY

There is a shortage of experienced miners at Republic at present. The Ben Hur Leasing Co. has installed an air-compressor and is preparing for a 125-hp. hoist. Ore shipments amount to 540 tons per week. The ore-shoot on the 200-ft. level is 250 ft. long, averaging $14 per ton over a width of 5 ft. The 300-ft. level drift is in $7 ore, and generally the mine is opening well. I. Benson is superintendent. The Blue Horse group is being developed by Pape and Larsen. At 70 ft. depth in the Iron Mask claim a drift has been driven 14 ft. south on a vein. This varies from 42 to 60 in., worth $76 per ton, 33 to 50% being in gold.

CANADA

NOVA SCOTIA

(Special Correspondence.)—The gold mines at Goldenville in Guysborough county, the principal one in which gold is found in the province, will resume operations about the end of the present month. A large amount of money has been expended in improving the plant during the past year, new machinery has been installed, the Lescome river has been dammed, and a large power-plant erected, capable of furnishing about 500 hp. The power will be used to operate the mines, to light the works and also the village. Possibly, later on power will be sold to other mining companies in the vicinity. It is hoped that the improved facilities for working the mine will result in a large output of gold. Gold mining in Guysborough county has been at a low ebb of late, and it is a hopeful sign that capitalists are again showing their confidence in the district.

Picton, May 12.

ONTARIO

It was expected that one unit would be available from the Sandy Falls plant, and by the end of the past week a unit should be available at Waiwaitin Falls. This will leave Porcupine in better shape than when the Sandy Falls power was in its usual condition, as each unit there is 1000 hp., and each unit at Waiwaitin 1500 hp., instead of a total of 2000 hp. from Sandy Falls alone. On both plants the work of repair has never ceased. The damage to the Sandy Falls plant was never as serious as was reported, only about 20 ft. of the flume having been washed away. At Waiwaitin, the damage was to the penstocks and was more extensive. However, that has now almost been completed and the worst phase of the situation should be well over next week.

The new plant at the McKinley-Darragh mine at Cobalt is in operation, and when the tube-mill is working, the daily tonnage should be 275 tons. The aerial tramway from the Savage mine to the new plant is one mile long, and with 700-lb. capacity buckets the line is carrying 10 tons per hour.

Sluicing away the overburden, to aid prospecting at the Nipissing, has been started for the season, and will be continued day and night. During the 1912 season, 33 acres was cleared.

YUKON

The electric power plant at Dawson was destroyed by fire early in May, and much inconvenience is being felt by mines and residents. Ice on the Yukon river has broken up, and steamers are now running. The Yukon Gold Co.'s dredges are in operation. The Atlas Copper Co., of White Horse, will keep its diamond-drills in operation during the coming season. From the Pueblo mine, three train loads of ore are shipped weekly.

ON THE WHITE PASS RAILWAY.

PHILIPPINE ISLANDS

The reported discovery of natural gas in the artesian well being driven at Oas, near Legaspi, Albay province, Luzon, has attracted considerable attention, but it is now believed that the deposit is of no commercial value. At a depth of 120 metres, a few pockets of what appeared to be marsh gas were found. The flow of gas at first was somewhat violent; but rapidly diminished and was followed by some water. Continued drilling resulted in further occasional rushes of gas, but no large or steady flow was obtained. The examination made by Paul R. Fanning of the division of mines, Bureau of Science, with J. W. Vickers, superintendent of the artesian well division, Bureau of Public Works, showed no evidence of either natural gas or oil.

WESTERN AUSTRALIA

A three years' agreement has been settled between the Chamber of Mines and the labor unions at Kalgoorlie, by which the firemen (boilers and furnaces), get 8c., surface laborers 18c., and trammers and shovelers 4c. per shift increase from $2.80, $2.40, and $2.62 per shift, respectively.

Schools and Societies

THE UNIVERSITY OF UTAH is offering four fellowships in mining and metallurgy, each worth $575 per annum.

THE ALUMNI ASSOCIATION of the Colorado School of Mines conduets a capability exchange, or employment agency, for graduates and undergraduates of the school.

STANFORD UNIVEASITY, at Palo Alto, California, held its commencement day on May 19, with the usual addresses. David Starr Jordan has been appointed Chancellor, being succeeded as president by J. C. Branner, head of the department of mining and geology.

TWENTY-FIVE members of the American Institute of Mining Engineers, residing at Los Angeles and district, have applied to the board of directors of the Institute for authority to organize a local section in that city. This section would include the territory of southern California.

THE MINE INSPECTOR'S INSTITUTE OF THE UNITED STATES is to hold a meeting at Birmingham, Alabama, on June 10. Subjects to be discussed will include compensation laws, ventilation of mines, portable electric lamps, uniformity of danger signals in mines, accidents, lights in mines, and election *v.* appointment of state mine inspectors.

THE Spokane local section of the American Institute of Mining Engineers held a meeting at Rosaland, British Columbia, on May 22 to 25. The eveninga of the first and second days were spent in discussion of papers, while the mines were inspected on the second day. On May 24, the party went to the Trail smelter, returning to Spokane the following day.

THE OREGON AGRICULTURAL COLLEGE, of Corvallis, had a class in field geology, under G. E. Goodspeed, on May 22, 23, and 24, near Myrtle creek, Douglas county. Instead of merely making an inspection trip to mining properties, as in previous years, every student, before entering his senior year, must work two months underground in a mine, or be employed by a mining or smelting company.

THE MISSOURI SCHOOL OF MINES has appointed C. L. Dake as assistant professor of geology and mineralogy. Mr. Dake is a graduate of the University of Wisconsin and has done considerable graduate work there in geology. He served as instructor in the department of geology, University of Wisconsin, during 1911-12, and during 1912-13 has been instructor in geology at Williams College. He has had an extensive experience in geological field work in the Lake Superior district.

THE UNIVERSITY OF CHICAGO has issued a circular dealing with the departments of geology, geography, and paleontology There are 15 instructors in the first subject, which includes mineralogy, physical geography, petrology, and the geologic phases of paleontology. The *Journal of Geology* is published by this department. For instruction in geography there are 7 officers. The courses deal with subjects which are intermediate between geology on one hand, and history, sociology, political economy, and biology on the other.

THE MINES BRANCH of the Canadian Department of Mines, has built at Ottawa a modern laboratory and ore-testing plant. It consists of a crusher, rolls, Hardinge mill, Ferraris, Keedy, and Callow acreens, 5-stamp mill, amalgamating apparatus, Callow tanks, Richards classifiers, Overstrom and Deister tables, Gröndal magnetic separator and cobbler, Ullrich magnetic separator, and a Huff electrostatic unit. The laboratory is fitted with the usual small-scale apparatus. During the current year a roasting and aintering plant will be installed. After July 1913 this plant will be open to receive samples of Canadian ores, which will be tested free. Eugene Haanal is director of the Mines Branch.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

JOHN A. VEACH is at Panama.

J. M. FOX was at Yerington last week.

T. A. RICKARD was in New York this week.

H. W. DUBOIS was in New York last week.

A. B. W. HODGES was in St. Louis last week.

L. J. PEPPERBERG has gone to the Wyoming oilfields.

JAMES DOUGLAS has returned to New York from Arizona.

SUMNER S. SMITH has returned to Juneau from Washington.

A. C. LUDLUM was in Berlin recently and has gone to St. Petersburg.

J. A. HOLMES has been investigating smelter-fume troubles in California.

HOWARD D. SMITH is in New York, returning from a month's trip to Europe.

T. R. HENAHEN addressed the Commercial Club at Silverton, Colorado, on May 19.

JOSEPH R. RISQUE has been appointed manager for the Tennessee Copper Company.

B. B. LAWRENCE is in the West, but expects to return to New York early in June.

W. J. LORINO is in Australia and will visit Burmah before returning to London in July.

RYOSAKU GODAI has been visiting Goldfield and Tonopah on his way from London to Japan.

PERCY E. BARBOUR has been in Chicago buying machinery for the Uwarra M. Co., Candor, North Carolina.

J. D. HUBBARD is general manager for the Yellow Butte Copper Co., Yellow Butte, Siskiyou county, California.

RICHARD MARSH is superintendent at the Yankee Girl mine of the Hobson Silver-Lead Co., Ymir, British Columbia.

C. P. NEILL, recently United States Commissioner of Labor, has resigned to organize a labor department for the A. S. & R. Company.

L. DE LASHMUTT has been appointed general superintendent for the Standard Silver Lead M. Co., at Silverton, B. C., succeeding James Cronin.

GEORGE WATKIN EVANS will study the commercial possibilities of the Matanuska coalfield for the United States Bureau of Mines. He left Seattle for Alaska on May 18.

A. E. DAUCKFA has resigned from the service of the Oriental Consolidated M. Co., to become technical manager for the Concession Minière Française de Chang-Song. His headquarters will be at the Nurupi Mines, *via* Unsan, Korea.

Obituary

ALBERT F. HOLDEN, managing director for the U. S. S., R. & M. Co., died after a lingering illness at his home at Cleveland, Ohio, on May 19. Mr. Holden was one of the best known and most influential men engaged in mining in the United States. He was born at Cleveland in 1866, and after graduating at Harvard in 1888, came to Salt Lake City, where he succeeded his father, L. E. Holden, one of the pioneers of Bingham, in mine management. To the Jordan and Galena mines he added the Telegraph and Central Eureka, and so laid the foundation for a general smelting business which has grown into the second largest in this country. He was associated with D. C. Jackling in the Alaska Gold Mines Co. venture, and at the time of his death had interests from Alaska to Mexico. He was an excellent manager, and a man who built up rather than tore down. Recognizing that the foundation of a smelting business is the ownership of ores, he spent money liberally in the search for mines, and his company has been conspicuously successful in getting hold of good properties.

The Metal Markets

LOCAL METAL PRICES

San Francisco, May 22.

Antimony	12—12¾c	Quicksilver (flask)	$40
Electrolytic Copper	16¼—16¾c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES.

(By wire from New York.)

NEW YORK, May 22.—Copper is now easier and buyers are holding back. The break in tin on the London Exchange May 15 seems to have been systematic, and prices have been easier since. Lead and spelter remain unchanged, and gold exports are still large.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
May 15	61.00	April 16	59.80
" 16	60.87	" 23	59.77
" 17	60.75	" 30	60.56
" 18 Sunday		May 7	60.98
" 19	60.87	" 14	60.25
" 20	60.87	" 21	60.66
" 21	60.62		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	59.26	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
May 15	4.33	April 9	4.30
" 16	4.33	" 16	4.33
" 17	4.33	" 23	4.39
" 18 Sunday		" 30	4.50
" 19	4.33	May 7	4.40
" 20	4.33	" 14	4.33
" 21	4.33	" 21	4.33

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
May 15	5.28	April 9	5.62
" 16	5.28	" 16	5.50
" 17	5.28	" 23	5.42
" 18 Sunday		" 30	5.36
" 19	5.28	May 7	5.31
" 20	5.28	" 14	5.28
" 21	5.28	" 21	5.28

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

Zinc producers in the Joplin district have been much concerned over impending tariff changes. The present duty on spelter is 1⅜c. per lb., and on manufactured articles 1⅝c. On ore containing 25% Zn, and nothing lower will stand importation, the duty is 1c. per lb. The Underwood bill proposes to place all alike on a 10% ad valorem basis. Last September spelter averaged 7.45c. St. Louis. Since then it has fallen steadily to the present 5.28c. Even at the high prices of last fall, demand was so large that there were importations, though not large ones, while at present prices imports are unimportant. Foreign prices are now only maintained by means of agreement. The average London price for the past six years has been 1.02½, 0.36, 0.70, 0.65, 0.42, 0.137 lower than the equivalent New York price. Freight and duty would equal about 0.60c. per lb. Apparently the new tariff would be, as its authors propose, "competitive."

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
May 15	15.55	April 9	15.17
" 16	15.50	" 16	15.37
" 17	15.50	" 23	15.44
" 18 Sunday		" 30	15.26
" 19	15.50	May 7	15.30
" 20	15.50	" 14	15.54
" 21	15.50	" 21	15.50

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
May	1912	65,295,368	134,176,000
June	"	49,615,643	117,801,600
July	"	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720

United States Production and Consumption

		Production.	Domestic deliveries.	Exports.
April	1912	125,694,001	69,513,846	53,252,326
May	"	126,737,836	72,702,237	69,485,945
June	"	122,315,240	66,146,229	61,449,650
July	"	137,161,920	71,093,120	60,121,600
August	"	145,628,521	78,722,418	70,485,150
September	"	140,089,819	63,460,810	60,264,796
October	"	145,405,453	84,104,734	47,621,342
November	"	134,695,440	69,369,795	55,906,550
December	"	143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February	"	130,948,881	59,676,402	72,168,623
March	"	136,251,849	76,585,471	77,699,306

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
April 23	41	May 8	40
" 30	41	" 15	40
		" 22	40

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	....	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, May 21.
Associated Oil 5s	101
E. I. du Pont 4½s	83½
Natomas Con. 6s	91
Unlisted.	
Associated Oil 1st ref	80
General Petroleum 6s	59½

Unlisted.	Closing prices, May 21.
Natomas Dev. 6s	100
Pacific Port. Cement 6s	99
Riverside Cement 6s	77
Standard Cement 6s	91½
Santa Cruz Cement 6s	85
So. Cal. Cement	78

STOCKS.

Listed.	Closing prices, May 21.
Associated Oil	40¼
Amalgamated Oil	85
E. I. du Pont Powder pfd	88
Pacific Coast Borax, pfd	100½
do com	80
Pacific Crude Oil	30c
Sterling O. & D.	1 00
Union Oil of Cal	91½
West Coast Oil, pfd	70

Unlisted.	Closing prices, May 21.
Mascot Copper	1
Noble Electric Steel	15
Natomas Consolidated	9½
Pacific Coast Borax, old	206
Pacific Portland Cement	59
Riverside Cement	45
Standard Cement	17
Standard Oil of Cal	187
Santa Cruz Cement	34¾

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 22.

Atlanta	$ .17	Mizpah Extension	$ .51
Belmont	6.50	Montana-Tonopah	1.45
Big Four	.56	Nevada Hills	.92
Buckhorn	1.30	North Star	.65
Con. Virginia	.11	Ophir	.13
Florence	.42	Pittsburg Silver Peak	.50
Goldfield Con	1.97	Round Mountain	.57
Halifax	1.20	Sierra Nevada	.06
Jim Butler	.86	Tonopah Extension	2.42
Jumbo Extension	.21	Tonopah Merger	.84
MacNamara	.16	Tonopah of Nevada	6.00
Manhattan Consolidated	.06	Union	.10
Mexican	.65	West End	1.12
Midway	.43	Yellow Jacket	.25

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	May 22. Bid	Ask
Adventure	$ 1½	2
Allouez	33	33½
Calumet & Arizona	64	64½
Calumet & Hecla	460	461
Centennial	13	13½
Copper Range	42½	43
East Butte	11½	12
Franklin	5½	6
Granby	62½	63
Greene Cananea	6½	6¾
Hancock	18¾	19½
Isle-Royale	23	23½
Mass Copper	3½	4

	May 22. Bid	Ask
Mohawk	$ 49	50
North Butte	28½	29
Old Dominion	46½	47
Osceola	85	86
Quincy	62½	64
Shannon	6¾	9
Superior & Boston	2½	3
Tamarack	27½	28
U. S. Smelting	39	40
Utah Con.	7½	7¾
Victoria	1	1½
Winona	1⅜	1½
Wolverine	51	51½

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

May 15.

	Bid.	Ask.
Alaska Mex.	9⅞	10¼
Alaska Tread.	40¾	42¾
Alaska United	20¾	22¾
Alaska G. M.	10½	11
Braden Copper	7¼	7⅜
B. C. Copper	2¾	3
Davis Daly	2¼	2½
Dolores	2	4
El Rayo	1	2
First Nat.	1⅞	2
Giroux	1⅞	2
Green-Can.	6⅝	6¾
Hollinger	17	18
Inspiration	16⅝	17¼
Iron Blossom	135	145
Kerr Lake	3⅛	3¼
La Rose	2⅝	2½

	Bid.	Ask.
Mason Valley	5¾	6
McKinley-Dar.	1⅞	2
Miamis 6s	163	173
Mines Co. Am.	2⅝	2⅞
Nipissing	8¾	9
Ohio Copper	1¼	1⅜
San Toy	18	20
Sioux Con.	2	5
S. W. Miami	5	7
So. Utah	¼	⅜
S. O. Calif.	175	177
Tri Bullion	⅛	¼
Tuolumne	2⅛	2⅜
United Copper	⅝	¾
Wettlaufer	12	14
Yukon Gold	2⅝	2¾

LONDON QUOTATIONS

(By cable, through the courtesy of Catlin & Powell Co., New York.)

	May 22. £	s.	d.
Alaska Mexican	2	7	6
Alaska Treadwell	8	12	6
Alaska United	4	12	6
Arizona	1	18	9
Camp Bird	0	18	9
El Oro	0	15	0
Esperanza	1	5	0
Granville	0	12	6

	May 22. £	s.	d.
Mexico Mines	5	12	6
Messina	1	7	6
Oroville	0	6	3
Rio Tinto	77	15	0
Santa Gertrudis	1	6	3
Stratton's	0	2	6
Tanganyika	2	6	9
Tomboy	1	6	3

AUSTRALIAN

	May 22. £	s.	d.
British Broken Hill	2	1	3
Broken Hill Props	1	18	9
Golden Horse-Shoe	3	1	3
Great Boulder Props	0	11	3
Ivanhoe	3	6	3
Kalgurli	2	1	3

	May 22. £	s.	d.
Mount Boppy	0	17	6
Mount Elliott	5	8	9
Mount Lyell	1	1	3
Mount Morgan	3	10	0
Waihi	1	18	9
Waihi Grand Junc	0	17	6

APRIL PRODUCTION OF THE PRINCIPAL COPPER MINES

	Pounds.		Pounds.
Ahmeek	1,503,535	Franklin	336,000
Allouez	663,905	Granby	1,806,452
Anaconda	7,324,880	Greene-Cananea	3,581,691
Baltic	1,830,000	Isle Royale	563,983
Boston & Montana	6,202,300	Moctezuma	2,753,249
Butte Coalition	2,115,400	Mohawk	1,312,000
Calumet & Arizona	4,500,000	Miami	2,312,900
Calumet & Hecla	5,048,812	North Butte	1,967,000
Centennial	213,580	Old Dominion	3,013,000
Champion	2,256,000	Superior	291,525
Copper Queen	7,079,600	Tamarack	630,190
Detroit	1,856,517	Tri-Mountain	1,034,000
East Butte	1,073,600	Wolverine	858,000

THE quarterly report of the Chino Copper Co. shows that an average of 6.5 steam-shovels were engaged in mining 568,177 cu. yd. of overburden and 488,915 tons of ore. The mill treated 429,750 tons of ore averaging 1.91% copper, producing 12,021,872 lb. The total profit was $807,823. Copper on hand and in transit at March 31, amounted to 16,454,389 lb., worth $2,322,697. Cash on hand was $329,975.

THE quarterly report of the Shannon Copper Co. gives the following:

Ore treated, tons	83,680
Copper produced, pounds	3,649,564
Gold, ounces	724
Silver, ounces	33,695
Average price received for copper, cents	15.35
Cost per pound, cents	13.12
Net profits	$75,847

THE annual report of the International Smelting & Refining Co. states that net earnings were $1,106,000, against $1,219,000 during 1911. The decrease was caused by the copper furnaces being shut down in October, there being no ore from Bingham mines, which were affected by a strike of miners. Dividends paid amounted to $800,000, which left a surplus of $306,047. This added to the previous surplus left a total of $1,862,988. Prospects for the current year are much better. There are 800 men employed.

DURING 1912 the Standard Silver-Lead Mining Co., of Silverton, produced the following:

Ore treated, tons	9,703
Smelter returns	$680,000
Other receipts (zinc bounty, $20,240)	68,030
Net profit	544,043
Dividends	425,000
Cash and quick assets	190,876

The Granby company smelted 24,402 tons of ore during the second week in May, making a total of 48,408 tons for the fortnight. Copper shipments were 343,000 and 697,000 lb. respectively.

THE Ray Consolidated Copper Co. treated 537,205 tons of 1.74% copper ore during the March quarter, yielding 12,369,696 lb. of copper. Of the ore treated, 14% was from development work, 35% from stoping, and 51% from broken ore in stopes. The average recovery was 66.20%, the ratio of concentration being 15.86 tons of ore to one of concentrate. The average cost was 9.51c. per pound of copper. The average mining costs were 72, and milling 46.48c. per ton of ore. Total net profit for the quarter was $682,626. All surface improvements at the mine are nearly finished. The seventh section of the mill was put in operation during the term, and the eighth will be ready during the current quarter.

Company Reports

TONOPAH EXTENSION MINING COMPANY

This company owns 257 acres at Tonopah, Nevada, and the report covers the year ended March 31, 1913. Results may be tabulated as follows:

Development and mining, feet	11,172
Ore reserves, tons	150,000
Ore treated, tons	54,618
Average contents:	
Silver, ounces	17.53
Gold, ounces	0.18
Bullion recovered:	
Silver, ounces	890,764
Gold, ounces	9,199
Total value	$737,616
Cost of mining ($5.33 per ton)	291,618
Cost of treatment ($3.29 per ton)	179,720
Net income	237,424

The new shaft was sunk to 952 ft., and three levels were opened. In April 1913 the 750-ft. level east drift was connected with the 660-ft. level by a raise from the old shaft. The bottom of the shaft is in ore-bearing formation. Shaft-sinking, charged to mining, cost $41,205. The ore mined during the year came from the 270, 400, 500, 600, and 660-ft. levels, working on four different lodes. The mill made a total recovery of 93.33%, against 90.61% during 1911. Bullion produced was 945 fine in silver and 9.76 in gold. At the mine, a Draeger oxygen rescue apparatus was installed.

EAST RAND PROPRIETARY MINES, LTD.

This company controls the operations of several subsidiary companies, which have 4331 claims, and a mill containing 820 stamps, 25 tube-mills, and sand and slime plants, with a total capacity of 200,000 tons per month. The registered capital is 2,514,000 shares of $4.80 each, 2,445,897 being issued. During 1911 the company attracted much notice by its inability to produce the tonnage and value predicted, and came in for severe criticism. During 1912 the ore reserves were again checked, the estimate at the end of the year being 6,716,605 tons, averaging 6.8 dwt. per ton over a stoping width of 54 in., as against 6,716,605 tons assaying 6.9 dwt. over 55 in. The following shows the summary of gold recovered during the last two financial years on the basis of tonnage milled:

	1912.	1911.
Ore treated, tons	1,848,050	2,194,552
Gold from amalgamation, ounces	424,925	366,787
Average per ton, dwt.	4.599	3.343
Extraction, per cent.	57.50	55.21
Gold from cyanidation, ounces	280,380	297,517
Average per ton, dwt.	3.034	2.711
Extraction, per cent.	38.00	44.79
Totals:		
Gold recovered, ounces	705,325	664,304
Extraction, per cent	95.50	100.00

It will be seen that the total recovery in 1912 amounted to 7.6 dwt. per ton, against 6 dwt. per ton in 1911, while the estimated average value of the ore reserves at the beginning of the year was 6.9 dwt. per ton. During the year the average recovery was increased by 4.2%. This marked improvement in the grade of ore sent to the mills is stated in the report to be due to a reduction in the stoping widths, from an average of 67 inches in 1911 to 53 inches in 1912, cleaner mining, closer sorting, and improved extraction. There is no statement in the report showing what proportion of ore came from the individual mines. Judging from the manner in which the richer ore reserves of the Driefontein and Angelo properties have been drawn upon and reduced during the year, it is evident that no insignificant share of the improved recovery per ton milled is due to increased proportion of ore worked from these richer sections of the property. It may be stated that there are no less than 8,000,000 tons of ore developed in the mines, which, with the present working costs, is unprofitable. On present lines of working, the payable ore reserves are ample to keep the mills running for over three years. Ore developed only amounted to 1,774,631 tons, as compared with 2,319,746 tons in 1911. This shortage in development is attributed to a scarcity of available development faces, especially in the western section, owing to the close approach of the Wit Deep water-dike. The working costs during the year were increased from $4 to $5 per ton. On the other hand, in making a careful selection of the ore sent to the mills, the recovery was increased from $6.08 to $7.70 per ton. As a result, the working profits were increased from $2.08 to $2.70 per ton, and the total profit from $4,650,000 to $4,900,000. The amount of capital expenditure last year was, however, only $1,030,000, as compared with $1,450,000 for the previous year. It has always been the custom of the East Rand Proprietary Mines to charge all shaft-sinking to capital account, which last year absorbed nearly $480,000 of the capital outlay. With regard to the future of the property, fair progress was made with enlarging the main service level No. 21, also with the secondary incline shafts, but little seems to have been attempted in the Angelo Deep section of the property, upon which so much of the future of the mine seems to depend. Good progress has, however, been made in the sinking of the Hercules shaft to the 'reef' and in cross-cutting to the raise workings, to facilitate development, which for the last two years, according to the present mining policy, has fallen somewhat behind. Little seems to have been done with regard to crossing the water-dike on the west side, where there is every indication of more promising ore being opened. The handling of the water likely to be liberated here requires some careful preparation, judging from the experience of neighboring mines; but it must be remembered that with the depth attained on the East Rand Proprietary Mines, even greater care and forethought are needed in penetrating the water-dike. An ambitious scheme of underground and surface concentration is outlined in the report, whereby it is proposed to make the Angelo Deep play an important part. The main level of this mine is to serve for the working of the deep area, with hoisting operations concentrated on the Angelo West and Hercules shafts. Two of the four mills now are at work are to be shut down.

AMALAGAMATED COPPER COMPANY.

This company closes its fiscal year on December 31, instead of April 30, as heretofore, and the present report covers eight months' operations in 1912.

Net income	$ 6,595,610
Dividends	3,847,197
Surplus	2,748,413
Previous surplus	21,252,201
Total surplus	24,000,614

The income is equal to 4.28% on $153,887,900 stock outstanding, or at the rate of 6.42% per annum. Assets include investments of $182,469,209, cash and cash assets, $15,683,417, while liabilities include capital stock $153,887,900, 5% gold and other notes, $12,527,000, and accounts payable, $7,737,112. The president, John D. Ryan, reported that the improvement in the metal market continued until well toward the close of 1912, the average price being higher than for any year since 1907. There was a very active business during the first half of the year, and accumulated stocks of the metal were all sold out in that period. In addition, orders were booked calling for the delivery of almost the entire output of the refineries to the end of September. A fair trade with consumers was done until October, when the breaking out of the Balwan war caused European manufacturers to cease buying almost entirely. They continued until the end of the year to work up metal on hand and in the warehouses, reducing the visible stocks in Europe to about 35,000 long tons—a very small stock for Europe to carry considering that our exports during the year and for the two years previous averaged about ten times that amount. Stocks in the United States and Europe decreased in the year 1912 over 20,000 tons.

James Lewis & Son's Copper Report

Standard copper has been subject to moderate fluctuations during April. Opening at £67 12s. 6d. for cash, it advanced gradually to £69 17s. 6d. on April 14, with a backwardation of 10s. to 5s. per ton for three months prompt, falling to £68 7s. 6d. on the 16th. It advanced again to £69 7s. 6d. on the 17th, from which point there was a steady decline to £66 17s. 6d. on the 24th, the recovery to £67 15s. 0d. on the 25th. There was another fall to £66 15s. for both May dates, and three months on the 30th. The closing price was £67 7s. 6d. for cash, and three months. Sales totaled about 40,000 tons.

The advance in the first half of the month was due to an artificial scarcity of warrants, and the covering of bear sales. The subsequent fall was influenced by the notable decline in the value of all securities on the New York Stock Exchange, and the precarious European political situation, arising from the difficult solution of the Near Eastern problem. Large purchases of American electrolytic copper for delivery over two to three months, on the part of both American and European manufacturers, have been followed by a lessened demand. Refiners failed to make sales of any quantity at their advanced prices, which have been undercut by second-hand holders.

American exports for April were 33,024 tons, of which about 18,000 was afloat to Europe; and little change in refiners' stocks may therefore be anticipated. European stocks have decreased 996 tons, and the visible supply 1746 tons during the month. Imports into England and France were 1331 tons, and deliveries 796 tons less than during the same period last year. The total arrivals in England and France for April were 18,944 tons, and deliveries 20,018 tons fine. The arrivals in England from Chile were 1859, and deliveries 2085 tons fine, and from other countries 10,800, and 11,337 tons fine respectively. The arrivals at Liverpool and Swansea from the United States were 3125 tons of bars, etc., and 1396 tons of ingots, etc., equal to about 4503 tons fine copper; in London 560, and in France 4770 tons fine.

The Chile charters for the month are advised as 3400 tons, including 1975 tons for the United States. Exports from Chile to April 30, total 13,757 tons fine.

STOCKS OF COPPER (TONS FINE)

	May 1, 1912.	Jan. 2, 1913.	Apr. 1, 1913	May 1, 1913.
Chilean in—				
Liverpool and Swansea..	5,203	5,348	3,624	3,398
France	778	832	531	487
American in—				
Liverpool and Swansea..	8,215	1,146	1,905	1,898
France	4,690	2,992	2,140	1,925
Sundries in—				
Liverpool and Swansea..	1,148	1,194	744	827
London and Newcastle..	5,060	3,234	3,102	2,781
Birmingham	850	325	75	185
France	567	572	863	811
English in—				
Liverpool and S. Wales..	14,210	16,516	13,077	12,675
Total in England and France	40,721	32,159	26,061	24,987
Sundries in—				
Germany and Holland...	10,121	2,882	15,313	15,391
Total European stocks.	50,842	35,041	41,374	40,378
Afloat (as advised by mail and cable to date)—				
From Chile	2,050	2,800	2,200	2,050
From Australia	7,000	5,400	4,000	3,400
Total visible supply...	59,892	43,241	47,574	45,828

Imports of other than Chile copper into England during the first four months of the year were: from United States, 14,424 tons; Canada, 648; Mexico, 3098; Peru, 539; Spain, 3327 and 1504 of precipitate; Portugal, 209; Norway and Sweden, 661; Africa, 2771; Australia, 4923; Japan, 67; Venezuela, 414; and sundries, 493; making a total of 33,078 tons fine.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING CORPORATIONS—REMOVAL OF DIRECTORS

The board of directors of a California mining corporation may be removed at the suit of a stockholder for failure to make and post in the office of the company an itemized balance sheet showing the financial condition of the company as required by section 588, Civil Code.

Kinard *v.* Ward *et al.* (California), 130 Pacific, 1194. February 5, 1913.

OIL AND GAS LEASE—BREACH OF CONDITIONS

Where plaintiff under a written agreement with defendant to obtain for it an oil and gas lease on certain property procured a lease entitling the holder to extract the oil and gas and remove the same from said property, together with the necessary easements for working purposes, "and good and sufficient title," it was held to be immaterial that plaintiffs could not convey an absolute estate in fee, or that coal rights had been previously conveyed under fifty acres of the tract.

Talford *v.* Jennings Producing Co. (Illinois), 203 Federal, 456. March 11, 1913.

OIL AND GAS LEASE—WRONGFUL CANCELLATION—DAMAGES

Where an owner of land gave notice to terminate oil and gas leases outstanding thereon, and brought suit to cancel the leases, and prior to determination of the suit, leased the land in question to other parties, who proceeded to extract the mineral, it was held that if the prior lessees were successful in the first suit to cancel the leases, they could hold the owner responsible in damages; not for the gross value of the oil extracted, but only the net value after subtracting the cost of extraction. If the cost of extraction exceeded the gross value, they could not recover. The case proceeds on the theory that oil and gas leases are not the owners of the oil and gas in the ground leased until they have reduced the same to possession.

Campbell *v.* Smith (Indiana). 101 Northeastern, 89. March 13, 1913.

TAXATION OF MINING CLAIMS—DEPRECIATION ALLOWANCE

In a suit to exact payment of federal excise tax by the defendant mining company, the defendants asked for a deduction to be allowed for the exhaustion of ore deposits. The court allowed them to subtract from their income statement an amount equal to the product of the tonnage extracted during the year by the "unit value" of the ore as it lay in the beds. It was held that it was immaterial whether such depreciation allowance was actually written off the books of the company or not.

United States *v.* Nipissing Mines Co. (New York), 202 Federal, 803. May 14, 1912.

[NOTE.—As this decision is of unusual interest to mining and oil companies, we recommend reading in connection therewith Treasury Department Bulletins No. 1742, 1754, 1755, 1796, which may be bad upon application to the Internal Revenue Department.—EDITOR.]

MINING CLAIM—CONTRACT TO RE-LOCATE

Where the owner of a mining claim enters into an oral agreement with the owner of an adjoining claim whereby the latter agrees to do the assessment work for the following year on the claim in question, and as consideration therefor the first owner agrees to allow the location to lapse for the current year with the understanding that the adjoining owner will re-locate it in the names of both parties as soon as the present year expires, a fiduciary relation is established, and if, after the first owner has allowed his location to lapse, the adjoining owner violates his agreement and re-locates the ground in his own name, he will be required to admit the original locator to part ownership in accordance with the terms of his contract, even though the agreement was not reduced to writing.

Clark *v.* Mitchell (Nevada), 130 Pacific, 760. March 11, 1913.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

COAL EXPORTS from Japan during 1912 totaled 3,957,795 metric tons, valued at 20,284,751 yen, an increase of 892,117 tons, worth 2,295,138 yen, over 1911. This was due to large exports to India, and general industrial progress in Japan.

BRICKS produced in the Hudson River district, New York, during 1912, amounted to 1,019,259,000, valued at $5,850,770, or $5.74 per 1000 bricks. The principal source of this material is from nine counties in New York and one in New Jersey.

TAIWAN (Formosa) is rich in petroleum-bearing ground, but drilling has not been attempted on account of the peculiar rock formation, which is very soft. American drilling machines are being tried there now, and the mining office is receiving applications for permission to prospect for oil.

GRAPHITE production in the United States in 1912 was 2445 tons of natural and 6448 tons of manufactured product, valued at $207,033 and $880,193 respectively. The output of crystalline graphite came from Alabama, New York, and Pennsylvania, and has decreased since 1909 from 3147 to 1771 tons. Amorphous graphite was produced by three firms in Michigan, Nevada, and Wisconsin. The first-named product is a slate carrying 25 to 30% graphite, and is used in manufacture of paints. Imports from Ceylon, Mexico, Canada, and Korea were 25,643 tons, valued at $1,709,337, an increase of 4941 tons. The International Acheson Graphite Co., at Niagara Falls, produced 6448 tons of artificial graphite averaging 6.44c. per pound.

GERMAN SILVER is made of 55 to 60% copper, 15 to 20% nickel, and 20 to 30% zinc. According to O. F. Hudson, in a contribution, on 'The Microstructure of German Silver,' to the Institute of Metals, England, samples containing 58% copper, 18.5% nickel, and 23.5% zinc were annealed from 1 to 10 and 24 to 72 hours at a temperature of 700°C. showed that the usual crystalline growth ocurred on annealing, but it was also observed that the cold-rolled alloy still showed distinct signs of the original 'cored' structure of the cast material. This 'cored' structure was still in evidence after 48 hours' annealing, and after 72 hours the alloy was practically homogeneous, although faint traces of the 'cores' were observed in the latter sample. The question as to whether or not german silver was composed of a perfectly homogeneous solid 'solution' could be decided by examining a suitably polished and etched surface by means of a hand lense, or even by the unaided eye, the presence of 'cores' showing by distinct graining, made prominent by relief polishing, due to varying hardness.

CALIFORNIA LAW does not constitute an exception to the general rule, stated in 'Concentrates' department of April 12, that failure to perform annual labor on a claim does not lose or forfeit it, but merely renders it forfeitable and locatable by others. In California, as elsewhere in the United States, a locator who has failed to perform his assessment work may, at any time before the rights of the third parties intervene, resume work on his claim and prevent its forfeiture. Section 1426-s of the Civil Code provides that a locator defaulting in his assessment work shall not relocate his claim within three years from the date of his original location, but it does not prevent him from validating his original location by resumption of labor before the rights of others attach. The object of the code section is to prevent claim owners from re-locating on the first of each year and claiming ownership under such relocations for the respective years in which they are made instead of doing assessment work. The section further provides that any attempt to so re-locate shall render the entire location void. Alaska law constitutes the sole exception to the rule as we understand it. By a special act of Congress it was provided that mining claims in that territory shall absolutely lapse and the ground become a part of the public domain if the assessment work is not done within the statutory time.

ENGINEERING PROJECTS AND MINING OPERATIONS require large use of explosives, and the selection of a suitable explosive from the many varieties offered for sale, is of fundamental importance. Many explosives suitable for quarry work have been proved unsuitable for use in deep mines, or in close workings. In metal mining, and in driving tunnels, the character of the gases evolved by the explosive on detonation is an important consideration. An explosive for use in gaseous or dusty coal mines must be formulated and compounded, so that its flame temperature, and the height and duration of its flame are reduced enough to permit its being used with comparative safety. In wet workings, or in submarine blasting, explosives impervious to moisture are requisite. In extremely cold climates, explosives that do not require thawing are desirable, provided they are equally good in other respects. An essential requirement of all explosives, especially of those for use in tropical countries, is that they shall remain stable without change in chemical or physical characteristics.

MICA is used in large quantities in the form of scrap mica, small sheets and the waste from the manufacture of sheet mica, being ground for different uses. Among these are the decoration of wallpaper, and the manufacture of lubricants, fancy paints, and molded mica for electrical insulation, according to the United States Geological Survey. Ground mica applied to wallpaper gives a silvery lustre. When mixed with grease or oils, finely-ground mica forms an excellent lubricant for axles and other bearings. Mixed with shellac or special compositions, ground mica is molded into desired forms and is used in insulators for trolley wires. Ground mica for electrical insulation must be free from metallic matter, minerals, and mica used for lubrication should be free from gritty matter. For wallpaper and brocade paints, a ground mica with a high lustre is required, and such lustre is best obtained by using a clean, light-colored mica, and grinding it under water. Coarsely ground or 'bran' mica is used in increasing quantities to coat the surface of composition roofing-material to prevent the tar or other ingredients used in its manufacture from sticking, when the sheets are rolled for shipping.

BLACK BLASTING-POWDER is stated to be best suited for work in which a gradual pushing or heaving effect is desired, such as in excavating cuts, quarrying soft rock or stone, and especially in quarries where large blocks of building stone are sought. In order to obtain the maximum efficiency, the charge must be well confined by suitable 'stemming.' Granulated nitro-glycerin powder is more effective, and gives better results from black blasting-powder, in soft and seamy rock, or in material that does not sufficiently confine the gases evolved. 'Straight' nitro-glycerin dynamites, as a class, develop greater disruptive force than any of the other commercial classes of explosives tested by the United States Bureau of Mines; and for this reason they should be used for producing shattering effects, or for blasting tough or hard materials, whenever conditions permit. If the 'straight' nitro-glycerin dynamites are found to be too violent for certain classes of work, the low-freezing, or the ammonia dynamites, which have lower rates of detonation, and hence less disruptive effect, are recommended. The low-freezing dynamites have the advantage of not freezing until exposed to a temperature of 35°F., or less; but, like all nitro-glycerin explosives, after they become frozen, they must be thawed before use in order to insure the most effective results. As the ammonium nitrate used in ammonia dynamite is deliquescent, this class of explosive absorbs moisture more readily than other dynamites, therefore it is necessary that care should be observed when storing this class of explosives in wet or damp places. The gelatin dynamites have been used to a large extent in wet blasting, such as in the removal of obstacles to navigation and in deep workings, and, as a general rule, they are best suited for these purposes.

Book Reviews

ANNUAL REPORT OF THE DIRECTOR OF THE MINT. Fiscal year ended June 30, 1912. Also report on the production of precious metals during calendar year 1911. Compiled by George E. Roberts. P. 317. Washington, 1913.

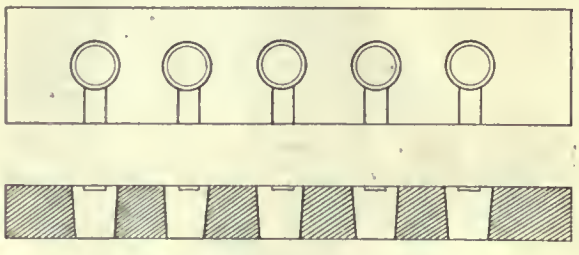
Besides covering operations of the mints at Philadelphia, Denver, and San Francisco, and the mine assay offices distributed throughout the United States, this interesting report deals with gold production of the United States and the world, mining progress in many countries, and coinage generally. In January 1912 the new electrolytic refinery at New York was started, being the fourth in the mint service, although that at Philadelphia is out of commission. This process is based on the Wohlwill patents, materially altered to suit mint conditions, and gives high-grade ductile bullion for coinage purposes. A new set of 16-in. rolls, the heaviest used in the mint service, was installed to deal with the minor coinage. At the various mints and offices there were 711 men employed. The coinage of gold is less than in previous years, due to an act authorizing the issue of gold certificates against gold bullion. There is held at the various mints and New York $109,048,918 in refined gold bars, duly stamped with weight, fineness, and value. The new nickel (5-cent) coins are now in circulation, and are distinctly characteristic of America. The amount appropriated for conducting the mint service in 1912 totaled $1,178,670, while with sundry receipts and balances there was available $1,253,151. There was deposited during the fiscal year 1912 gold bullion worth $151,929,881, while with coin received and redeposits the total was $180,747,607; also $23,069,460 from foreign sources. Silver bullion purchases and deposits were 7,031,263 fine ounces, costing $4,072,626, and from foreign sources 1,063,592 standard ounces, and 8816 oz. in coin. Coinage during the year amounted to 173,388,176 pieces of a value of $24,567,835.40 for domestic circulation, 510,993 peso pieces for San Salvador, and 8,253,505 pieces at the San Francisco mint for the Philippine Islands. Visitors were: Philadelphia, 84,763; San Francisco, 41,369; and Denver, 69,363. Since 1873 there has been deposited at United States mints and assay offices, from all sources, gold bullion valued at $3,791,395,842; silver bullion weighing 622,462,954 fine ounces; while the coinage has been worth $2,497,792,299, and $607,259,120, respectively, and the total value of all coinage has been $4,304,288.084. The world's gold and silver production in 1911 was 22,327,088 and 225,338,194 fine ounces respectively, and the coinage absorbed 18,002,444 and 117,237,838 fine ounces.

GEOLOGY OF THE WAIHI-TAIRUA SUBDIVISION, HAURAKI DIVISION. By James Mackintosh Bell and Colin Fraser. Bulletin 15 (new series). P. 192. Ill., maps, plans, charts, index. Department of Mines. Geological Survey Branch. Wellington, New Zealand, 1912.

This interesting and valuable report was prepared from field examinations made prior to March 1911 by the authors, who have left the Survey and are now in England, and is published through P. G. Morgan, director of the New Zealand Geological Survey. The Hauraki Peninsula contains practically the only gold and silver deposits in the North Island, and has been studied by Cox, Park, Maclaren, McKay, Fraser & Adams, and Fraser, in order, previous to this report. The principal centres of mining activity from the north are Coromandel, Thames, Tairua, Waitekauri, Waihi, and Karangahake, with many smaller places between, but most of the interest is now around the two latter districts. The silicious ores of this section are mainly silver bearing, and, with the exception of the Talisman mine, metal contents are decreasing, as will be remembered by those who follow the work at Waihi. The principal rocks are andesite, rhyolite, and dacite. Rock alteration, due to hydrothermal action, more especially in the vicinity of the lodes, is marked. The commonest gangue minerals are quartz and calcite, the latter often being manganiferous, while pyrite is the most abundant metallic mineral. Most of the mines are wet, and expensive pumping plant is necessary. The Waihi-Tairua subdivision, since 1875 to the end of 1910, has produced bullion worth $49,000,000, Waihi contributing about 90% of this total. The report briefly describes the many prospects and operating mines, and concludes by stating that "a feature of the subdivision is the number of isolated and circumscribed areas in which mining has been conducted, or is now in progress; and the distribution and extent of these metalliferous areas is intimately connected with geological structure. The first period rocks, andesites, dacites, and dacitic rhyolites, enclose lodes which have yielded $48,500,000; second period, andesites and dacites, $180,000; and third period, rhyolites, $700,000. In discussing the possibilities of the discovery of important metalliferous areas apart from those already known, and also the chances of the lateral extension of the recognized areas, these facts are of great importance." The report is well illustrated with maps, plans, and half-tones.

Improved Mortar Base for Stamp-Mills

An improvement in the way of a mortar base has recently been placed on the market by George W. Myers, Kohl building, San Francisco, which experienced stamp-milling men claim will effect economy in stamp-milling methods and at the same time prolong the life of mortars. It is a recognized fact that one of the primary objects in stamp-milling is the maintenance of maximum weight of stamp stem for the purpose of keeping tonnage up to standard. Under the system of stamp-milling, the shoes are worn down so thin that their loss in weight is quite a factor and means a consequent reduction in tonnage. The new feature in the improved mortar base provides that a shoe need only be worn half way down, and then can be removed and inverted in the base and serve as a die. This method obviates the necessity of the purchase of dies and will permit



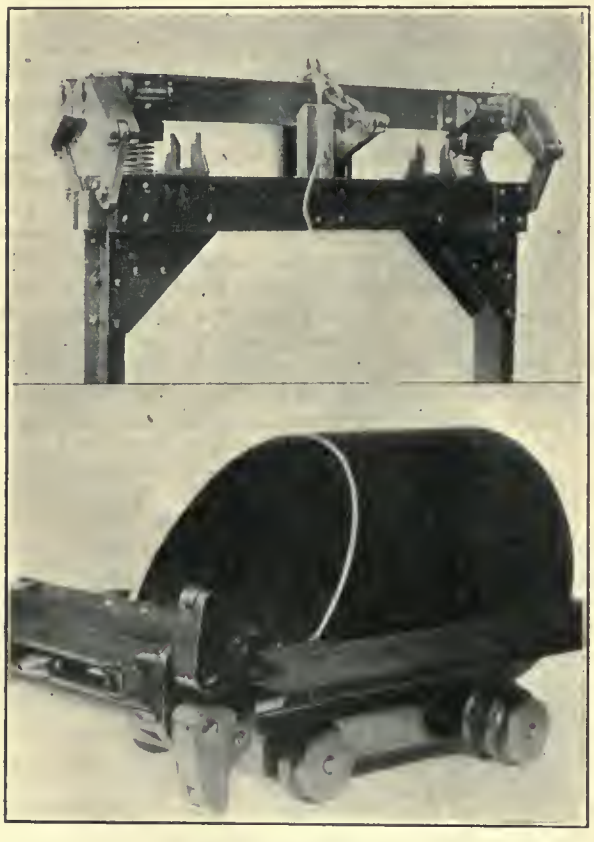
MYERS IMPROVED MORTAR BASE.

of the inverted shoe, now being used as a die, to be worn down to a knife edge before being scrapped. A further claim for this improved base is that it acts as a buffer on the mortar bottom and greatly increases the life of the mortar. This device also serves to keep the stamp stems in true alignment and avoids the shifting of dies in the bottom of the mortar. The mortar base should be made of solid steel, preferably chrome, and the life should be several years. Installations have been made of this improved mortar base in one complete casting, but it is feasible to have it made in two or three parts for greater convenience in placing in and taking out of the mortar. There is a greater wastage in the discarded die bases than in the discarded shoe shanks—a further feature of economy. The utility and economy of Mr. Myers' device will appeal at once to experienced milling men who have found the operation of steel shoes on steel dies a success.

A brief summary of the advantages claimed for the new mortar base follow: Better average of stamp-stem weight maintained; better average of tonnage of ore in stamp-duty maintained; increased life of service of battery mortars; true alignment of stamp stems assured; absolute avoidance of shifting of dies; maximum consumption of steel shoes; substitution of steel for iron dies; elimination of die details and purchase.

New Safety Device for Blast-Furnace and Mine Hoists

A new safety device recently invented and patented by Peter Hinkle, and applicable to both vertical and inclined hoists, is illustrated herewith. This device incorporates a new feature, the double safety guard. According to A. F. Plock, who builds the device, if the cage at any time is accidentally released by reason of parting cables or breaking of hoisting machinery, it will be locked in place instantly and automatically. This is accomplished by means of a powerful coil or leaf spring which brings the eccentric grippers into contact with the guides. The mechanism employed is entirely independent of the load carried by the cages, or the power used, but when applied the car and its load holds the cages locked in place and are no longer dependent on the springs. The device can be installed without any changes to cage or guides. In the figure the device is shown as attached to both cages and skips. It matters not how badly worn the guides may become on one or both sides; so long as there is a guide left,



HINKLE SAFETY DEVICE.

the device will hold tight. Each side works independently. The presence of the guide makes it impossible for the skip car to jump the track. A number of tests have been made on a recent installation at a blast-furnace where cages loaded up to six tons were cut loose, and at no time did the device fail to stop the load instantly.

The smoother the faces of the cam the tighter they will grip steel guides, and a cam designed for steel guides will not work satisfactorily on wooden ones. The powerful grip of the smooth cam causes the wood to spring outward, partly as a result of the oil which penetrates the guide and partly because of the elasticity of the wood. It was found necessary to employ a cam or eccentric with a corrugated face in such cases, arranged in such manner that no sharp edges exist which may injure the substance of the wooden guides. Even wooden guides are not injured by the action of the cams or eccentric in locking the cage. The cams are immediately released and automatically returned to their normal working position as soon as sufficient tension exists in the hoisting cables, and the cage is again ready for service.

Westfalia Mine-Rescue Apparatus

S. F. Hayward & Co., of New York, announce that they are now exclusive American agents for the Westfalia mine-rescue and oxygen reviving apparatus formerly sold direct by the Westfalia Engineering Co. The Hayward company is an old concern which has the largest American business in fire department supplies. They have organized a special department to handle the new line. The Westfalia apparatus is adapted to either mouth breathing or helmet construction. It is of the injector type and an especially perfect cooling system is claimed. The apparatus is in use at the experimental mine of the United States Bureau of Mines at Bruceton, Pennsylvania, at the testing station at Pittsburgh, Pennsylvania, and on cars No. 4 and No. 7, stationed at Pittsburg, Kansas, and Denver, Colorado, respectively. It is used exclusively on the mine-rescue car of the Victor Fuel Co. in Colorado.

Allis-Chalmers Manufacturing Company

On April 16, 1913, Allis-Chalmers Manufacturing Co. took over the properties and entire operation of the business of Allis-Chalmers Co., which latter company during the past year has been in the hands of a receiver. This change marks the end of the Allis-Chalmers receivership and the commencement of the administration of the new company. Beginning with April 16, all business has been and will be conducted by Allis-Chalmers Manufacturing Co., which starts out under conditions promising success. The new company will operate all departments of the business as conducted by its predecessor, and will carry out all contracts on hand for the sale of its products. It has no bonded indebtedness or liabilities of any character. In addition to all assets of the former Allis-Chalmers Co., the new company has over $4,000,000 additional cash for new working capital, which has been raised through the recent reorganization. The new company will continue to operate the large West Allis works and Reliance works at Milwaukee, the Chicago works, and in addition will control the operations of the the Bullock Electric Manufacturing Co. at Cincinnati. Otto H. Falk, of Milwaukee, who for the past year has been receiver of the Allis-Chalmers Co. and under whose management as receiver the operations of the business have shown marked improvement, has been elected president of the new company. The general offices will be at Milwaukee.

Commercial Paragraphs

The Montreal, Canada, office of the SULLIVAN MACHINERY Co., formerly at 403 Lagauchetiere St., West., is now situated at Room 806, Shaughnessy building, corner St. Paul and McGill streets.

The HARDINGE CONICAL MILL Co., 50 Church street, New York, reports that the Teziutlan Copper Co. has just given its second order for two of the largest size Hardinge pebble mills. All of its mills are now equipped with the improved type of iron lining, which is giving satisfaction in several big plants.

The DODGE MANUFACTURING Co., manufacturers of power transmission machinery, Mishawaka, Indiana, has secured from the Alaska Treadwell Gold Mining Co., Juneau, Alaska, an order for 300 ft. of line-shafting, 3 15/16 to 8½ in. diameter, 14 flange couplings, 44 ring-oiling rigid-pillow blocks on plain base plates, 30 safety split collars, 30 improved standard split iron pulleys. The total weight of the order figures 104,000 lb. net. The material will be used in a 150-stamp gold mill.

TAXES paid by the Copper Queen Consolidated Mining Co. in 1912 to the state of Arizona and Cochise county amounted to $248,109 on an assessed value of $11,890,011. This does not include school taxes of $24,000, and city taxes of Bisbee and Douglas, amounting to $17,000 in 1912.

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EDITORIAL STAFF:

San Francisco

H. FOSTER BAIN - - - - - - - Editor
EUGENE H. LESLIE } - - - Assistant Editors
M. W. von BERNEWITZ }

New York

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London

T. A. RICKARD - - - - Editorial Contributor
EDWARD WALKER - - - - Correspondent

SPECIAL CONTRIBUTORS:

A. W. Allen. Charles Janin.
Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

FAILURE of the Brazilian loan of £11,000,000 in Paris, though backed by the Rothschilds, emphasizes the 'tightness' of the money market. Only six per cent of the loan was subscribed by the public.

OROVILLE shipped on May 27, the first peaches ripened this season in California. Incidentally, they were raised upon ground made by smoothing over old dredge tailing. The same ground last year shipped the earliest Tokay grapes.

AMONG new technical committees established by the American Institute of Mining Engineers is one on mining methods. The appointment of committees to stimulate the activity of the Institute along special lines is proving extremely effective, and there is no field where such a committee can be more helpful than in the study of mining methods.

THANKS to the activity of the United States Bureau of Mines and the technical skill of California petroleum engineers, gas wells in Oklahoma from which more than 100,000,000 cubic feet of gas was being wasted daily have been closed. The gas came from a sand overlying the oil sand and was being allowed to blow off in order to make the oil available. The California method of 'mudding' the gas sand under pressure proved effectual, and it will now be possible to get the oil without wasting the gas. This is practical conservation.

ANOTHER fire has visited the Geological Survey offices at Washington, and important manuscript maps and records have been burned. It is a comfort to know that the Survey will be in a new fire-proof building just as soon as the structure can be completed, the building having been recently authorized. In the same building are to be housed the United States Reclamation Service and the United States Bureau of Mines, both outgrowths of the former activities of the Survey. Entry into the new building will therefore be more of a home-coming than a breaking of home ties. It is to be hoped that the fire losses in the interim may not be serious.

WHEN is a dredge not a dredge? That is a problem that customs officials of Portugal are now debating. The American dredge shipped recently to that country for work in the tinfields, started from the shops billed as structural steel, obtaining thereby a favorable freight rate. At the Portuguese border it was found that the tariff on structural steel was almost prohibitory, so the owners are now busy explaining that even in its dismounted condi-

tion it is after all a dredge, hence mining machinery, hence entitled to a low custom rate. It would certainly be anomalous for the materials in a machine to take a higher rate than the machine itself, but apparently vagaries are not confined to the United States tariff.

PRELIMINARY estimates of the Canadian Department of Mines for the year 1912, show an increase of nearly 29 per cent in the mineral production of that country. This increase has come almost entirely from the mines which were in operation the previous year, and no new discoveries of importance have been recorded. Porcupine was the only new contributing district of importance, with a gold production of $1,750,000. The completed figures will undoubtedly show a marked increase in the silver production and place Canada in the forefront of silver-producing countries.

REVIVAL of the Inquisition is apparently one of the sequelae of the new tariff schedule, according to statements made by Messrs. O. W. Underwood and W. C. Redfield. Fearing lest manufacturers who do not like the new tariff may attempt to put it and its sponsors 'in a hole' by unjustifiably decreasing wages, or shutting down their plants, on the plea that they cannot afford to operate under the new rates, Mr. Redfield announces that the Department of Commerce and Labor has undertaken to find out whether the facts do or do not justify the threatened reductions. Efficiency engineering has become something of a fad recently, and its methods have, in the case of individual enterprises, led to some marked improvements in practice. But an attempt by a bureau of the federal Government to subject to similar searching analysis the industries of the nation is more provocative of astonishment at its temerity than of hopeful anticipation of its benefit. The view expressed by the Secretary of Commerce that "the public has the right to efficiency in its public servants"; in other words, that the public which pays the bills has a right to insist that efficient methods of manufacture and management be employed in order that these bills may be as small as possible, is an essentially modern one, but one that has not yet attained universal acceptance. It is none the less fundamentally sound, and is slowly but surely becoming an important factor in present-day living conditions. But approval of the general concept does not necessarily entail approval of every method that may be devised for its enforcement. Aside from the magnitude of the task, a comparison of public and private business methods and results affords scant ground for the belief that government officials can profitably instruct manufacturers as to the conduct of their business. We agree with Mr. Woodrow Wilson that "no body of men would have the wisdom necessary to enable them to regulate the industrial processes of the country." But, proceeding along reasonable lines, the Department of Commerce and Labor may easily accomplish much of good, and we hope the temerarious announcement may be the precursor of more moderate performance.

Agrarian Reform in Mexico

One of the many problems that confronts the Mexican Government and which has been a war-cry for every revolutionary leader who has raised his standard in Mexico since the downfall of Sr. Porfirio Diaz, has been the solution of the agrarian problem. While many plans have been proposed and an attempt has been made on the part of the Government to accomplish something toward this end, nothing definite has as yet materialized. The subject is a most important one to the Government as well as to the peon, and if properly handled will do much toward the pacification of the country, an end toward which every effort is being made at the present time. The very uneven distribution of wealth which has prevailed in Mexico since the Spanish colonial days, has tended toward the development of two distinct and separate classes; the land-holding, which is in the decided minority but which owns practically the whole of Mexico, and the peon, which comprises over 90 per cent of the population but which owns nothing. That which goes to constitute the backbone of every commonwealth, the middle class, is conspicuous by its absence. As a result of this segregation of the population into but two distinct classes and the consequent placing of an almost insurmountable barrier between the peon and the land-owner, animosities have arisen and the feeling of unrest has developed to the point where revolution was the natural sequence.

Sr. Zeferino Dominguez, an expert in Mexican affairs, is about to present a plan to the Government for the solution of this problem, and it is to be hoped that some good may be accomplished, even though results from such a measure will be felt slowly. Sr. Dominguez has made a special study of agricultural conditions in Mexico as related to the peon class and toward the betterment of this class has spent the past three years in the United States investigating modern farming methods, later putting them into practice on his *hacienda* at Santa Maria in the state of Coahuila. The experiment which he has tried with the peons who have been in his employ, has been eminently successful, and there is no reason to believe that it will not prove equally so if tried upon a large scale with Government backing. Each laborer on his ranch was given a small piece of land amounting to about seven acres, together with grain for planting it and instructions as to the best methods of tilling the soil. He was also given a certain amount of time each day for the cultivation of his own land. As a result, the peon became interested in his work, was elated with the thought of being a *haciendado*, and Sr. Dominguez always had an abundance of efficient labor.

Recently, revolutionary agitators visited the Santa Maria district, offering the peons the unheard of wage of ₱3 per day, together with a rifle, horse, and a division of the spoils obtained in the looting of villages and farms if they would enlist. This offer, which under ordinary circumstances would muster every peon in the district to the 'revolutionary' cause, did not bring forth a volunteer from among the laborers on the Dominguez *hacienda*. As the peons on this ranch are of the same stripe and

breed as every other in the Republic, this little experiment gives evidence of what can be accomplished by peaceable means and a knowledge of the people.

While at the present hour Mexico is not looking for experiments, and the sword wielded by strong arms seems to be the most expedient means of establishing peace, a solution of the agrarian problem is one which will have to be found sooner or later, and the plan which Sr. Dominguez will present to the President looks promising.

Phosphate Deposits and the Law

Phosphate lands have led to much litigation in the West, the main controversy being over the question whether or not the deposits should be located as lodes or placers. The United States Land Office was at first disposed to favor placer claimants, on the basis, apparently, that, the deposits not being clearly lodes, the placer law should apply. Later the disposition was to put the matter up to the courts, and there have now been three decisions bearing on the subject. The first, by the United States District Court of Idaho, was to the effect that the question to be decided was one of fact, and as such was within the jurisdiction of the Land Office rather than the courts. While the practice of the Land Office had not been uniform, the fact that patents had been granted to placer claimants was held to be sufficient warrant for giving a decision favorable to the placer claimant, who in this case had the prior right. Since that decision was announced, the Wyoming District Court, and now the United States Circuit Court of Appeals, have found for the lode claimants. It was held that the matter was properly within the jurisdiction of the courts, since a determination as to character of the deposit was necessary in order to render a decision of the controversy, and it was further held that the deposits, being zones of calcium phosphate between walls of siliceous limestone and having a well defined strike and dip, were lodes within the meaning of the law. Much was made of the fact that the deposits were "rock in place," and it was held that as such they were properly locatable only as lodes.

Without entering into the question of the equities of the particular cases in dispute, it is fair to say that this decision is revolutionary and big with consequences. If the term "rock in place" is to control, it is clear that the result will be to reverse the previous tendency to narrow the scope of lode law and to broaden that providing for placer locations. As a matter of fact, as any competent geologist will agree, the phosphate deposits are sedimentary beds, and he would be a bold man who would claim that either the lode or placer law, when enacted, was intended to provide for their location or for that of any similar deposits. That this is true is evidenced by the fact that special laws were enacted to permit entry of coal and building stones, which, as bedded deposits, were felt to be clearly outside the scope of the general mining law. The fact that the lode law and the placer law have been repeatedly stretched to cover newly defined deposits, is but another instance of the fact that if Congress will not act, the courts must. The courts, doubtless, are quite as competent as Congress, but unfortunately they do not have a free hand. In the present instance, for example, the court was not permitted to frame a law to meet the situation, but merely to decide which of the existing laws met it less badly. The fundamental objection to regarding phosphate beds as lodes lies in the complication of extralateral rights thereby created. It is not sound policy to give to one man the phosphate rock of a township by virtue of his ownership of a strip along the outcrop, and the inevitable result is a revolt on the part of juries. This makes a sport of the law.

In the years yet to come the phosphate deposits on the public lands are sure to become more and more important. At the same time other bedded deposits containing metals of little value at present, or non-metallic in character, will also come into demand. A reasonable care for equity and orderly procedure would demand that the matter be given serious consideration and that Congress frame a law designed to meet the case. We have no sympathy with the disposition of Congress, and at times the Departments, to shirk responsibilities and to pass their burdens on the courts; the proper function of the courts is judicial—not legislative.

Wholesale Mining at Juneau

Mining large low-grade orebodies is one of the problems of the present, but is also preëminently the problem of the future. The demand for metals can only be met by handling lower and lower grade ore. Reactionaries may temporarily raise the cry of 'selective mining,' but fundamentally 'wholesale mining' is sound. Our Johannesburg correspondent pointed out last week why selective mining is impossible at the Simmer Deep, and how wholesale mining alone will enable the property to make good. It is cheaper to mine the low-grade ore while the stopes are open than to go back and re-open the ground. Assuming that the manager is capable and honest, the lowest grade of rock possible at any given time should be mined. If the manager is either so dishonest as knowingly, or so incapable as blindly, to mix barren rock with the ore for the purpose of reducing operating costs, the remedy is to change the manager; not to gouge the mine. At the Homestake mine, Mr. T. J. Grier has striven with eminent success so to arrange the underground lines of transportation and the surface treatment plant, as to treat everything that must be broken and hoisted. If low-grade ore must be broken, or even if in working that of higher grade it is only developed ready for breaking, it should be mined and treated, if its value is sufficient to leave a profit over and above the cost of the extra work necessary to handle it. It is entirely proper to assess the general cost against the other ore which is to be mined in any event, and to consider anything over operating expenses as profit on the low-grade. In determining this operating profit, the cost of wear and tear on plant must enter, and if only a limited milling capacity is available and capital cannot be secured for additions, it may be better temporarily

to crush the richer ore only. This, however, should be regarded as a temporary measure. As against the argument that by gouging the mine, money obtained from the richer ore is the more quickly set at work earning interest, it is to be remembered that this is based upon an unlimited market, and that the interest earned must be measured against the cost of re-working old stopes and the inevitable loss of some of the ground. This extra cost is almost invariably high, and it is a sound general rule to mine the ore when it is exposed.

Wholesale mining is perhaps best exemplified among the gold mines of the United States, in the work done on Douglas island, and about to be begun at Juneau, Alaska. The great Treadwell mines on the island have long been famous for their low costs. In January last, the group produced and treated 128,583 tons of ore. The average cost for the whole group of mines, including construction account, was $1.27 per ton. This is the more notable from the fact that operating costs are highest in the winter, when the minimum of water-power is available and the snow and cold introduce other complications. Actual operating costs in the summer months have been brought to below 80 cents per ton, and with additional development of water-power and completion of an extensive construction program, low costs the year around are to be expected. The change from shipping concentrate to its treatment by cyanidation and the development of a main hoisting shaft have brought costs down 25 cents per ton within the past two years. For the complete treatment now given the ore, two horse-power per stamp is necessary, and the amount of power available is therefore of first importance in any program of expansion. The water resources of the island have long since been developed to a maximum and power is now drawn from Sheep creek and Nugget creek on the mainland. While there is opportunity for storage and additional development on Nugget creek, that stream will probably not furnish enough power to meet the new demands of the Juneau district. Investigations are therefore being made on Admiralty island and at Snettisham, below Taku inlet. It seems certain that ample power can be developed, though the cost will be large and there are important technical difficulties to be overcome. To bring the Snettisham power to Juneau, for example, will require a submarine cable over three miles long.

The demand for additional power arises not alone from the needs of the Treadwell, but from those of the Alaska Juneau, the Alaska Gastineau, and the probable development of the Ebner mine, all on the mainland back of Juneau. These three properties cover a great lode running through Silver Bow basin, the Gastineau being to the south and extending into Sheep Creek basin, the Alaska Juneau covering 6800 feet along the central portion of the lode, and the Ebner lying immediately to the north. The lode is a belt of black slate, interleaved with which are stringers of white quartz containing free gold and approximately two per cent metallic sulphides. The body of ore is so large that it is difficult to arrive at any sound conclusion as to its average value. The Alaska Gold Mines Company, which is opening the Alaska Gastineau property, is predicated on a recovery of $1.50 per ton. In the annual report just issued, Mr. D. C. Jackling states that the average gross value of 300,000 tons of ore delivered to the Perseverance mill during five years was about $2.05 per ton, which value was checked by sampling the workings from which the ore came. The Alaska Juneau, when under Wernher Beit management, operating only in the summer and on a small scale, milled ore that was worth about $1.60 per ton at a cost of $1.10. This mill feed, however, was obtained in part by selection. The quartz alone is worth about $6 per ton, but the average grade of the whole lode is naturally much smaller. The Alaska Juneau is now being opened 1700 ft. below the outcrop by Mr. F. W. Bradley and associates. An adit driven from near sea-level has intersected the lode on the north side of a cross-fault which divides it. A cross-cut here showed the lode to be 500 feet wide and the average recoverable value was $1.70 per ton. The adit is being advanced to open the south part of the lode, after which an incline starting on the foot-wall and extending to the hanging is to be driven to connect with the open pit on the surface. Ore from this cross-cut, with one additional to be driven farther south and another north of the one already open, is to be taken as a sample upon which to design a final treatment plan. The calculations of Mr. Bradley and his associates are based upon an average of $1.35 recoverable. It is worth noting that this undertaking is in a region where the minimum wage is $3 per shift, where the capital expense of power development will be at least $250 per horse-power, where underground mining is necessary, and where amalgamation will have to be supplemented by concentration, cyanidation, or both, in order to effect a satisfactory recovery. Compared with this, mining one per cent copper ore with steam-shovels is easy work.

Simultaneous development of the Alaska Gastineau and the Alaska Juneau by two groups of engineers of large experience and ability will afford many interesting opportunities for comparison. The Alaska Gold Mines Company is to build a 6000-ton mill for its first unit, and, while no final announcement has been made, it is understood that crushing will be by rolls. The Alaska Juneau pilot plant is to consist of 30 stamps, preceded by a rock-breaker, and probably followed by Chile mills. The opportunity to compare performance of rolls and stamps on the same ore, each in the hands of an excellent technical staff, should yield results of large general interest. At the Treadwell, experiments have shown that 18 tons can be crushed to one-half inch with the ordinary 1250-pound stamp, by suitable arrangement of by-passes. As the Juneau ore must be brought to about 30 mesh, re-crushing will be necessary, and the most economical means of doing this is still to be determined.

Development of these two mines, followed perhaps by the Ebner, will make Juneau the centre of one of the world's greatest mining regions, and, it is to be noted, the whole industry is predicated upon wholesale mining.

Cost of Working Thin Veins at the Standard Consolidated Mine

By C. E. Grunsky, Jr.

The Standard Consolidated mine has produced over $16,000,000 in bullion since the exploitation of its orebodies was actively commenced in 1879. Most of the profitable ore has been obtained from the large high-grade orebodies, but none of these now remain and the veins being mined at present are narrow, some of them not more than a few inches in width. Because of the narrowness of these veins the data concerning the cost of working them may be of interest. These veins, or stringers, are in most instances foot or hanging wall branches from large veins, which have been worked, and were originally rejected because their narrowness made stoping too expensive.

The vein varies in nature from a hard banded quartz to a soft, porous, and granular quartz, often containing seams of soft black oxide of manganese. Crystals of secondary feldspar are also found in the vein-matter. Often irregular fragments of quartz are found in the vein-filling, which is almost entirely composed of a soft yellowish brown clay, with stringers of quartz ('enrichers') which carry the mineral and lie close to the foot or hanging wall. The ores carry only gold and silver, and at the present time about 75% of the output is free milling.

The wall rock is a hornblende-andesite. In parts of the mine this is found to be so leached out and decomposed that it is very soft and is almost colorless, but in the present workings the walls are firm and fairly hard, the andesite being only slightly altered.

Timbering in the stopes consists of placing short stulls or poles, 6 to 10 inches in diameter, where needed. All drilling is done by hand, and the powder used is 35% gelatine. The stoping widths are kept as narrow as possible, being in the thin seams not more than 18 to 24 in. wide. The stopes are back-filled with waste, the excess waste being run to the dump. As the dip of the veins is steep, being in some instances almost vertical, the ore runs freely in the chutes, and there is no handling expense in the stopes, except that incurred in conveying the ore to the chutes.

The development adits are 7 by 5 ft. in cross-section, and where timbered, square sets of 10 or 12-in. squared timbers are used. All drilling is by hand and 40% Hercules powder is used.

The miners are unionized, and the following scale of wages is in force for underground labor:

Foreman	$6.00	Miners	$4.00
Shift-boss	5.00	Cage-tender	4.00
Engineers	5.00	Carmen	4.00
Timbermen	4.50	Watchmen	3.00

Mining is carried on by two eight-hour shifts. At present all mining is above the 500-ft. level, and the ore from the different levels is hoisted or lowered in the vertical shaft and dumped into the ore-bins on the 303-ft. level. It is then drawn from the bin-chute on the 334-ft. level and trammed by mule-train through an 1800-ft. adit to the mill.

The stamp-mill was constructed about 1877, but was destroyed by fire in 1898 and rebuilt. It is a 20-stamp mill with stamps weighing 1000 lb. and dropping 105 times per minute. The usual drop is 4 to 5 inches. Crushing is accomplished in weak cyanide solution. The battery screens are No. 1 round hole, punched steel. The amalgamating plates are of unplated copper, and the battery aprons are 16 ft. in length. The batteries and mill plates retain about 50% of the gold. The tailing is hoisted by four 10 by 54-in. Frenier pumps to an elevation sufficient to permit a gravity flow to the cyanide plant. The mill is operated in three 8-hour shifts and has a capacity of 75 tons per day.

The cyanide plant was built in 1894 and additions and enlargements were made in 1901, 1902, and 1904. The mill tailing runs to a 5 by 22-ft. Allis-Chalmers tube-mill and then to a mechanical classifier. The closed circle is made use of, only the fine overflow going to the agitators. The agitators are ten in number and the agitation is by mechanical means. Filtering is accomplished in four units, containing 140 leaves of the Butters type. The extraction obtained from the combined treatment in the mill and the cyanide plant is about 95%. The cyanide plant has a capacity of 125 to 150 tons, or about double the mill capacity, in order to handle the old mill tailing, which has been collected for years in the slime reservoirs below the mill.

All of the machinery is operated by electricity generated at the plant of the company, which is at Green Creek, a distance of 14 miles from the mine. The power-plant was built in 1893 and has been in continuous operation since that date. At the time of its completion, it was one of the longest high-tension lines in existence. The line transmits a voltage of 6600 volts. The current generated is 3-phase, 66 cycles, and the plant is capable of developing 350 hp. The annual cost per horse-

power has so far averaged approximately $25.

The following costs are based on data from the summer months, when the plant was running almost at capacity. Supplies include the distribution accounts, and labor includes the distributed general-labor.

Mining:		
Development labor	$2.312	
Development supplies	0.798	
Stoping labor	3.986	
Stoping supplies	1.358	
Power	0.067	
Total cost of mining		$8.521
Milling:		
Labor	0.633	
Supplies	0.330	
Power	0.133	
Total cost of milling		1.096
Cyaniding:		
Labor	0.548	
Supplies	0.671	
Power	0.030	
Total cost of cyaniding		1.249
Administration		1.593
Total		$12.459

Altogether, 6216 ft. of raises, winzes, drifts, and cross-cuts were driven during the year, developing only about 8700 tons of ore. The cost of development was $6.37 per linear foot. This cost was divided as follows: labor, $4.854; supplies, $1.428; and power, $0.088. This labor item includes a part of the general mine labor. A table, showing only the actual labor devoted to development, is given below.

Operation.	Ft. per shift.	Cost per ft.
*Driving	1.304	$3.07
Cross-cutting	1.187	3.37
Raising	1.326	3.02
Sinking	0.608	6.58

*Driving (not included above) through previously worked veins in search for valuable fill and pillars was at the rate of 0.641 ft. per shift.

The cost of stoping varied greatly because of the variation in the widths of the different veins, and the following table will serve to show how the labor cost varies. This labor item, to permit of more satisfactory comparison, includes only the actual stoping labor, general labor not being included.

Vein.	Av. width, in.	Variation in width, in.	Vein matter.	*Pitch of vein	Tons per shift	Cost per ton stoped
Zeta	3	.....	hard	steep	0.38	$10.520
Hobart	5	4 to 6	hard	steep	0.42	9.590
West	5	4 to 6	soft	steep	1.21	3.317
No. 7	8	3 to 17	med. hard	flat	0.91	4.388
No. 6	9	6 to 13	med. hard	flat	0.99	4.052
Middle	12	8 to 18	med. hard	steep	1.46	2.740
Lander	18	14 to 20	hard	steep	1.44	2.776
Flat	28.5	9 to 42	soft	flat	1.91	2.095

*The dip of the veins was sufficient to allow the broken waste and ore to run freely in the chutes, with the exception of the flat veins, where the broken material had to be handled several times.

The figures given below for stoping supplies are based on the following unit costs: Finished lumber, $35 per M.; tamarack poles, 10c. per linear foot; lagging, 10c. per piece; powder, $8 per 50-lb. box.

General Cost of Stoping Supplies (company work)

Material.	Cost per ton.
Lumber	$0.429
Explosives	0.388
Steel and miscellaneous	0.108
Distribution accounts	0.544
Total (based on a year's figures)	$1.469

It is not possible, under the present system of cost-keeping, to segregate the stoping supplies according to the veins on which they were used. However, the following figures for supplies issued to lessees will furnish some idea of the supplies used on certain of the veins.

For lease No. 1, on the Bruce vein, which is 7 in. wide, the vein-matter being a medium hard quartz with firm andesite walls, and the dip almost vertical, the figures are:

Material.	Cost per ton.
Lumber	$0.608
Explosives	0.500
Steel	0.076
Miscellaneous	0.131
Total	$1.315

For lease No. 2, on the incline vein, which is of hard banded quartz and is 12 in. wide, pitching steeply and with hard andesite foot and hanging wall, the costs are:

Material.	Cost per ton.
Lumber	$0.337
Explosives	0.539
Steel	0.066
Miscellaneous	0.067
Total	1.009

The following table of costs of mill supplies is based on the entire figures for the year 1912-13:

Supplies.	Cost per ton.
Battery shoes, at 7c. per pound	$0.039
Battery dies, at 5c. per pound	0.057
Boss-heads, at 6c. per pound	0.004
Liners, at 5c. per pound	0.011
Screens, at 20c. per square foot	0.012
Mill-plates, at 28c. per pound	0.034
Quicksilver, at 5c. per ounce	0.011
Belting	0.009
Fuel, at $8 per cord	0.070
Sundries	0.134
Total	$0.381

The cost of cyanide plant supplies is shown in the table below, being based on the annual figures for 1912-13:

Supplies.	Cost per ton.
Sodium cyanide, at 26c. per pound	$0.269
Lime, at 1c. per pound	0.192
Zinc, at 12c. per pound	0.058
Pebbles, at 2c. per pound	0.020
Lead acetate, at 14c. per pound	0.013
Fuel, at $8 per cord	0.031
Sundries	0.197
Total	$0.780

Recent Development at Utah Copper Company Mines

By D. C. Jackling

*In the annual report for 1911, the total area of mining ground owned by the company was shown to be 723.870 acres. During 1912 an addition was made to this area by the acquisition of the Copper Mining Co. claim, which has a net patented area of 15.528 acres. Re-calculation and checking of all surveys resulted in detecting slight differences in the areas of some of the groups. The corrected acreages are as follows:

	Acres.
Original Utah Copper claims	193.518
Original Boston Consolidated claims	362.335
Shawmut Consolidated group of claims	100.721
Pay Roll group of claims	60.134
Copper Mining Co. claim	15.528
Outlying fractional claims	8.158
Total area of lode mining claims	740.394

Development at the Mines

The length of tunnels, drifts, and raises driven during the year 1912 was 35,473 ft., bringing the total length of all underground work at the end of the period up to 414,691 ft., or 78.54 miles. Of this total, 69,763 ft. has been destroyed by steam-shovel work and 194,024 ft. by underground work, making a total length of workings so lost of 50 miles and leaving about 29 miles still accessible. Previous to 1912, there had been driven on the Utah and Boston groups, 7 diamond-drill holes, having a combined depth of 2609 ft., and 35 churn-drill holes, having a combined depth of 15,939 ft., making at the end of the year 1911, a total combined depth of all diamond and churn-drill holes of 18,548 ft. During the year 1912, 18 additional churn-drill holes were drilled, the aggregate depth of which was 8770 ft. Therefore, the total combined depth of all drill-holes, at the end of the year 1912, was 27,318 ft., corresponding to an average depth of hole of 455 feet.

The cost of underground development for the year 1912 amounted to 15.62c. per ton on all ores mined from underground workings, and to 3.47c. per ton on the total tonnage of all ores mined and shipped to the plants from both the underground workings and steam-shovel levels. The cost of churn-drill development during the year amounted to 1.04c. per ton on all ore produced. Therefore the total cost of both underground and surface development amounted to 4.51c. per ton of ore mined. This cost was all charged against operations and included in the per ton mining cost for the year.

Ore Reserves

At the end of the year 1911, the total ore-bearing area fully and partly developed was 214.61 acres, of which 119.46 acres was in the original Utah group, 86.94 acres in the original Boston group, and 8.21 acres in the original Pay Roll group. During the year 1912 this area was increased to 217.26 acres, and the average thickness of developed and partly developed ore increased from 418 to 424.3 ft. Revised calculations, taking into account the results of the year's work, show that previous to January 1, 1913, there had been developed in the property 337,700,842 tons of ore, of which quantity 257,584,500 tons is classed as fully developed and 80,116,342 tons as partly so. This tonnage includes about 28,800,000 tons of partly developed ore in the slopes of the steam-shovel workings. The average assay of the fully developed ore is slightly in excess of 1.60% copper, and the average assay of the partly developed ore is 1.16% copper, making the average assay of the total of both classes of ore 1.50% copper. There was mined prior to January 1, 1913, from the entire property, a total of 21,200,842 dry tons of ore, averaging 1.542% copper, and the total reserves remaining amount, therefore, to 316,500,000 tons, averaging 1.495% copper. The year's addition to reserves was 15,000,000 tons in excess of the tonnage mined. In making the calculations to determine the average grade of ore reserves, there were used 43,296 assay samples, representing a total of 279,529 linear feet of drilling and underground development.

Stripping Operations

For the 1911 report, it was estimated that the average thickness of capping on the original Utah group was 80 ft., on the original Boston group 134 ft., and on the Pay Roll group 173 ft., making an average thickness over the orebody, as then developed, of 106 ft. Additional data as to the thickness of capping obtained during the year, taken in connection with the increase of ore reserves and developed area, indicate an average thickness of capping on the Utah group of 84 ft., on the Boston group 134 ft., and on the Pay Roll group 206 ft., making an average thickness over the entire orebody of 110 feet.

The total amount of capping removed during the year 1912 was 4,676,568 cu. yd., the average rate being 389,714 cu. yd. per month. Previous to January 1, 1912, the total area upon which stripping had been conducted was 132.26 acres. This work was extended during the year 1912 over an additional 23.44 acres, making a total area over which such operations had been conducted up to January 1, 1913, of 155.70 acres. Prior to the year 1912, the actual area completely stripped was estimated at 33.52 acres. During the year, this was increased by 11.009 acres, and at the end of the year 1912, the area completely stripped was, therefore, 44.529 acres.

The average thickness of capping over the entire orebody corresponds to 177,476 cu. yd. of stripping per acre. The total amount of stripping removed from the property represents the equivalent of completely stripping 97.43 acres. As the area over which stripping has been completed or partly completed contains an average of about 1,422,000 tons

*Abstract from the general manager's annual report for 1912.

per acre, a quantity of capping has been removed equivalent to the complete stripping of 138,525,974 tons of ore. Of this quantity, there has been mined and shipped to the plants 21,200,842 tons, or about 15.3%. The ratio of stripping to ore, both as to thickness and tonnage, within the limits of the fully and partly developed area, is approximately 1 to 4.

Mining Operations

Underground mining operations were conducted at the Boston mine in the original Utah mine on the East Tunnel side of Bingham canyon, until interrupted by labor disturbances in September. These operations were resumed in a small way at the Boston mine in November, but it is not the intention to again do any undergroud mining in the original Utah area, and it is our purpose to discontinue underground mining altogether before the end of 1913. Of the total ore mined during 1912, 77.81% was obtained by steam-shovels from the original Utah mine; 4.33% was mined underground in the Utah mine, and 17.86% was mined underground in the Boston mine; as compared with 74, 4, and 22%, respectively, for the previous year.

The average cost of steam-shovel mining for the year was 35.19c. per ton, of which 8.84c. represents charges on account of stripping expense and prospecting, leaving an actual working cost, including all extraordinary and general charges except development and stripping expense, of 26.35c. per ton, as compared with 24.61c. for the year 1911. The average cost of underground mining for the year at the Utah and Boston mines was 67.39c. per ton, of which amount 15.62c. represents the cost of underground development, as compared with 68.35 and 15.66c., respectively, for the previous year. The cost of underground mining in the Boston mine was less than at the Utah mine on account of a larger tonnage being mined from the former. During the year, the average cost of mining all the ore obtained from surface and underground operations was 42.33c. per ton, of which amount 12.01c. was charged to cover prospecting with churn-drills, underground development, and the proper proportion of stripping expense, leaving a net working cost for producing all ore, including general and fixed charges, of 30.32c. per ton, as compared with 44.79, 12.81, and 31.98c., respectively, for the year 1911.

Equipment and Improvements

During 1912 no additions were made to the equipment at the mines, and at the end of the year the railway and steam-shovel equipment was as follows: 22 standard-gauge steam-shovels; 35 standard-gauge switching locomotives, 1 standard-gauge Shay locomotive, 11 narrow-gauge locomotives, 100 standard-gauge 12-yd. all steel dump cars, 117 standard-gauge 6-yd. dump cars, 144 narrow-gauge 4-yd. dump cars, and 4 flat cars of 100,000 lb. capacity. Two of the steam-shovels are obsolete in design and are not used except in emergency. For blasting and prospecting operations, we have 11 churn-drills. There are 6 air-compressors having a combined capacity of about 8000 ft. of free air per minute. We do not anticipate the necessity of providing any additional equipment during the year 1913.

Mill Construction and Operations

No extensive additions were made at the Magna plant excepting the enlargement and improvement of the coarse-crushing department, which work was commenced during the year with a view to increasing the capacity of that department for handling wet and frozen ore in winter weather. These improvements were not finished in time to be of service during the past winter, partly on account of the inability to secure deliveries of the necessary structural material and machinery, and because of the forced suspension of work in September. They will be completed for next winter's operations. The contemplated enlargement of the steam power plant at Magna to provide for growth of our business became unnecessary as a result of our having contracted for our entire future power requirements from the Utah Power & Light Company.

At the end of the year 1911, the remodeling of six sections of the Arthur plant had been completed, and this work was continued as rapidly as necessary to accommodate the increase in tonnage of ore available from the mines. The thirteenth and last section was finished early in September. The enlargement of the coarse-crushing department at this plant was not finished in time to be of service during winter weather, but will be completed early in the year 1913.

Milling Capacity

During the year there was milled at the Magna plant 3,454,800 tons of ore, a decrease of 270,604 tons as compared with the previous year; while at the Arthur plant, the full capacity of which was not required throughout the year, 1,860,521 tons was milled, this being an increase of 905,124 tons as compared to the previous year. Therefore the total ore treated at both plants for the year was 5,315,321 tons as compared with 4,680,801 for the previous year. During the summer months, the Magna plant demonstrated its ability to handle over 12,000 tons of ore per day, when the supply was plentiful and regular, and under the same conditions, the reconstructed Arthur plant has shown a capacity of over 8000 tons per day. With the coarse-crushing departments of both plants enlarged and improved so that they can, during bad weather, handle full tonnage when the ore is wet or frozen, the combined economical capacity of both plants may therefore be considered as about 21,000 tons per day.

The average grade of the ore treated at both plants for the year was 1.3642% copper, as compared with 1.51% copper for the year 1911. This decrease was due principally to the disturbed conditions prevailing at the mines during the latter part of the year, which interfered with stripping operations and caused practically an entire suspension of underground mining. Under the circumstances, it was necessary, during the last quarter, to mine nearly the entire tonnage from the low-grade area near the northerly limit of the ore deposit, and as this area had been only partly stripped, the grade of the ore was further reduced by the inter-

mixing of unusual quantites of capping. This resulted in the ore treated during the last quarter averaging 1.104% copper.

The average recovery for the year at the Magna plant was 66.03% and at the Arthur plant 66.86%. The average recovery at both plants was 66.32%, corresponding to 18.09 lb. of copper per ton, as compared to an average recovery of 69.53%, or 21.03 lb. copper per ton, for the previous year. The lower percentage of recovery was due in part to the lower average grade of the ore milled and in part to the inferior quality of ore and disturbed operating conditions prevailing throughout the last quarter.

The cost of milling at Magna was 39.64c. and at Arthur 45.18c. per ton, as compared with 40.06 and 48.01c., respectively, for the year 1911. The average cost of milling at both plants was 41.58c. per ton, as compared to 41.68c. for the previous year. The average cost at both plants during the first nine months of the year was only 35.46c. per ton, as compared with 70.39c. per ton for the last quarter. For the months of July and August, when the plants milled an average of 19,616 tons per day, the average milling cost was 31.09c. per ton; and we expect this cost to be less than 30c. per ton, when conditions are such that the mills can be operated to their full capacity of about 21,000 tons per day. The milling costs stated include their proper proportion of all fixed and general charges.

Production and Costs

The total gross production of copper contained in concentrate for the year 1912 was 96,175,090 lb., as compared to 98,436,224 lb. for the year 1911.

The concentrate produced averaged 20.75% copper, as compared to 25.62 for the previous year. The reduction in average grade of concentrate was due partly to the character of underground ores from the Boston Consolidated mine, which contain a somewhat higher percentage of iron than the ores from the original Utah Copper mine, and partly to the treatment of ores from the low-grade area of the deposit and the slopes of steam-shovel levels near the northerly limit of the orebody, also containing a high percentage of iron as compared with the average of the reserves so far developed.

The average cost per pound of net copper produced for the year, after making allowances for smelter deductions and applying credits for gold and silver recovered, but without crediting miscellaneous income, was 9.024c., as compared with 7.8655c. for the year 1911. This increase in cost was due partly to the lower grade of ore treated, accompanied by correspondingly lower recovery, but mainly to increased expenses during the period when we were forced by labor conditions to operate irregularly, and at only part capacity.

If the miscellaneous income in Utah, including that from the Bingham & Garfield railway, amounting to 0.243c. per lb. were credited to the cost of production, the net cost per pound for the year would be 8.781c. If, however, the total net earnings of the Bingham & Garfield railway, in addition to other miscellaneous income in Utah, were used in this way, the amount would be 0.565c. per lb., and the cost per pound for the year, reduced by this amount, would have been 8.459c. These costs include all expense of smelting, transportation of the blister copper to the refinery, refining, and selling. The net value of the gold and silver recovered amounted to 0.957c. per lb., as compared to 1.07c. for 1911. For the months of July and August, those being the first ones in the history of our operations in which we approximated full capacity, having averaged 19,616 tons per day of ore containing 1.4196% copper, we produced not quite 22,000,000 lb. of copper, net at a cost per pound without the application of any credits for miscellaneous or railroad earnings, of 7.61 cents.

Total Cost

The average total cost for the year of mining and milling, exclusive of transportation charges, was 83.91c. per ton, as compared with 86.47c. for the year 1911, and 87.6c. for the year 1910. There is included in this cost a charge of 4.51c. per ton to cover the cost of churn-drill and underground development, as well as a fixed charge of 7.5c. per ton for the retirement of stripping expense. The mining and milling costs stated include all of the extraordinary expense incurred as a result of the labor disturbances which seriously affected operations, particularly during the months of September and October. The average cost for the year of mining, transportation, and milling, per dry ton of ore, as compared with the years 1910 and 1911, are as follows:

Year.	Mining.	Transportation.	Milling.	Total.
1910	$0.4097	$0.2978	$0.4663	$1.1738
1911	0.4479	0.3078	0.4168	1.1725
1912	0.4233	0.2848	0.4158	1.1239

It will be noted from the above that all these costs for the year 1912 show reductions as compared to those of the previous year, notwithstanding the extraordinary expenses and deranged conditions of operations obtaining during the latter part of the year. The decrease in cost of transportation of ore from the mines to the mills was due to a contract provision that became effective early in the year, by which the freight rate was reduced 2.5c. per ton.

Future Reduction in Costs

A further decrease in milling costs will accompany increasing tonnage, and the mining cost will be lower when conditions are such that the entire tonnage can be obtained from surface operations with steam-shovels. Reductions will also result in costs of both mining and milling in the future from the use of hydro-electric power, under a 25-year contract entered into with the Utah Power & Light Co. during the year. The terms and conditions of the contract are such that we not only procure our power cheaper than we are able to produce it ourselves, but we are protected as to character of service in such a way as to insure fully as great reliability from this source as that afforded by our own steam plant.

Pig iron production in the United States during April was 2,754,353 tons, equal to 91,812 tons per day.

Graphical Determination of Dip and Strike

By R. Clyde Cameron

The usual method of taking observations upon the dip and strike of a vein, and calculating or plotting of probable underground sections, is often about as satisfactory as a topographical map would be with the elevations plotted, but without contour lines. Any scheme, which will present a picture of the form and elevation of a vein, that can be comprehended almost at a glance, has many advantages over a collection of elevations. Nothing seems to accomplish this purpose better than contour lines.

Finding the dip and strike of a vein graphically, with the elevations of the projected points shown by contour lines, is not only a clear presentation of the probable location of the vein, but is also a more accurate determination of its dip than could otherwise be obtained. The projected points in Fig. 2 may seem unreasonably far, but the dependence that can be put upon the direction and continuation of a vein beyond accessible points, rests largely upon the geological character of the country. Although the projection of a vein is not to be considered too seriously in any event, yet its apparent position from known data is evidence upon which to plan development work.

A plane passing through an uneven surface will cut the latter in an uneven line; the course of this line being dependent upon the contour of the surface and the angle of the cutting plane. Therefore, the angle of the plane can be determined by the course of this line of intersection, by reason of the fact that three points not in a straight line will determine a plane. Similarly, the course of the outcrop of a vein along an uneven surface determines the dip and strike of the vein. The accuracy is greatly increased if there are shafts and workings to permit underground observations. When there are no workings on the vein, points should be selected at the greatest extremes, as in the bottoms of gulches and on the crests of ridges.

Fig. 1 is a hypothetical case showing an outcrop over uneven ground. The points *a*, *b*, *c*, etc., are located from field notes and projected to their proper elevations, *a′*, *b′*, *c′*, etc., in a vertical plane. A straight line is now drawn connecting *a* and *c*. Another straight line, *bh*, is drawn in a direction approximately at right angles to the strike and intersecting the line *ac*. Since *a*, *b*, *c*, and the line *ac* lie in the same plane, therefore a line drawn from *b* intersecting any point on the line *ac*, also lies in the same plane. Hence *bh* and *bh* extended lie in the same plane, *abc*. The points *a′*, *c′*, are connected with a straight line, and the point of intersection *h* projected to *h′*. Then *b′h′* is drawn and extended. The lines 100, 125, 150, 175 in the front elevation represent horizontal planes. The intersections of the line *b′h′* with these planes are *k* and *l*, which are now projected to *k′* and *l′*, and show the positions on the map at which the vein has elevations of 125 and 100 ft. respectively, provided the vein continues in the same plane as at *abc*. The same process is repeated at *cde* and *efg*, and the elevations determined along the lines *di* and *fj* extended. Points of equal elevation are connected with contour lines, and the dip and strike are thus shown along the entire surveyed course of the vein and at any depth that seems consistent with the points of observation and the supposed regularity of the dip.

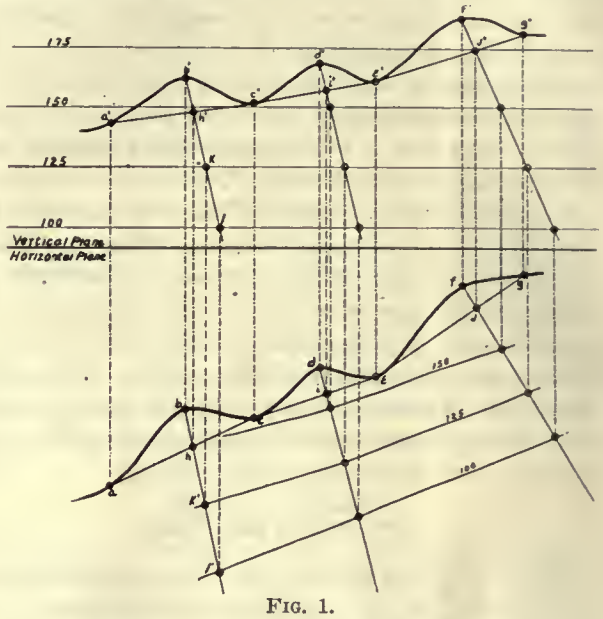


Fig. 1.

Fig. 2 was made two years ago of a vein with considerable variation of dip and strike. Subsequent development work, however, has shown that it very nearly coincides with these contours, which were determined and drawn by this method. The advantages of knowing the shortest distance to a vein and the directions in which the drifts will run, after the vein is reached, and of having these data cover the entire section of interest, can be seen very clearly in this figure. In this case observations were taken in inclined shafts, so that it was necessary to use only two points to produce a line downward

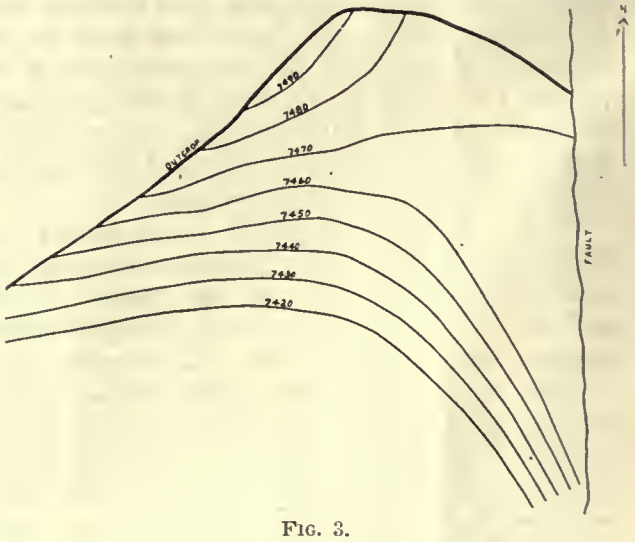


Fig. 3.

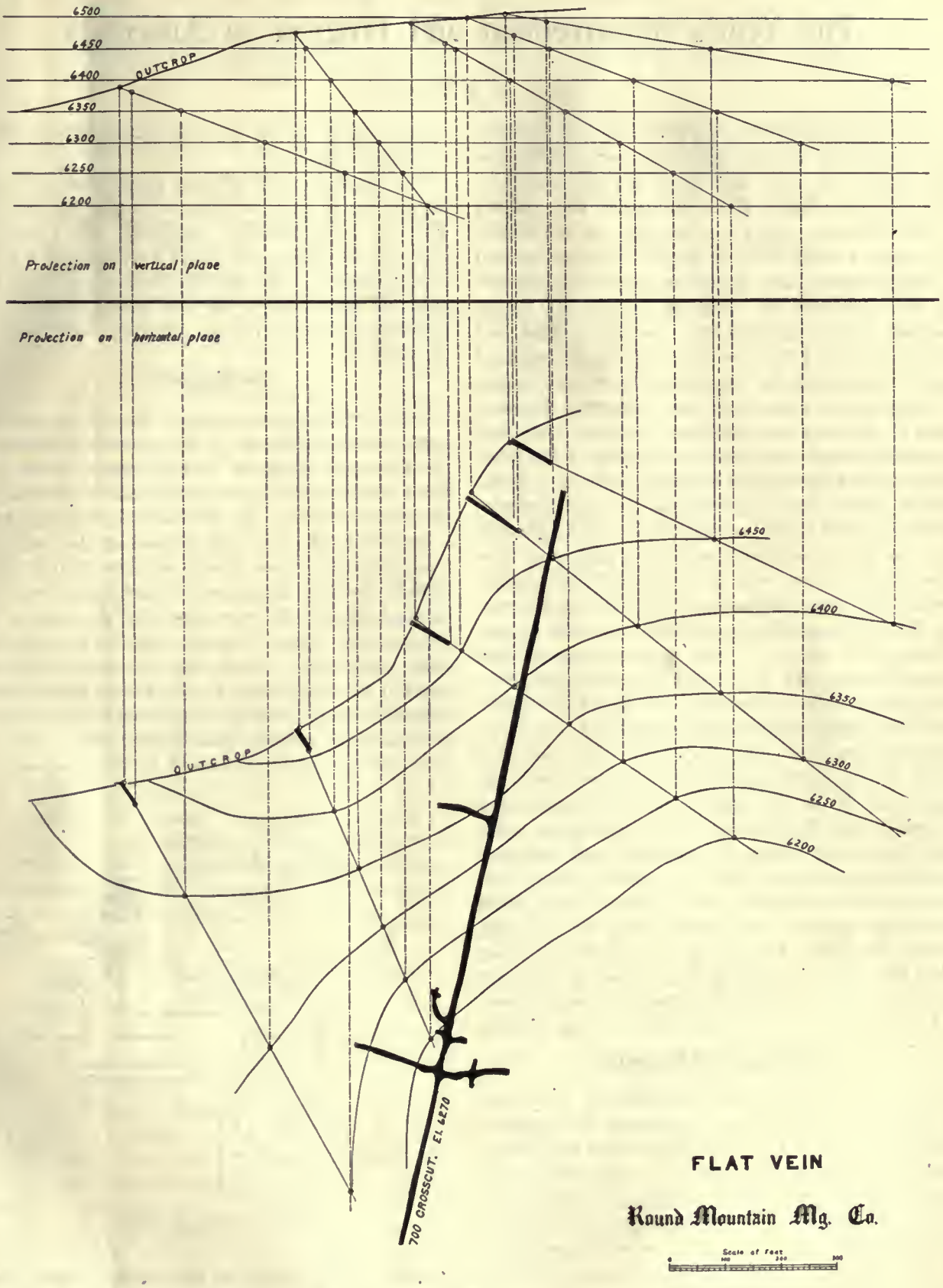


FIG. 2.

through the vein. A point at the collar and one at the bottom of each incline was determined, which correspond to b and h, respectively, in the horizontal plane, and b' and h', respectively, in the vertical plane of Fig. 1.

Fig. 3 was mapped from a Brunton compass survey of a prospect. Construction lines by which the contours were determined have been omitted in this copy; only the results are shown. The outcrop had not been found east of the eastern extremity shown on the map. The decided curves of the contour lines on the eastern side suggested the possibility of a fault, which upon later investigation was found to exist. A considerable displacement had occurred, in which that portion of the section shown on the map had moved to the north, just as indicated by the contour lines. This simple case serves to illustrate the advantages which may be derived, by this method, in working out geology, as well as in planning development work.

The Year's Improvement and Progress at Anaconda

By B. B. Thayer

*The mines and reduction works of the company were operated without any serious interruptions throughout the year, and in consequenee the tonnage of ore hoisted from the mines and treated at the reduction works was greater and the output of eopper correspondingly larger than for several years previous. This condition was made possible by the fact that the weather during the spring and fall of the year 1912 was remarkably mild, and there was but little trouble from the freezing of ore in transit and but few delays in transportation.

Early in the year there was a marked improvement in the priee of copper, and as prices advaneed a general feeling developed on the part of the labor organizations throughout the mining regions of the United States that a partieipation in the greater profits enjoyed by the eompanies should be granted them in the form of an increased wage scale. The Anaeonda eompany was in aecord with this belief, and a three-year eontract was entered into between the Butte Miners' Union and the Anaconda Copper Mining Co., wherein it was mutually agreed that when the monthly priee of electrolytie copper is 15c. and over, but under 17c., the wages of all men employed underground shall be increased 25c. above the minimum wage seale of $3.50 per day; and that when the priee of copper is 17c. and over, the wage scale for underground men shall be increased an additional 25e. per day; the agreement being sueh that the eontract is automatie, and that eorresponding reductions in the inereased wage seale will take place when the priee of copper falls below the figures named. Similar eontraets for the same period, providing for an increase of 25c. per day when the priee of copper is 15e. per pound and over, were entered into with the other different classes of labor. These contracts will expire on June 1, 1915.

Consolidation of Properties

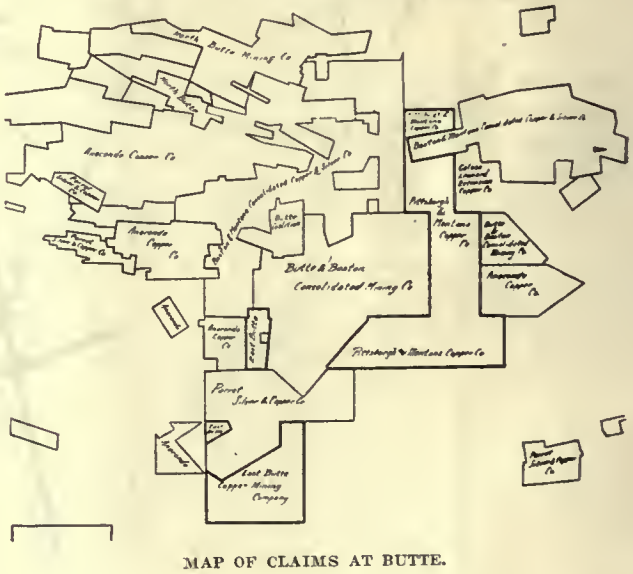
In the year 1910, when the different properties in the Butte district were purehased and consolidated, the attention of the stockholders was drawn to the fact that it was expeeted by the management that one of the economies to be brought about would be the possibility of eliminating property lines so far as underground work was concerned, and that by conneeting the various shafts, the orebodies adjacent to them, regardless of claim boundaries, eould be mined. This was done, and in the future a description of eaeh individual shaft will not be made in the annual report, but the entire property treated as a unit, and only sueh shafts as merit special attention on account of unusual development will be mentioned. Twenty-two shafts were operated during the year, through whieh the ore was hoisted.

There was done during the year, in the form of drifts, eross-euts, raises, winzes, and shafts, 34.1 miles of development work, and a large tonnage of ore in exeess of the amount extraeted was added to the ore reserve.

The shafts of the different properties were sunk during the year to additional depths aggregating 4736 ft. The Modoc, Anaconda, St. Lawrence, Steward, and Tramway shafts were sunk to a depth eorresponding to the 2800-ft. level of the High Ore mine, at which depth the new drainage adits eonnecting all mines with the High Ore shaft will be established.

Development

The developments generally have been satisfaetory, but especially so in the ground tributary to the Leonard, Tramway, Badger State, West Gray Rock, Originial, Steward, and Gagnon shafts. On the bottom level of the last three mentioned shafts a continuous shoot of ore of good grade and width was developed for a length of over 2800 ft. The 2000-ft. level of the Leonard shaft was partly developed during the year, and the showing at the deepest point thus far reached in the property was most gratifying. While the Tramway shaft has reached a depth of 2400 ft., the lowest lateral development is on the 2200-ft. level, where a fine body of ore, in width greater than on the level above and of equal grade, was disclosed by the cross-cut.


Butte & Boston Consolidated Mining Co.
Anaconda Copper Co.
Pittsburg & Montana Copper Co.
Parrot Silver & Copper Co.
Lost Butte Copper Mining Company

MAP OF CLAIMS AT BUTTE.

An auxiliary shaft to the Badger State mine, known as the Emily shaft, situated on the Emily elaim, whieh had originally been sunk to a depth of 400 ft., was sunk an additional depth of 517 ft. during the year, and connection made with the 1000-ft. level of the Badger State mine. Development work has been done on the 1100, 1300, 1400, 1600, and 1800-ft. levels of the Badger State mine, with very gratifying results. The mine made an average daily output of 550 tons of ore throughout the year. Sinking in the main shaft below the 1800-ft. level was started on December 19. The West Gray Rock shaft was sunk to the 1600-ft. level dur-

*From report of Anaconda Copper M. Co. for 1912.

ing the year, and while the veins found in this territory are smaller than in some of the other mines, the results of development at the greatest depth yet attained in this property were most satisfactory.

On December 10 a fire was discovered in the stopes above the 1700-ft. level of the Steward mine, but was extinguished with comparatively little loss. Many years ago, the ground adjacent to the Moose shaft, lying in a westerly direction from the Badger State mine, was worked to a depth of 500 ft., with fair success, for ores carrying silver only. During the year 1913 it is proposed to start sinking the Moose shaft to a depth of 1800 ft. and to prospect the veins at greater depth. This shaft can also eventually be connected with the Badger State workings and will be of great assistance in perfecting ventilation. On August 29, surface work was started on the Tropic shaft, situated on one of the most easterly properties of the Anaconda company, preparatory to sinking the shaft 200 ft. below the 500-ft. level, its present depth, at which depth a body of ore is known to exist.

The Southern Cross mine is about 20 miles from the City of Anaconda. Mention of the purchase of this property by the Anaconda Copper Mining Co. was made in the last annual report. Prior to the purchase by the company, the mine had been developed through a two-compartment shaft to a depth of 300 ft., and during the year a third compartment was added to this shaft. Sinking was resumed and the shaft will be sunk to the 500-ft. level. The mine is being equipped with a new hoisting engine and ore-bins, and regular shipments of ore will be made to the Washoe smelter at Anaconda in the year 1913. While the ore from this property contains practically no copper, it has a fair gold content, and is, in addition, a valuable aid to smelting operations at Anaconda.

Use of Compressed Air

The work of installing the new cylinders on various hoists, preparatory to using compressed air, electrically developed, for hoisting purposes, was carried on continuously, and the main hoisting engines at the Diamond, High Ore, Original, Tramway, West Gray Rock, Mountain View, Pennsylvania, and Leonard shafts were operated by compressed air, and in addition the auxiliary engines at the Green Mountain, Diamond, and Tramway shafts were erected. The main engines for the West Steward, Modoc, Mountain View air shaft, Berkeley, Badger State, and West Colusa shafts, and the auxiliary hoists for the Leonard, West Colusa, Pennsylvania, Anaconda, and Mountain View shafts, are now on the ground, and will be erected as rapidly as possible.

The engineers in charge of this work are satisfied that the new method of hoisting is resulting in large economies; but it will be impossible to determine the comparative savings until the system shall have been completed and the use of boiler plants discontinued. Much greater progress could be made in installing the hoists were it not for the fact that considerable inconvenience is occasioned when more than two of the large producing shafts are out of commission at the same time.

The full installation of electric pumps at the High Ore shaft was completed, and the results were absolutely satisfactory, for in addition to the economies effected, the fact that no heat is introduced into the underground workings is an item worthy of serious consideration. Electric haulage is being installed generally in all the mines, with marked success.

System of Ventilation

A system of ventilation is being perfected generally throughout the different properties, by the introduction of fresh air carried into the mines through shafts independent of the main working shafts, and by the installation of large exhaust fans at different other shafts, by which the heated air is drawn in large volume to the surface. During the year a thorough investigation of underground sanitary conditions was made by a specially appointed commission of scientific men, whose report was most favorable, and everything is being done not only to maintain this condition but to better it if possible.

The mines produced during the year 4,576,289.24 tons of ore and 3667.51 tons of copper precipitate; a total of 4,579,956.75 tons.

The reduction works treated for all companies, during the year, 3,880,203.37 dry tons of ore and other cupriferous material at Anaconda, and 1,189,039.10 dry tons of ore and other cupriferous material at Great Falls. Of this, 4,486,872.98 tons of ore from company mines, 581,031.97 tons of purchased ore, and 1337.52 tons of precipitate and cleanings from the old works were treated, from which there was produced 222,763,670 lb. of fine copper, 9,702,604.52 oz. of silver, and 52,563.891 oz. of gold at Anaconda; and 71,710,491 lb. of fine copper, 1,312,132.45 oz. of silver, and 8750.576 oz. of gold at Great Falls; or a total production of 294,474,161 lb. of fine copper, 11,014,736.97 oz. of silver, and 61,314.467 oz. of gold.

In the year 1910, concentrating tests were started at the Washoe plant with a centrifugal machine on a small scale, the results of which indicated great possibilities. At a later period a large working unit was constructed, which, however, on account of mechanical defects, was incapable of doing the work satisfactorily, and a new machine embodying many improvements was built. This has been operated during the year, together with the original unit in which the defects had been partly remedied, and while the results would indicate that upon certain classes of material the operation of the machine is satisfactory, there is still a doubt as to whether for every-day practice some one of the other machines tested might not be of equal service. In order to make a definite determination, a test will be made in the near future, operating both machines upon the slime material as it comes from the mill.

In the last annual report it was stated that it was the intention to remodel one unit of the concentrator at the Washoe plant, installing in place of the old system of concentration the one evolved

at Great Falls, whereby it was expected that not only would the tonnage treated be increased, but also a material saving would be effected. This was done, and the results, based upon three months' continuous operation of the remodeled unit, proved it to be an absolute success.

Experimental Work

A great amount of experimental work has been done during the year, embracing the testing of many concentrating machines, with varying success, and also a process for the reduction of slime and tailing, which promises well. The process will be tested on a larger scale as soon as possible, and should it prove successful, a complete installation will be made, which will mean not only a reduction in costs, but a very marked increase in output of refined copper from the same tonnage of original ore treated. The process referred to has been perfected by employees of the company in the laboratories and works. There is available at the Washoe plant many millions of tons of tailing, the accumulation of many years of operation, all of which would be amenable to profitable treatment by the process, should it prove successful. Everything in connection with the Washoe plant is in excellent condition.

The Great Falls smelter was built in the year 1889, and notwithstanding the fact that improvements were made from time to time, the plant became somewhat antiquated, and the condition of the buildings was such that it was deemed advisable to erect a new smelter, with the exception of the blast-furnace department, rather than to attempt to repair the old one. Preparations were made during the year for the new steel structure, and the erection of the same will begin in the early part of the year 1913. It is planned to use the stack and flues which were built several years ago, and no changes will be made in the electrolytic refinery.

The greatest improvement made during the year was in the converting department, where a radical change was made in the size of the converter shells. The 12-ft. cylindrical converter, known as the 'Great Falls type,' from which excellent results were obtained, and which has been adopted by many other smelters, was supplanted by a converter cylindrical in shape and 20 ft. in diameter, which has been tested out thoroughly over a period of several months and found to give most excellent results. The new smelter will be equipped with converters of this type.

Coal Mines

The coal mines at Belt, which have been in operation over a long period of years, have reached such a depth that the mining of coal cannot be carried on under economical conditions, and it is probable that this property will be closed during the year 1913. An ample supply of coal for all needs can be furnished from the mines at Diamondville and Washoe, and from independent producers in Montana. The mines at Belt, Montana, produced 82,653.95 tons of coal; 62,998.25 tons was shipped to other departments of the company, 114.15 tons was sold commercially, and 19,541.55 tons was used at the coal mines. The mines at Diamondville, Wyoming, produced 624,477.04 tons of coal; 340,274.65 tons was shipped to other departments of the company, 231,179.44 tons was sold commercially, and 53,022.95 tons was used at the coal mines. The mines at Washoe, Montana, produced 130,683.90 tons of coal; 110,934.70 tons was shipped to other departments of the company, 13,391.20 tons was sold commercially, and 6358 tons was used at the coal mines.

Lumber Mills

For the past four years the lumber business has been in a very depressed condition, and it was considered advisable to curtail the output from the mills to a slight degree until such time as some of the stock of commercial lumber could be disposed of. A marked improvement in general business occurred during the latter part of the year, and conditions generally would tend to indicate continued improvement during the coming year. The mills at all of the plants are in excellent condition, and everything is in preparation to turn out a sufficient amount of lumber to meet the demand. The sawmills of the lumber department at Hamilton, Hope, Bonner, and St. Regis cut during the year 73,541,349 ft. of lumber, and 43,360,629 ft. was purchased, of which 76,621,345 ft. was shipped to the Anaconda mines, 54,189,160 ft. was sold commercially, 1,044,856 ft. was used at the mills for repairs and construction, 5,452,086 ft. was supplied to the factory, and 65,560 ft. was shipped to agencies; or a total disposition of 137,373,007 ft., decreasing the stock of finished lumber on hand by 20,471,029 ft. The subsidiary departments of the company show for the year profits of $308,346.22.

Railway Lines

Good progress was made during the year in the electrification of the Butte, Anaconda & Pacific railway from the mines at Butte to the reduction works at Anaconda, and the road should be in full operation some time during the year 1913. On November 1, 1912, the Georgetown extension of the Butte, Anaconda & Pacific railway was completed. Steam locomotives will be used in operating this extension, as it is not considered that there will be a sufficient volume of business to warrant electrification, at least for the present. The railway transported during the year 5,715,540 tons of ore and freight, and 265,829 passengers. The gross earnings were $1,259,170.43, and rental of tracks and miscellaneous receipts, $22,135.66; operating expenses, $1,090,703; taxes, interest, and rental on leased lines, $86,169.85; net income, $104,432.74. A dividend of $30,000 was paid, leaving a surplus profit for the year of $74,432.74. The company also declared a stock dividend of $1,500,000.

Gold production from 53 Rand mines in February was as follows:

Ore treated, tons	1,994,600
Gold recovered	$14,321,180
Total cost per ton milled	4.38
Working profit	2.34

Hydro-Electric Power-Plant for the Waihi Mine

*In New Zealand, the Government keeps a close watch on all important water-powers available. The Waihi Gold Mining Co. has obtained a concession for 42 years, at an annual rental of $5700, to utilize 10,000 hp. at the Hora Hora falls, on the Waikato river, 51 miles from the mine. So far, about $700,000 has been spent in constructing the plant and transmission lines, as described recently in the company's annual report by W. P. Gauvain, the chief engineer. The wires cross some rough mountain ranges on their way to the 200-stamp mill at Waikino, and the 90-stamp mill and mine plant at Waihi. The Waihi company will supply power to other mines and towns in the district if they require it.

The Power Station

The plant at the power-house consists of six 1500-hp. turbines, operating under a head of from 24 to 26 ft. Each turbine is direct coupled to a 3-phase alternator, generating current at 5000 volts. with a frequency of 50 cycles. The speed of these sets is 187 r.p.m. Current is taken by two 3-core armored cables from the power-house up to the transformer house, which is situated on rising ground above the former, and is here transformed from 5000 up to 50,000 volts. The transformer plant consists of six single-phase transformers, with necessary oil switches and lightning arrester gear. The transformer house is a ferro-concrete building with steel roof. Adjoining this building are the workshops and oil-boiling shop.

From Hora Hora to Waiorongamai, a distance of about 32½ miles, the line runs for the greater part of the way along the roadside. It consists of three copper wires carried on steel towers, which are spaced approximately eleven to the mile. In accordance with government regulations, the lowest wire has to be kept 24 ft. from the ground. The telephone wires (metallic circuit) are carried on the same towers, and below the power wires, and are transposed at every pole. At Stanley Bridge, 23 miles from Hora Hora, a halfway station is to be erected containing disconnecting switches. From Waiorongamai, the line runs for a distance of about 5½ miles over the Te Aroha ranges, rising to a height of 2500 ft. above sea-level. The whole of this ground is of an extremely rough character. Special towers and insulators have been ordered for this portion of the route, the maximum spans being 1200 ft. The line then runs through rough country for a distance of 6½ miles to the Waikino transformer.

The Waikino transformer station is practically a duplicate of that at Hora Hora, the current being transformed down from the line voltage, 46,000, to 11,000 volts. At this latter pressure current is sent to the Waihi mine, some 5½ miles distant. There are also in the transformer house three 3-phase transformers, receiving current at 11,000 and stepping down to 500 volts. Some 25 motors are being installed at this mill, all of them being operated from the 500-volt circuit. The mine transformer-station contains four 500-kw. 3-phase transformers receiving current at a pressure of 11,000 volts, and transforming down to 2000 volts, at which latter pressure the motors receive current. The motors installed here will be utilized for hoisting, pumping, air-compressors, ventilation, and lighting.

Waihi company's 200-stamp mill, sand, slime, and concentrate treatment plants at Waikino, 6 miles from the mine. Power used is water, steam, gas, and electric. Transmission lines from the hydro-electric plant cross the hills at the right. The highest peak showing is Mt. Te Aroha, 3120 ft. Ohinemuri river in the foreground. This is used for water power and as a 'sludge-channel' for residue from all mills in the Waihi-Waitekauri-Karan-Gahake districts.

Progress During 1912

During the year good progress has been made at Hora Hora, but considerable delay has occured on the transmission line and distribution work owing to the strike of miners referred to in this journal during the past nine months. The six 1500-hp. turbines and governors are erected complete and ready for work. The six generators with their exciters are finished, and the cable work up to the switchboard is now under way. The work on the switchboard was to be finished by the beginning of March 1913. The transformer house, workshops, and oil-boiling shop are finished, and the erection of the extra high-tension work is in hand. It was hoped that it will be possible to give a trial run to the plant at Hora Hora during the month of May of the current year.

*From annual report of the Waihi G. M. Company.

Mining the Prince Consolidated Ores

By D. W. Jessup

*In mining the large orebody a shrinkage system is employed similar to that in use in some of the large porphyry copper deposits. The orebody is divided into pillars and stopes, usually of equal width. A stope is started and the roof advanced upward, the drilling being done from the top of the broken ore. The ore is drawn out in such amounts that there is always sufficient space for the machine man. The pillars are removed later. The advantages of this system of mining lie in the low cost of mining and the constant available supply of ore. No timber is used except for the chutes and manways.

The large orebody is being mined at present by two stopes, known as the East and West stopes. Between them lies the core of silicious ore that serves as a pillar. This will be withdrawn later. The stoping is begun by sending up raises from the bottom level. Next a horizontal slice is taken out to the width of the stope and the roof is advanced upward by drilling and blasting, keeping it well arched and trimmed so that no semi-detached or loose slabs of rocks will fall. As fast as the ore is broken it is drawn from the chutes below, always leaving enough in the stope so that the machine man is able to drill. This open space is about seven feet high. The drilling is continued until the capping is reached, then the broken ore is withdrawn as fast as the pillars are extracted. Of the broken ore one-third is drawn and the two-thirds remaining is withdrawn with the pillar, or it may be withdrawn when the stope is finished.

Method of Working

The roof or back stands exceptionally well because of the presence of a small amount of magnesium carbonate in the ore. This hardens on exposure to the air and reinforcing the roof reduces the danger of falling slabs. The ground is exceptionally good for drilling and breaks with but little powder. Drilling is done with hammer-drills or stopers of the Waugh and Cochise makes, and are used with an air pressure of 70 lb. The holes have a depth of 5 to 7 ft., and are placed 4 ft. apart from collar to collar. Holes of greater depth will pot when blasted, because of the softness of the ore. When blasting, from 2½ to 3 sticks of 30% blasting gelatine are used in each hole. Six machines are employed in stoping. They break about 1000 tons of ore per day, of which 350 tons is drawn from the stopes; the remainder is left in the stopes. One machine per shift will average 20 holes, each 6 ft. deep, and may break 250 tons of ore. In two days three machines broke as much as 4000 tons, and in one and one-third months two machines completed the East stope, the dimensions being 85 ft. long, 35 ft. wide, and 50 ft. high. In this, 14,500 tons of ore was broken. One ton of ore in place will measure 10 cu. ft., and broken will measure 16 cubic feet.

*For description of the orebodies, see 'Ore Deposits of the Prince Consolidated Mines,' *Mining and Scientific Press*, May 24, 1913.

The only timber used is in the chutes and manways. The latter are made from 3 by 12-in. lagging set on edge, forming a hollow square with a 2-in. space left between each lagging, the inside measurements are about 3½ ft. square. Ladders are placed in the manways, access to which is gained from one of the levels. Chutes of two styles are used, those with the vertical posts, and those with the inclined posts and angle-brace. The latter are considered with more favor and will be adopted for the future chutes, as there is no bottom other than the broken ore, and if the ore becomes jammed and blasting is necessary there is no wooden chute bottom to be destroyed. With the vertical posts the wooden bottom is used. Fig. 1 illustrates a chute with the inclined posts. The latter are doubled, as are the angle-braces, and are made from 8 by 8 or 10 by 10-in. timbers with 3 by 12-in. lagging.

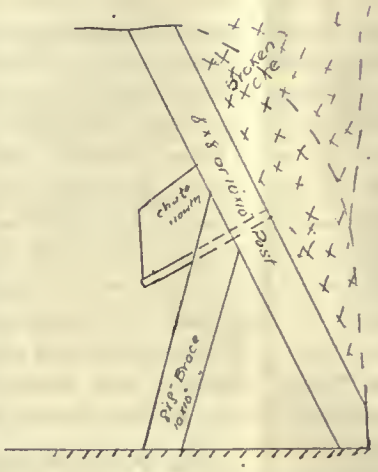


Fig. 1. Cross-section of chute.

The main drift and the cross-cuts or laterals under the main ore-bed, on the third level, are shown in Fig. 2. The drift parallels the direction of the bed, and at a distance of every 30 ft. the laterals are run at right angles to the drift, extending from one wall to the other. On the west side of the drift the laterals are about four feet in advance of those on the east side, the object being convenience in track switches and tramming. In each lateral, chutes are placed at a distance of 20 ft. apart. They are 7 ft. high and 5 ft. wide. From the chutes the ore is run into cars and trammed to the shaft by hand. The cars have a capacity of 16 cu. ft., or one ton of broken ore. Fig. 3 illustrates a vertical section of a lateral and the chutes. From each chute

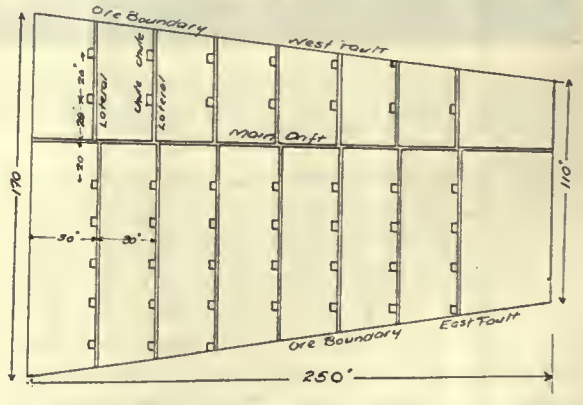


Fig. 2. Main drift, laterals, and chutes on the third level.

the ground is sloped upward at an angle of 45° until it reaches the wall or the slope from the neighboring chute, thus forming a series of adjoining funnels or hoppers through which the ore runs into the chutes.

Both the East and West stopes will soon be completed and in a short time a new stope will be in progress. This will be at right angles to the present stopes and will cut across the ore-bed. It will be

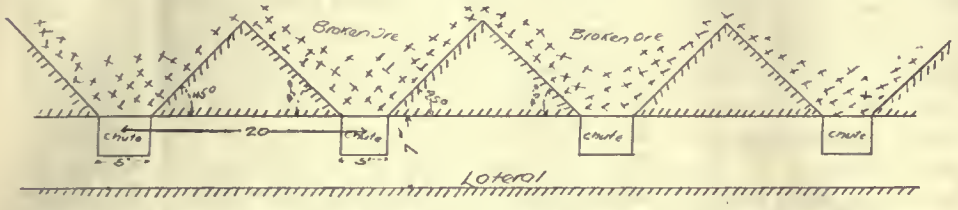


FIG. 3. SECTION OF STOPE BOTTOM, SHOWING CHUTES AND LATERAL, THIRD LEVEL.

170 ft. long, 30 ft. wide, and 150 ft. high, and will contain 75,000 tons of ore. The West stope is 200 ft. long, 30 ft. wide, and 60 ft. high.

Mining the Smaller Ore-Bed

The second or 18-ft. ore-bed has not been mined to a great extent. Four small stopes about 20 ft. wide, 40 ft. long, and 18 ft. high have been opened, more in the nature of development than production. The method of mining is by the room and pillar system. A drift from the main level is run to the wall or to the desired length. It is then extended laterally or 'side swiped' to the desired width, keeping the roof well arched and advancing it until it reaches the shale above. At present the ore is shoveled into cars and trammed to the shaft, and there is always sufficient ore left so that the machine man will be able to reach the roof with his drill from the top of the muck pile. Further extraction of the ore and pillars will follow later.

The 5-ft. ore-bed will be mined extensively. It is of a higher grade, as is usually the case with the smaller beds. It has been prospected for a length of 600 ft. and a width of 300 ft. In stoping, the backfill method is used. The ore is drilled by machines, the holes stopping about 18 in. from the roof of shale, so that when blasting, the ore will break just to the roof and not bring down a large amount of waste. The small amount of waste that is mixed with the ore is sorted out by hand. A T-piece or a head-board and stull are used as a support for the roof. They are easily put in place and many are taken down again for further use. They are spaced about five feet apart. As the ore is mined, the top or roof is allowed to cave and fill the stope, there being no object in keeping it open. The beds dip 17° to the southeast and the main drifts will be to the south. Stoping will then begin and a small gravity system will be installed for the handling of the ore. A 5-ft. sheave-wheel, with brake blocks, and two smaller sheaves will be placed. A small wire cable passes around the sheaves and will operate two skips, one of which when loaded with ore and moving downward will pull back the empty skip. This system can be changed as desired. The ropes are 25 ft. apart and the stopes are 50 ft. wide. This makes a maximum throw of 12½ ft. for the shoveler. At present three 2¼-in. machine-drills are being used in stoping.

Mining in the Fissures

The two fissures vary in width from 6 in. to 4½ ft., and are mined by the filling system. Drifts have been made through the fissures and timbered with 8 by 8-in. drift sets. From these drifts, manways and chutes will be started at desired points. The ore will then be mined, and dropping into chutes, leaving the waste in the fissure. This avoids the necessity of timbers for support of the walls, and no timber will be used except for an occasional stull and for the manways and chutes. If there is insufficient waste from the vein-matter to be used as a fill, then the walls will be used as a source of supply and filling carried up as fast as the ore is extracted. There is no regularity as to the distance between the chutes. This will depend upon the regularity of the ore-shoots and their character. The drifts will connect with the shaft and will be used as haulage-ways. At present single-jack work is being done, as it is better adapted to clean mining.

Shaft and Levels

The underground workings consist of an inclined shaft, six levels with various drifts and cross-cuts, two stopes in the large ore-bed, the stopes in the smaller ore-beds, and the fissure veins. The shaft is 550 ft. in depth, with a pitch of 64° to the west. It contains but the one compartment. A two-ton skip handles the ore, using a ⅞-in. cable. The skip runs on a track of 3-ft. tread, with 16-lb. rails. When hoisting men, the ore skip is removed and a man skip, holding 10 men, is substituted. The shaft is timbered only a portion of the way; 8 by 8-in. and 10 by 10-in. timbers are used; the inside clearance is 4½ by 7½ ft. Three levels are in the main ore-bed, the ore being trammed from the third level, a depth of 240 ft. and at the bottom of the bed. The remaining three levels are in the lower ore-beds. Each haulage-level contains ore-pockets at the shaft having a capacity of about 70 tons each. At the shaft the levels are in the shale, and as the ore-beds dip downward, these levels intersect the beds at the desired points. No timber is needed in the drifts except in one that encountered an old watercourse, where a few sets were necessary. No waste is handled except that taken out in driving the levels or drifts through the shale. The drifts are 7 by 7 ft., and the cross-cuts are 6½ by 7 ft. in cross-section.

Handling and Transportation of the Ore

From the ore-pockets at the various levels the ore is loaded into the two-ton skip, hoisted to the surface, and dumped into an open hopper placed in the head-frame. Underneath the hopper is the ore-car in which the ore falls, and the car or cars are then hauled by a mule to the ore-bins and dumped, a distance of about 400 ft. These surface cars are

side dumping and have a capacity of three tons each. The ore-bins are of the flat-bottomed type, which affords a greater capacity than those with the sloping bottom. They will hold 600 tons.

From the bins the ore is loaded directly into railroad cars and is taken to Pioche, where the line connects with the San Pedro railroad. The latter road carries the ore to the smelters in the vicinity of Salt Lake City, the distances varying from 350 to 400 miles. The bulk of the ore goes to the International Smelting & Refining Co. at Tooele, Utah, and the remainder to the United States Smelting company, Midvale, Utah, and the Garfield Smelting Co., Garfield, Utah. The railroad connecting the mine with Pioche is owned and operated by the Prince Con. Mining Co. It is of standard gauge, nine miles in length, and was completed June 30, 1912, requiring five months to build and costing $120,000. The company owns the locomotive, which is of the oil-burner type, and the ore-cars are supplied by the San Pedro railroad. There are no ore-bins at Pioche, the transfer being made direct from one railroad to the other.

Surface Equipment

All of the mechanical equipment is operated by gasoline engines or by compressors driven by gasoline engines. The engine-room and hoisting plant are equipped with a 50-hp. gasoline hoisting engine of the Fairbanks-Morse manufacture, also a 100-hp. air-hoist operated by a 100-hp. gasoline engine of the same manufacture. The air-hoist is not in use at the present time owing to its large consumption of air. As most of the air is necessary for drilling underground, the gasoline hoist is used. The air-compressor is of the Ingersoll-Rand manufacture and is a one-stage, two-cylinder type, with a capacity of 700 cu. ft. per minute at an air-pressure of 70 lb. The engine-room also contains a machine lathe. A water-condensing tower is built at the rear of the building, which condenses the water used in cooling the engines and compressor. The blacksmith-shop is not equipped with a drill-sharpener, and for the present the steel is sharpened by hand. The main office, assay office, boarding-house, several small bunk-houses, eight dwelling houses, and a round-house constitute the remaining buildings. Water is piped from the Pioche main, tapping it 1½ miles distant with a 1¼-in. pipe-line. From this line the water is distributed by laterals to the various mine buildings. A water-tank of large capacity is being erected and will be used for fire protection. A pressure of 250 lb. is obtained.

Labor and Costs

The labor employed is of many nationalities. At present 45 men are employed underground, and 45 men on the surface. About 20 of the surface men are engaged in construction work and will be discharged in a short time, as this work will be finished. Per shift of eight hours, the machine men receive $3.50, the shovelers and carmen $3, the timbermen and helpers $3.50 and $3, and the hammer men $3.25. The men board or live at the mine. The ore in the stopes is being broken at a cost of 21c. per ton, this cost including the broken ore that is not drawn from the stopes. The total cost per ton of ore is $1.25. This cost includes every expense in connection with the mining of the ore and the transportation to Pioche. With a reduction of the surface force and extra labor, this cost will be reduced to 75c. per ton. About 350 tons of ore per day is the present production, and this can be greatly increased with but little effort.

The company also owns two dumps of low-grade tailing that are the refuse from former stamp and amalgamation plants. They have been reworked several times, but still contain a sufficient metal to ship to the smelters, and net close to $3 per ton. The principal dump is at Bullionville, about 10 miles below the mine and on the main railroad line. The tailing is loaded into the cars by means of a dredge, at a cost of 10c. per ton, reducing the former cost of 35c. by hand labor. The dump contained about 150,000 tons of tailing, of which about 50,000 tons has been shipped. The other dump is in Dry Lake valley, about two miles from Bullionville, and can be reached by a spur built at a low cost. It contains about 60,000 tons of tailing, and can be loaded into cars at the same rate as the first dump.

Future Developments

Sinking will soon begin on a new 3-compartment vertical shaft about 500 ft. south of the present inclined shaft, and in the country rock. The ore-pockets at the stations will have a capacity of 250 tons each. The main levels or drifts below the 400-ft. level will be in the waste, and only the lateral cross-cuts will extend into the ore. This will eliminate all danger of caving of the drift and will provide an open and safe passage for the transportation of the ore and for the men. The drifts in the ore above the 400-ft. level will remain as haulage-ways, as they are already in place. A new engine-house and a full mechanical equipment for hoisting will be installed.

No pillars of ore have as yet been robbed, but preparations are being made for this work. Vertical raises will be put up in the centre of the pillars, about 25 ft. apart, and extending up to the capping. If the capping fails to stand, then a top slice will be removed and a mat of timbers substituted—the method as practised at Miami. The timber mat and surface material will then be allowed to follow the ore as it is drawn from the stopes. The mat will prevent the waste from coming in contact with the ore and will always rest on top of the slice as it is extracted. If the capping remains intact, as will probably be the case, the pillars will be removed in horizontal slices. From the raises in the pillars, a series of cross-cuts to the stopes on each side will be made, about 18 ft. apart in a vertical height. As the ore in the stopes is withdrawn, consecutive slices will be drilled, blasted, and drawn out with the ore from the stopes. This method will prove more satisfactory than removing the bottom slice of the pillar and allowing the pillar to crush in by its own weight.

The block of ground in the 300 ft. between the end-line and the new stope to be started will be mined by the same shrinkage system; there

will be five stopes, each 30 ft. wide and separated by pillars of the same width. The lengths will be from 170 to over 200 ft., and the depth about 180 feet.

Ore from the mine has been shipped only for six months of the past year, but in connection with a large tonnage of tailing, the smelter returns amounted to approximately $632,236, and netted a profit of over $230,000. Sufficient iron-manganese ore has been blocked out so that 500 tons per day could be shipped for five years, or about 1,750,000 tons. There is a large tonnage of ore blocked out in the fissures that will average over $30 per ton, also about 160,000 tons of tailing. There are good prospects of additional value based on the strength of the fissures in depth. The officials deserve commendation for their openness and hospitality to visiting engineers. They have no information to conceal, and are mining the orebodies with the end in view of improving the methods of ore extraction and developing the property to the best of its possibilities.

Waste of Natural Gas

According to a report by Ralph Arnold and Frederick G. Clapp, issued as Technical Paper 38 by the United States Bureau of Mines, waste in drilling is not so great as formerly, because at the present time drillers have usually every facility at hand to close a well as soon as completed. By proper preparation, most wells can be packed, tubed, and shut in within two hours. According to the conservation commission of Louisiana, the waste from the two principal 'wild' wells in Louisiana had its beginning more from a lack of knowledge of what precautions would be effective than from negligence or indifference. The waste from the first big gas well found in drilling for oil in the Buena Vista Hills field of California was due to the unexpectedness of the great flow and to local inexperience in handling such pressures. This well was controlled only after a Texas operator had been engaged to do the work.

The most notorious waste at present is in Oklahoma, Louisiana, and California. The commission on the conservation of the natural resources in Louisiana, after an exhaustive examination of the situation in the Caddo field, found that the waste approximated 75,000,000 cu. ft. per 24 hours, an amount equal to 20 times what the city of Shreveport uses now in the same space of time, and equal to one-twentieth of the amount consumed by the entire United States. It also found that the value of the gas wasted from a single 'wild' well in that state was in excess of $2000 per day. There were three principal wells in the Caddo field from which the greater part of the waste occurred. They were known locally as the 'dry gas well,' the 'mud gas well,' and the 'salt gas well.' Two of these have been closed by the owners, thus proving that closure is feasible. No attempt has been made to close the other, and when visited by Mr. Clapp in February 1912, it consisted of a crater perhaps an acre in extent, in the centre of which the gas was forcing a geyser-like mass of mud and water to a height of 20 to 30 ft. During much of the time this well is burning. The gas from this well has been going to waste for three years. Two other wells having an estimated volume of 20,000,00 or 30,000,000 cu. ft. per day blew out and burned for one or two years. In the Caddo field at least 400,000,000 cu. ft. of gas has at certain times been wasted daily, practically all the waste being preventable. Mr. McDowell states that the daily waste of gas in Oklahoma by escape into the air is equivalent to at least 10,000 tons of coal daily, and he states that 80% of this loss is preventable.

Determination of SO_3 in Furnace Gases

In the method of Lunge and Reich either the reactions of the gases with the KOH solution and with the iodine solution do not proceed according to the theoretical equation, or the furnace gases contain substances that use up proportionally more iodine than SO_2, or act only upon the iodine solution and not the KOH solution. E. Richter, in *Zeitschrift für angewandte Chemie*, 26, 132-4, holds the view that the reaction between the SO_2 and iodine does not proceed quantitatively, and that the complete absorption of the SO_3 is difficult; there may be, for example, condensation in colder parts of tube before entering the absorbing solution. In a specially devised apparatus, Richter has made a series of experiments on the condensation of the SO_3 from gas mixtures. To insure complete condensation of the quickly cooled (by ice-salt mixture) SO_3, the velocity of the gas mixture passing through the apparatus must be very small (about 1000 c.c. in 20 to 25 min.); to remove all SO_2, pure dry air is aspirated. The SO_3 was dissolved in H_2O, precipitated with $BaCl_2$ and weighed as $BaSO_4$. It was shown that: (1) The soluble exterior of the tubes (no SO_3 used, but pure dry SO_2 passed through, then air, then drying in a current of heated air and a special H_2SO_4 desiccator, without previous washing) contains substances that are precipitated as Ba compounds. The amount of same for the tubes used in the experiments is constant (whether H_2SO_4 or P_2O_5 was used as drying agent) = 0.0005 gm. SO_3. (2) On drawing air for a time through pure concentrated H_2SO_4, an amount of the latter, not to be disregarded, is taken up (0.0019 gm. SO_3 in 20 minutes; velocity, 1000 c.c. in 20 minutes). SO_2, even when mixed with air, has no influence on the amount of SO_3 found (0.0005 gm.). It was shown that the condensation of SO_3 is quantitative and that the method may be used to determine same. Richter used two condensing tubes, but if the velocity does not exceed 1000 c.c. in 20 min., all the SO_3 condenses in the first tube, the second being used as a precaution. The results are reported in detail. The method is recommended for use where a minimum of SO_3 is desired.—(Abstracted for the American Chemical Society by F. W. Smither.)

The world's largest bucket dredge was recently launched at Renfrew, Scotland. It is 309 ft. in length, 47 ft. in breadth, and 20.17 ft. in depth, and is to work at the entrance of the Suez canal.

BIG FOUR MILL AT MANHATTAN, NEVADA.

The Big Four Mill, Manhattan, Nevada

By J. C. KENNEDY

The new mill of the Manhattan Big Four Mining Co., which started work on March 6, was designed by C. D. Wilkinson, engineer for the company, and formerly with the Goldfield Consolidated Mines Co. The main idea in design was to erect a plant with high tonnage capacity, low operating costs, and low first cost of construction, to treat an unusually free-milling ore. The ore is a soft, brown-colored, calcareous schist containing fine gold, which occurs generally along the laminations of the schist and in innumerable small cross-fractures. These fractures are filled with calcite, often silicious, and sometimes entirely replaced by quartz. To the present depth of 500 ft., it is reported that the mine has disclosed no sulphides.

Crushing Plant

The ore is trammed directly from the shaft, over a distance of about 175 ft., in ordinary mine-cars, and dumped into a Chalmers & Williams No. 4 bronze ball, suspended-spindle, McCully gyratory crusher. This has a daily capacity of 270 tons, crushing to 2-in. diam. A crusher larger than necessary at present was chosen, partly to eliminate the expense of an attendant, and partly that an additional 10 stamps could be installed without adding another crusher. The crusher is driven by a 30-hp. motor. The ore then falls into a flat-bottom storage-bin of substantial construction with a capacity of about 240 tons, from which it drops into a delivery box fitted with a scraper, the arm of which is driven by a shaft and eccentric actuated by a small chain-drive from the lower pulley of a conveyor. This is of the Jeffrey type, 34 ft. between centres of pulleys, with a belt 14 in. wide, and set at an angle of about 18°. A 5-hp. motor drives the conveyor, which delivers the ore at the top of a sloping-bottom battery-bin of about 70-ton capacity. This bin delivers ore through the usual rack-and-pinion gates to two improved suspended Challenge feeders. The usual friction disk and toggles of the impulse-wheel are dispensed with, and are replaced by a simple and effective clutch at the back of the wheel. This device is said to have been devised by A. D. Foote, and used by him at the North Star mine, Grass Valley, California; and has not been patented. The feeders deliver to two 5-stamp, narrow, quick-discharge Joshua Hendy mortars. The stamps weigh 1050 lb. each, and were set at starting to drop 6 in. at the rate of 100 drops per minute. The order of drop is 5-1-4-2-3, or, starting at the feed stamp, 3-2-4-1-5. The height of discharge is about 4½ in., and it is understood that no attempt will be made to keep this height approximately uniform by false dies. The chuckblock in use is 5¾ in height. The battery-frame is of the back-knee type, and is fastened rigidly to the base of the battery bin.

Batteries

The stems work in Goldfield guides. This is a heavy shell with inclined sides, cast in two halves, fitting in the heavy cast frame, forming part of the heavy cast cross-bitt bolted to the cross-beams of the battery-frame. Tyler ton-cap, 8-mesh, woven, bronze and steel wire screens are used. Each battery has a separate 6-in. cam shaft with self-locking cams, driven by a back-geared induction motor running at 560 r.p.m. at full load. It is provided with a potential starter for reducing the voltage applied to stator windings, during the starting period. The starter consists of potential transformers for reducing the voltage, and a controller for making necessary changes in connections. Belt tightening is done by sliding the motor on its two rails. The mortars are fastened to the heavy concrete foundation by long heavy bolts extending in a diagonal direction entirely through the foundation. The bottom flanges of mortars are beveled for bolt-heads to a plane at right angles to direction of bolts, so that there is no bending strain on bolts when their nuts are screwed down hard. Both ends of all foundation bolts of mortars, all nuts on bolts holding battery posts to bases, and all other bolts and nuts about battery-frame, mortars, and their foundations are easily accessible. A heavy steel spiral spring of 1-in. thickness, inserted at the foot of bolts between a plate on foundation and a cap plate beneath the nut, takes up jar and vibration, and keeps a constant pressure against the nut. The sleeve-flanges

of bull-wheels, as well as other castings in the mill, are unusually massive.

The pulp from the mortars drops through a collecting box, containing an automatic pipe-sampler, from which pipes convey equally to two 4 by 14-ft. Akins classifiers working at 7 r.p.m. The overflow from classifiers flows by suitable pipes and launders to the amalgamating plates, while the thickened sand underflow drops to a 5 by 54-in. Frenier spiral sand pump. This is the only pump in the mill. Water can be introduced, if desired, into the pump box, and also into sides and bottom of classifiers to dilute the sand. The pump delivers to the spiral feed of two 5 by 18-ft. tube-mills, fitted with El Oro liners and running 28 r.p.m. Pipes are so arranged as to make a closed circuit between classifiers and tube-mills, all sand traveling the circuit until reduced fine enough to pass off in the classifier overflow. Each tube-mill is driven by a 50-hp. motor working at 580 r.p.m. at full load. The power is transmitted to drive shaft of tube-mill by a silent chain, the shaft being connected by a friction clutch. Norway pebbles are used in the mills and are fed in through the manhole. The two classifiers are on each side of the longitudinal axis of the building, and the tube-mills are outside of these, nearer the sides of the building. It will be seen that there are two complete units; and the flow from either battery can be diverted to either tube-mill or classifier at will. The degree of comminution desired by the tube-mills, and the percentage of sand and slime which will pass certain meshes are not known, as no sizing tests from actual work have been made.

Amalgamation Plates

The launders conveying pulp to the plates are made of planed 2-in. lumber, and are provided with stationary and movable fingers, and bottoms to divert the flow as desired. The delivery openings through sides of feed launders are ½ in. square, and may give trouble by clogging. The pulp is distributed at will to all or any of four silver plates, each 4 by 36 ft. The plates are in sections of 5-ft. lengths, each at its lower end overlapping the following one, thus making a short drop equal to the thickness of a plate. The last 6-ft. section of each table is covered by one thickness of burlap. The run-off from plates is collected by launders which unite and deliver to a shallow wooden amalgam-trap of four compartments. From the trap the slime falls to a box containing the well known automatic pipe-sampler, the frequency of taking samples being governed by the jet of clear water entering the triangular actuating box at the end of the pipe. The tables are set rigidly at a slope of 1¾ in. per foot, with no provision for quick change of fall. They have unusually high sides, and this, added to their height above the floor, makes it rather inconvenient for the amalgamator to give effective dressing to the middle line of plates. Plates of such great length are unusual at the present day, the most notable example, perhaps, being at the Homestake mills in South Dakota, and at some of the mills in South Africa. It is understood that, at the Homestake mills, wells or amalgam traps are put in between plates varying from 9 to 15¾ ft. in length, the pulp being thoroughly turned over and mixed before reaching each succeeding plate. It is also said that some plates in these mills are 18 ft. in length. The practice of using long narrow plates, so prevalent in California at an earlier date, is now obsolete. In California, succeeding sections of such plates were often made narrow toward the discharge end, and sometimes even given a steeper grade toward the end. The use of such plates grew up from still earlier practice in sluices used in placer mining. In case of long narrow plates arranged as mentioned, their lower parts simply acted as launders to carry off floured gold, and sickened mercury, along with waste sand. In the Big Four mill, however, it will be noted that all plates are wide, and it would seem by proper manipulation of water that every particle of fine sand or slime passing over these plates should come into contact before being discharged. Water is, of course, provided at the head of the plates for dressings and clean-up, and this can be turned into the supply launders.

Millsite

The site of the mill is an excellent one for continuous movement of material by gravity, and allows of future possible additions. All parts of the mill, especially the amalgamating end of it, are well lighted. There is plenty of room about all machines, and switches and starting-boxes are conveniently placed. All parts of the mill below the crusher and conveyor belt are visible from any point. Water for the mill is furnished by the mine. Intelligent thought has been applied to the conditions at the mine and character of the ore, which has been well expressed in designing the mill. The total horse-power consumed in the mill, with everything running at full loads, is from 160 to 165, and the amount of ore expected to be treated is 100 tons per day.

Anthracite shipments for April amounted to only 5,966,189 tons. The shipments for April 1912 do not afford a fair comparison, as that was the time of a suspension of work due to local disturbances, and only 266,625 tons of coal was shipped. In April 1911 the shipments were 5,804,915 tons, and in 1910 they were 6,224,396 tons. The amount of coal on hand at tidewater shipping ports decreased 225,872 tons from 772,115 tons on March 31, 1913, to 546,243 tons at the close of April. The Philadelphia & Reading railway led last month in anthracite tonnage with 1,180,115 tons, the Lehigh Valley was second with 1,149,896 tons, and the Lackawanna third with 861,078 tons. The Central Railroad of New Jersey carried 738,579 tons, the Erie 672,386 tons, the Pennsylvania 585,472 tons, the Delaware & Hudson 561,700 tons, and the New York, Ontario & Western 216,963 tons.

The slate production of the United States is practically confined to the northeastern part of the country.

Mining in Queensland in 1912

*An advance copy of the annual report of the Under Secretary for Mines, A. R. Macdonald, gives the following information: The value of the year's mineral output was $20,028,200, an increase of $2,500,000 over that of the previous year. The stimulating influence of high prices of industrial metals, and the great advance in copper production, and in a less degree in tin, wolfram, and other minerals, have contributed to the increase in the state's production. Coal-mining has made moderate progress, but prospects for large expansion are exceedingly good. The decline of gold output continues, there being no new fields discovered, and deeper prospecting of existing fields has so far shown nothing of promise. The value of the copper production exceeded that of gold by $1,050,000. On the whole, the year's work was gratifying, and the current year should be better. Dividends paid by mining companies totaled $2,200,000, an increase of $110,000.

The mineral production was as follows:

Name.	Quantity produced, tons.	Value.
Bismuth	6	$ 13,900
Coal	902,166	1,623,400
Copper	23,120	8,200,000
Fireclay	6,336	12,000
Gems	.....	192,000
Gold	.....	7,300,000
Ironstone (flux)	15,526	42,000
Lead	3,108	260,000
Limestone	97,175	115,000
Manganese	308	5,500
Molybdenite	102	80,000
Opal	.....	14,400
Silver	.....	300,000
Tin	3,230	1,600,000
Wolfram	627	270,000
Total		$20,028,200

The Mines Department collected $170,000 in rents, royalties, and fees, and spent a similar amount, exclusive of about $80,000 in loans in aid of deep sinking, aid to prospecting, roads and bridges in mineral districts, and coal-prospecting operations. Several bills of interest to the mining community were passed during the last session of Parliament, including drainage of mines at Charters Towers, issue of licenses to persons in charge of hoists at mines, regulation of coal and oil mining, and the construction of certain railways in the Chillagoe and Cloncurry copper districts. The School of Mines at Charters Towers has been affected by the emigration of miners from that centre, and the general status of the institution raised.

Fatal accidents totaled 32, and there were 322 non-fatal, out of 16,632 employed at mines, mills, and smelters.

Stamp-mills in the state for gold ores contained 2095 stamps, of which 433 worked continuously, 531 part of the year, and 1131 were idle. For tin ores there were 85 stamps in full operation, 150 part of the time, and 115 were idle. A good deal of new machinery was added to existing plants, and the use of large suction-gas engines is a prominent feature, five of a total of 1220 hp. being installed at certain plants. The usual examinations for mine managers' certificates were held. The Geological Survey has been busy examining the Gympie goldfield, the Ipswich coalfield, and other districts. The artesian-water areas and deposits suitable for making portland cement are to be investigated during the current year. The *Mining Journal* maintains its reputation as a reliable exponent of the mining industry of Queensland, and is generally well received throughout the world.

Dealing with individual metal production, the following notes are given: The gold mines at Charters Towers produced $1,950,000 from 136,431 tons of ore, tailing, and concentrate. Interest centred in the district where the Brilliant Deeps company has been opening a rich shoot cut on No. 4 and 5 levels in the main Brilliant formation, at a depth of 2544 and 2609 ft., and also in the Brilliant Blocks has prospected for an extension of this shoot from the Deeps mine. Temperatures are high here, and the Government will assist the companies in this work, as it is the most promising part of the field. No. 15 level, at 2543 ft. depth, in the Mills United, on the Day Dawn 'reef' has been driven 700 ft., and the Brilliant Extended is mining fair ore from 2896-ft. depth on the Brilliant 'reef.' Nothing special is noteworthy from the other mines. Gympie mines treated 125,579 tons, yielding $800,000, of which the Scottish Gympie contributed 86,700 tons, averaging $5.70 per ton.

Prospecting in other mines has been carried down to a depth of 2154 ft., and the Amalgamated Monkland & Glanmire Co. is sinking its shaft below 1190 ft. to prospect for auriferous strata below the Monkland slate beds. Generally speaking.

MAP OF QUEENSLAND.

*Abstract from *Queensland Government Mining Journal.*

the Croydon, Rockhampton, Gladstone, Clermont, Hodgkinson, Mareeba, the Peninsula, and other gold districts attracted a fair amount of attention, but interest is falling off. These produced about $1,100,000 in gold. Mt. Morgan produced gold worth $2,800,000, mainly from smelting its copper ores, the chlorination plant being closed part of the year.

Copper Mines and Transportation

The copper production of the state is increasing, due mostly to the Mt. Elliott and Hampden mines, while when the new plant at Mt. Morgan is completed, a further increase is certain. The Cloncurry district produced 10,435 tons, of which Mt. Elliottt produced 6690 tons from 54,531 tons of ore, also 11,776 oz. gold and 12,014 oz. silver; and the Hampden, 2392 tons copper, 850 oz. gold, and 24,930 oz. silver. Faith in the future of the field is based on exploration of deeper ground.

Railroads under construction will help the district considerably, especially Mt. Cuthbert in the northern section. The Mt. Cuthbert mine has 150,000 tons of 8% and 70,000 tons of 4% copper ore. The Mt. Oxide mine, 160 miles northwest from Cloncurry, is being developed. There are several other mines in this district which are yielding high-grade ore. The problem of Cloncurry is transport. Over 1000 men are employed. In the well known Chillagoe district, a fire has locked up 50,000 tons of ore in the Lady Jane mine, and one furnace of the Chillagoe company is smelting copper ore. Development at Mt. Perry is promising, and has been assisted by the Government. The New Queensland Copper Co. treated 4120 tons of ore yielding 421 tons of copper, 19,566 oz. silver, and 260 oz. gold. The Many Peaks mine, at Gladstone, supplied 100,339 tons of pyrite ore to the Mt. Morgan smelters, yielding 1473 tons copper and 775 oz. gold. In the Rockhampton district, the Great Fitzroy mine produced copper worth $490,000. Development continued during the year, and the plant is now doing better work, after much experimenting. Mt. Morgan produced 7068 tons of copper, and was particularly active, especially in reconstruction of the smelter. Prospecting has been resumed from a winze sunk 100 ft. below the 950-ft. level, and diamond-drilling is to be done from this and the 650-ft. level. The Mt. Morgan Extended has tried hard in its prospecting to find an extension of the Mt. Morgan deposit. Its shaft is down 1630 ft., 1000 ft. below the 950-ft. level of the parent mine, and drilling is to be undertaken.

Silver, Lead, and Tin

In the silver-lead districts, the Mungana, Girofla, and Lady Jane, and others at Chillagoe produced 164,389 oz. silver and 1956 tons of lead, besides some copper, the ores of this section being particularly complex. Other lead came from the Etheridge and Herberton districts.

The greater part of the tin production comes from Herberton, which produced 1927 tons, and where is situated the Vulcan mine, whose shaft is down 1460 ft., and reserves are satisfactory. This mine has produced 11,036 tons of tin to date. The Irvinebank company has also done considerable work. Lode tin-mining in the Herberton field is flourishing. The area south of Cooktown, with plenty of water, is being prospected to a large extent. Dredging at Stanthorpe contributed $60,000 to the total tin output of $100,000.

Herberton produced 432 tons of wolfram, also some bismuth, and with the exhaustion of rich surface ore, work at Wolfram Camp is now dull. A report of the work of the Irvinebank Mining Co. is promised in a future issue of the *Journal*. Queensland has been noted for its gems, and the Anakie field had a good year. The population of this place is 575, and the production was worth $192,000. Coal-mine development, apart from the large output, was distinctly encouraging.

Metal Mining in Utah

The total value of the mine output of gold, silver, copper, lead, and zinc in Utah in 1912, according to advance figures compiled by Victor C. Heikes, of the United States Geological Survey, was $42,922,302, against $36,837,457 in 1911.

The production of gold was valued at $4,265,851, a decrease of $431,147, or 10%, compared with 1911. The largest producer of gold was Juab county, which yielded $1,804,842, against $1,500,359 in 1911. The Tintic district, which is partly in Juab county and partly in Utah county, produced $1,900,732, or 44% of the total output. The Bingham district, in Salt Lake county, ranked first in gold output in 1911, but was second in 1912, when it produced $1,788,730 or about 42% of the total.

The silver production of Utah in 1912 was 13,835,903 fine ounces, valued at $8,509,080, and showed an increase of 1,362,116 oz., or 10%. Juab county produced 6,638,425 oz. in 1912, against 4,673,698 oz. in 1911, and Utah county 531,478 oz. in 1912, against 934,768 oz. in 1911. Salt Lake county produced 2,218,822 oz. in 1912, against 2,947,481 oz. in 1911. The silver output of the Park City region in 1912 was 3,642,749 oz., an increase of 214,098 oz., or about 6%, over that of 1911.

The copper production in 1912 was 137,307,485 lb., valued at $22,655,735, a decrease of 9,653,342 lb., caused largely by the 40-day strike of the miners in the Bingham district. The district produced 116,621,793 lb. of copper in 1912, against 129,995,865 lb. in 1911. The Tintic district yielded 13,339,026 lb. in 1912, against 10,922,154 lb. in 1911, an increase of 2,416,872 lb. The Park City district of Summit and Wasatch counties, produced 1,968,249 lb. in 1912, against 1,281,190 lb. in 1911. Beaver county yielded 3,040,400 lb. in 1912, against 3,739,282 lb. in 1911.

The production of lead in Utah in 1912 was 140,311,135 lb., valued at $6,314,001, against 136,496,750 lb. in 1911. Of the 1912 output, 31% was derived from mines in the Bingham district, which produced 43,822,495 lb., against 46,576,337 lb. in 1911. The Park City district produced 42,111,561 lb. in 1912, or 30% of the total lead output.

The zinc production of Utah was 17,067,177 lb., valued at $1,177,635, in 1912, against 17,840,261 lb.

in 1911. The Park City mining region alone produced 8,001,512 lb. of zinc in 1912, against 8,596,564 lb. in 1911. The yield of this region in 1912 was about 47% of the total zinc production of Utah. The Tintic district was also an important producer, for the first time in the history of the district, and yielded 22% of the zinc, or 3,709,737 lb. in 1912. The Bingham district was a large producer, but its output decreased from 4,715,121 lb. in 1911 to 2,711,982 lb. in 1912.

There were 207 mines producing gold, silver, copper, lead, and zinc in 1912, against 208 in 1911. Of these, 9 were small placers in 1912. The number of producing mines in the Bingham district was 32; Tintic, 40; Big and Little Cottonwood, 15; Park City, 18; and Stockton and Ophir, 26.

The total quantity of ore sold or treated in Utah in 1912 was 7,770,270 short tons, an increase of 501,740 tons. The average total recoverable value per ton was $5.52 in 1912, against $5.07 in 1911. There was an unusually large quantity of old slag and old tailing smelted. These were produced in the early years of mine production. Many of the old waste dumps at the mines were found of sufficient value to be shipped to the smelters. The 'porphyry' copper ores aggregated 6,101,972 tons in 1912, against 5,478,366 tons in 1911. Of the total of all classes of ore, 171,117 tons, mostly from Tooele county (5248 tons of which was from the Bingham district), went to gold and silver mills, and 6,477,567 tons went to concentrating mills, producing 381,358 tons of concentrate, which, with 1,036,268 tons of crude ore, went to smelters. Salt Lake county continues to produce over half of the total metal production by value, chiefly from its copper, having furnished 85% of the total production of that metal and 85% of the total tonnage of ore treated during the year.

North Carolina Metal Mines

North Carolina in 1912 not only retained first rank in the output of gold among the Eastern or Appalachian states, but also increased its actual and relative production. According to H. D. McCaskey, of the United States Geological Survey, the gold produced from North Carolina placers and deep mines in 1912 was 8030.93 fine ounces, against 3399.89 oz. in 1911. In 1912 the value of the North Carolina gold output was $166,014 of the total of $222,496 for all the Eastern states, against $70,282 of the total of $159,370 in 1911. The gold was obtained from 22 gold placers and 14 deep mines. Many of these mines, especially the placers, were small. The bulk of the gold output was, as usual, derived from the Iola mine, of Montgomery county, which had a considerably increased production. The silver output of the state, recovered as a by-product from gold milling or smelting ores of gold, copper, and lead, was 4854 fine ounces, valued at $2985, against a corresponding total of 934 fine ounces, valued at $500, in 1911.

In addition to silver and gold there was a small output of copper, lead, and zinc in 1912. The total value of the output was $205,214, against $70,782 in 1911. From the 14 producing deep mines in 1912 there was treated 16,073 short tons of ore, of which 14,358 tons was silicious gold ores, with an average recovery of $10.62 per ton in gold and silver, and the remainder copper and lead-zinc ores. The placers of North Carolina yielded 423.38 fine ounces of gold and 35 fine ounces of silver in 1912, and the silicious ores 7321.95 oz. of gold and 1902 oz. of silver.

Georgia's Gold-Silver Mines

The mine production of gold in Georgia in 1912 was 694.67 fine ounces, valued at $14,360 (the smallest in the past eight years), and the output of silver was 77 fine ounces, valued at $47, according to H. D. McCaskey, of the United States Geological Survey. The production of gold in 1911 was valued at $35,070. The yield of placer gold was 331.18 fine ounces in 1912, against 1148.32 oz. in 1911, and the output from quartz or deep mines was 363.49 fine ounces, against 548.19 oz. in 1911. The production of silver from placers and deep mines was 23 and 54 fine ounces, respectively, against 109 and 103 oz. in 1911. The precious metals were produced by 23 placers and 5 deep mines in Georgia in 1912. There was 1359 short tons of silicious gold ores, with an average gold and silver recovery of $5.53 per ton, treated in Georgia in 1912, against 3737 short tons, with an average recovery of $3.05, in 1911.

Placer Mining in Trinity County, California

The water-supply for hydraulicking at the mines of the Trinity Consolidated Hydraulic Mining Co., at Douglas City, is derived from a diversion dam on the Grass Valley creek, a tributary of the Trinity river, which supplies a system 12 miles long, with a capacity of 4000 cu. ft. per minute, delivering to a point 450 ft. above mine bedrock. In all there are 20 flumes from 15 to 150 ft. long; 4 siphons, (1) 951 ft. long, under 236-ft. head, (2) 962 ft., under 201-ft. head, (3) 1861 ft., under 96-ft. head, and (4) 4706 ft., under 581-ft. head, this one crossing the Trinity river; and 3 tunnels, 60, 70, and 150 ft. long, the whole, with pressure-pipes and giants costing $250,000. During the year ended November 30, 1912, the following work was done on the three main sections:

	Union Hill.	Hupp.	Brown's Ranch.
Operating time, days.....	99.5	40.8	16.7
Water available, inches.....	2,700	2,000	1,000
Gravel sluiced, yards.....	700,000	98,000	32,000
Daily average, yards.....	7,035	2,400	1,920
Duty per inch, yards.....	2.6	1.2	.....
Value per yard, cents.....	4.14	13.00	21.00
Operating cost, cents.....	2.09	7.34	12.7

Total: Gravel sluiced, yards, 830,000; value per yard, cents, 5.83; cost per yard, cents, 3.11.

German pencil factories produce annually about 432,000,000 lead, colored, copying, and slate pencils, and penholders, which have a value of $2,500,000. The American output is greater than this, being over $4,000,000.

The Dome Mines

The second annual report of the Dome Mines Co. for the period November 30, 1911, to March 31, 1913, has just been made public, and as it is the first official publication of the operations of this company, it is of considerable interest not only to the shareholders but also to the general mining public, who have awaited with interest a full statement of results from this, one of the largest Porcupine properties. The report shows a marked progress in all branches of the work. W. W. Mein, the consulting engineer, reports that during this period 128,015 tons was mined. Of this, 102,836 tons was ore which was sent to the mill and treated, and 25,179 tons was waste. Of the ore sent to the mill, 93,581 tons came from the open pits; 101,812 tons was milled, realizing $1,043,995, equal to a net recovery of $10.25 per ton. The operating cost per ton milled, $4.95, is high, but as a result of the improvements now being made, this will be gradually and substantially reduced.

Apart from the temporary disturbance of labor conditions by the strike of last November, and the utilization of costly steam-power, the factors which inevitably bear upon the early operations of a pioneer producer in a new mining district, have so far kept the operating expenses high. The greater portion of development during this period has been confined to preparations for economical mining the ore above the 100-ft. level. This will be done by means of open pits with large benches. Development has also been done toward the establishment of sufficient ore reserves to justify increased mill equipment. The tonnage of ore developed above the 45-ft. level is estimated at 315,528 tons with a value, as determined by sampling, of $7.53 per ton. In addition to this reserve there has been developed 250,000 tons of ore between the 45 and 100-ft. levels, which cannot be valued with the knowledge of the ore now available. On the 100-ft. level there is a horizontal area of 46,750 sq. ft. of ore, but it is not thought advisable to take credit for a definite tonnage and value below this level until further development has been done.

With this supply of ore developed, a policy is projected for the working of the deposit as cheaply as possible rather than to determine the value of the partly developed ground. In this estimation of ore reserves, no credit is taken for the large bodies which are indicated by bore-holes and by development at the 260-ft. level from the vertical shaft (No. 2) east of the 'Dome,' which results give promise of a large, though at present imperfectly defined, extension of ore. Holes drilled in the vicinity of the No. 2 shaft and which are within an area of 200 ft. square, show a mineralized zone of considerable size. The four drill-holes, which are tabulated in the report, show mineralized cores of 57, 168, 478, and 273 ft., respectively, with assays of $7.18, $4.15, $3.69, and $4.56. Selected portions of these lengths showed much higher assays than the averages given. In the shaft an orebody was cut at 172 ft., which had not been indicated by any of the bore-holes. Sampling results average $4.87 for a distance of 85 ft., with the bottom of the shaft still in ore at a depth of 257 ft. The strike of miners interrupted the sinking of the shaft and a cross-cut was started south at the bottom. This cross-cut has been driven 200 ft., and averages $5.39 throughout this entire length.

The results obtained from the deeper extensions of the famous Dome of rich quartz, that marked the original outcrop of the vein, give hope that, while a gradual fall in yield per ton is inevitable in the future, a long life on an increasing scale of operations may be confidently expected. A fall in the cost of production should follow the cessation of extraordinary expenditures which are associated with the operations of a new mine and mill; the increasing efficiency of methods and supervision in relation to local problems; a probable improvement in the standard of labor efficiency through the establishment of more attractive and stable conditions; and also an uninterrupted supply of hydro-electric power, the benefit of which installation was not gained during the past year. With increased capacity, working costs would be further reduced and additional bodies of ore would thereby be made capable of profitable treatment. The development undertaken during the year may be classified as follows: shaft sinking, 155 ft.; raising, 866 ft.; driving, 1835 ft.; cross-cutting, 2059 ft.; incline, 657 ft. In working the mine, tramming from the 45-ft. level has been abandoned, as the short vertical height made the slope of the pits too flat for the ore to run freely. The tramming from the 100-ft. level is being done through five chutes from the pits. The raise from No. 2 shaft is now through to the surface and provides another chute. The footage drilled per machine-shift was 16.5 and the footage advanced in drifts and cross-cuts per machine-shift was 0.62. In stoping operations 43.7 tons was broken per machine-shift.

The mill, which was designed and erected by the Merrill Metallurgical Co., comprises forty 1250-lb. stamps, four duplex Dorr classifiers, four 5 by 20-ft. tube-mills, four Pachuca vats, 8 by 40 ft., three 90 by 4-in. frame Merrill slime filter-presses, and two 52-in. Merrill zinc-dust precipitation presses. The result of the treatment during the period under review may be summarized as follows: tons milled, 101,812; yield by amalgamation, $560,481; yield by cyanidation, $483,513; total value, $1,043,995; value per ton, $10.25. The percentage of gold recovery, based on the gold won by amalgamation plus the sample value of cyanide head, has been 95.63. The most important change in the mechanical department was the replacement of steam by electric power. The power is delivered from Wawaitin falls, 13 miles distant from the property. Adequate water supply is being obtained from Porcupine lake by the installation of two electrically-driven four-stage turbine pumps. An itemized statement of the operating costs per ton milled for the year shows the mining cost to have been $1.31; crushing, $0.24; milling, $2.11; general, $1.29; making a total cost per ton milled of $4.95.

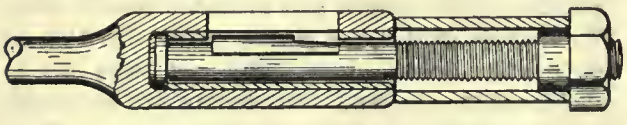
The financial statement of the company may be summarized as follows: The net current assets on November 30, 1911, amounted to $64,618. The receipts for bullion less all expenses, amount to $509,956, to which must be added a loan of $175,000 and

miscellaneous receipts from salvage, etc., of $9387, making a total of $758,961. Of this amount there has been expended $429,621 for buildings and equipment and $209,478 on development, which leaves a balance of $119,861. Allowing for the indebtedness to the bank, the net excess of current liabilities over current assets is $45,148.

A Chuck-Bushing Puller for Machine Drills

By J. F. Berteling

*Some method for removing the bushings from the chuck of a rock-drill is needed every time a bushing must be replaced, on account of wear or a change in the size of steel used. The ordinary method is to insert a drift through the opening in the chuck in which the key or drift fits. The drift is then struck with a hammer until the bushing is forced out. In most cases the bushing is ruined if the method succeeds. A cold-chisel is often needed to split the bushing, or the chuck is heated in a forge and expanded, enabling the bushing to be driven out more easily. Even on new machines, considerable difficulty is encountered in removing bushings, and if the bushing has been rusted in, it is a difficult job. Drift keys are sometimes made up for this purpose, so as to have a better leverage on the bushing; but, while superior to home-made drifts, these special keys are open to the chief objections described above.



The accompanying sketch shows a method devised by Charles Berg, master mechanic of the Reserve Mining Co., near Commonwealth, Wisconsin. This method consists in pulling the bushing out of the chuck instead of driving it out. A steel rod, of suitable size, is threaded at one end with a heavy thread of coarse pitch. At the other, a suitable slot is cut, in which a steel wedge is laid, carrying a square shoulder. This rod is inserted in the chuck, the wedge placed in position through the key or clamp opening, and a short piece of heavy pipe placed over the threaded end of the rod. A heavy nut is then screwed on over the free end of the rod until it is flush against the section of pipe. As it is screwed in, it pulls out the rod and brings the shoulder of the wedge against the edge of the hole in the bushing. The inclined surface of the wedge being underneath the bushing, the entire device is solid and secure, and in most cases the bushing can be drawn out without damage to itself or to the chuck.

*From *Mine and Quarry*.

The Belgian Zinc Industry in 1912

Imports or zinc ore into Belgium through the port of Antwerp during the year and destined to all the works in the country, were as follows, in metric tons: From Sardinia, 84,549; Spain, 65,194; France, 36,181; Algeria and Tunis, 78,417; England, 10,167; Sweden, 21,398; Greece, 14,243; Chile, 8183; Australia, 257,205; Japan, 24,572; Siberia, 15,613; other countries, 49,990; total, 665,712 tons. Of this total, the Vieille-Montagne Co.'s share was 215,317 tons, or about one-third. In the imports the large tonnage of zinc concentrate from Broken Hill, New South Wales, is noticeable. One of the most important zinc enterprises of the Liege district is that of the Vieille-Montagne Zinc Co., at Angleur. The company's annual report shows that its 14 plants produced 107,526 metric tons of crude zinc in ingots, while its rolling mills turned out 78,099 tons, and its mills for producing zinc-oxide 11,687 tons. There was 124,634 tons of ore extracted from the company's mines. Of this amount, 113,482 tons was zinc ore and 11,152 tons lead ore. The average price of zinc was $125.34 per metric ton of 2204 pounds, which was an increase of $4.82 over the average price in 1911. Quotations did not fluctuate much, ranging between $123.80 in April and $132.78 in October. Owing to the generally favorable situation of the industry, assisted by the syndicate of European zinc producers, prices remained firm throughout the year, and were not seriously affected by the political situation in the Balkans. English lead was quoted at $87.24 per ton, an increase of $19.26 over 1911.

Copper Consumption in 1912

The apparent consumption of refined new copper in the United States in 1912 was about 775,987,332 lb., according to figures compiled by B. S. Butler of the U. S. Geological Survey. In 1911 it was about 681,753,279 pounds. The method employed in determining the quantity of copper retained for domestic consumption is shown in the following table, which does not include stocks of copper held by consumers:

	1911, pounds.	1912, pounds.
Total refinery output of new copper	1,433,875,025	1,568,104,478
Stock at beginning of year	122,803,656	88,372,195
Total available supply	1,556,678,682	1,656,476,673
Refined copper exported	*786,553,208	*775,000,658
Stocks at end of year	88,372,195	105,497,683
Total withdrawn from supply	874,925,403	880,498,341
Apparent consumption	681,753,279	†775,978,332

*Exports of pigs, ingots, bars, etc., reported by the Bureau of Foreign and Domestic Commerce.

†The apparent consumption as here calculated differs considerably from the domestic deliveries reported by the Copper Producers' Association. This difference is accounted for in part by the difference in export figures as reported by the Bureau of Foreign and Domestic Commerce and the Copper Producers' Association, owing to the fact that the two sets of export figures are based on a slightly different period and therefore may show considerable difference for any one year, and in part due to the difference in refined new copper as shown here and reported by the Copper Producers' Association.

If to the 775,978,332 lb. of new refined copper is added the 274,000,000 lb. of secondary copper and copper in alloys produced during the year, it is found that a total of about 1,050,000,000 lb. of new and old copper was available for domestic consumption.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Stamp-Mill Cam Curves and Speeds

The Editor:

Sir—In a search for proper conditions for high-speed cams for stamp-mills, some data became available which, it is thought, may be of some general interest.

For uniform lifting velocity, the involute cam, working on the flat-faced tappet, is used, and has the proper shape for the purpose. The effect depends upon the diameter of the inscribing circle and not upon the distance between centres of the shaft and stem, although, to reduce the side thrust as much as possible, it is better to make this distance equal to the radius of the circle. It is a property of the involute curve that the velocity of lift, during the time the involute is in action, is the same as the velocity of a point on the inscribing circle, from which follows the necessity of making the diameter of this circle to correspond with the velocity of lift and number of drops or revolutions selected. The neglect of this point will result in a failure to produce the desired end.

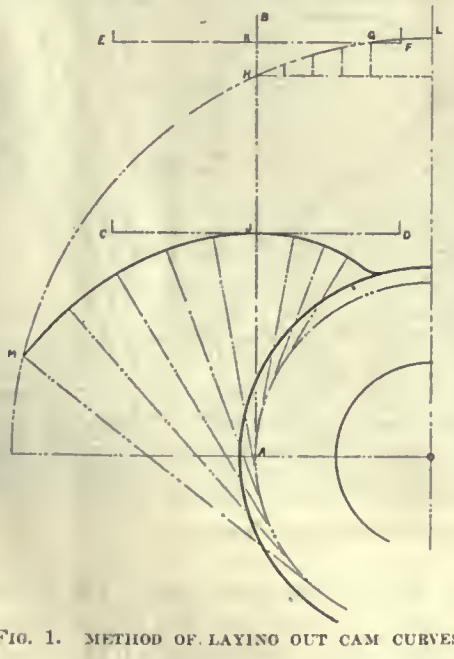


FIG. 1. METHOD OF LAYING OUT CAM CURVES.

Fig. 1 shows the method of laying out a cam for a given set of conditions: Given 11-in. inscribing circle, 6-in. drop, 108 drops per minute. Draw an 11-in. circle, with stem centre line *A B*, line *C D* at lowest desired position of tappet for 6-in. drop, and *E F* 6 in. above it for the highest position. Mark at *G* where the cam leaves the tappet (taking into account the cutting off of the cam corner), and draw a circle with radius *O G*. This will be the outside diameter of the cam, and it will show, by its intersection with the line *A B*, how much of the total lift is done at the uniform velocity and how much at a decreasing velocity. The lift from *J* to *H* will be uniform; at that point the involute ceases to act as such, and the remainder of the lift *H* to *K* will be at a velocity which decreases as the distance of the point of contact from the shaft centre line *O L* decreases. The involute is drawn in the usual way and terminates at *M*. A point on an 11-in. circle, making 54 r.p.m., has a velocity of 2.6 ft. per second, which will be the lifting velocity from *J* to *H*, a height of 4 15/16 inches.

Fig. 2 is a diagram showing the time occupied by the various parts of the stamp movement. The line *A E* represents 0.405 second and is the time for the full movement, *A B* is the uniform velocity lift, *B C* the decreasing velocity lift, *C D* an allowance for final stopping of the stamp, and *D E* the curve of the drop. At the velocity under consideration, the theoretical retardance curve, due to the velocity at *B*, and which resembles closely the upper part of the curve *D E*, would appear very little above *B C*, and there is no doubt but that frictional resistance will keep the tappet on the cam. It is, however, evident that the work on the cam during this part of the lift will be confined to friction. At higher velocities there will be a greater tendency to leave the cam at *B*, but whether or not it will do so will depend upon the friction.

As the allowance *C D* depends upon the final lifting velocity at the instant the cam leaves the tappet and upon frictional conditions, it will be somewhat indefinite, and will vary with the diameter of the inscribing circle, even with the same lifting velocity. For the curve *D E*, 7% has been added to the theoretical time required for falling bodies, as shown by experiments noted in 'Ore Dressing' by R. H. Richards. In Richards' table of computed drops per minute* there is an error, as may easily be determined by a few minutes with a slide rule. None of the inscribing circles will give a lifting velocity of 2.66 ft. at the revolutions noted. The data are given in the table below.

Beyond *E* there will be a certain time allowance for rest, which, with the movement time, will make up the total time for one drop. In this case, at 108 drops, the total time is 0.555 second, leaving a rest period of 0.15 second. By multiplying the number of feet, 2.6, by the numbers of seconds, 0.15, the 'clearance' of 4.67 in. is found. This 'clearance' is the distance traveled by a point on the inscribing circle between the instant when the tappet reaches its lowest point and when it is struck for the next lift. It represents an effective clearance between cam

Drop, in.	3	4	5	6	7	8	9	10	14	18
Drops, min.	143.50	126.80	115.20	105.40	97.60	91.30	85.50	80.30	65.50	55.60
Circles, in.	6.00	7.30	8.46	9.57	10.58	11.54	12.53	13.47	17.08	20.49
Velocity, ft.	1.88	2.02	2.13	2.20	2.26	2.30	2.34	2.36	2.44	2.49
Circles should be..	8.52	9.66	10.60	11.58	12.50	13.40	14.30	15.20	18.65	21.95

*'Ore Dressing,' Vol. I, p. 216.

and tappet and is a convenient means for comparing various working conditions.

There are two ways in which the number of drops per minute can be increased: by increasing the velocity of lift and by decreasing the rest period. How much the rest period may be safely reduced will

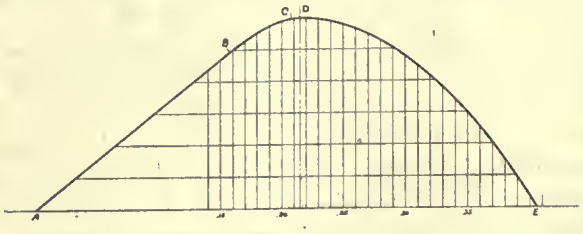


FIG. 2. VELOCITY CURVE FOR CAM LIFT AND DROP.

depend upon operating conditions, and especially upon the steadiness of the speed and the closeness to which the drop is held to that selected. With fixed height of drop and speed, a material increase in the number of drops may be made by reducing the rest, provided a corresponding change is made in the involute. When the drop increases, by reason of wear, from that originally set, the clearance decreases very rapidly, as it loses at both ends of the movement. Overspeeding of the shaft also soon results in interference, as it reduces the total time per drop, but does not make a corresponding increase in velocity of lift. It is experience with cams running under these unsuitable conditions which has given rise to the idea that high-speed cams are out of the question.

At the present time, cams are ordinarily run to give a lifting velocity of about 2.6 ft. per second, which seems to be about the limit with the standard form of tappet held in place by friction. With the higher speeds, it will be necessary to use a more secure method of holding the tappet, and it will be advantageous to cushion the blow struck by the cam. By sacrificing speed, cams may be made to reduce the violence of the blow by a modification of the curve to permit picking up the stamp at a point closer to the shaft. The effect is obtained only when the tappet drops to the point for which it was designed.

It will be noticed that, in the foregoing, no account has been taken of an easement on the point of the cam. The desirability of this will depend upon the relation of the curve *B C* (Fig. 2) to the theoretical retardance curve and upon friction. It will be of more use in slow than in high speeds. Neither is account taken of the slowing of the drop when the stamp strikes ore.

Fig. 3 gives the diameter of the inscribing circles for certain velocities of lift and number of drops per minute. The only conditions involved are the two given; for instance, at 110 drops and 2.4 ft. per second, a 10-in. involute is required. Whether it is possible to obtain that number of drops at that velocity must be determined by other means. The diagram of clearances for 6-in. drop answers the question for that particular case. The clearance at 2.4 ft. lifting velocity and 110 drops is about 3¾ in., and the time by calculation is 0.13 second, which is ample. For 130 drops at 2.6 ft., a 9.15-in. involute is required, and the clearance for 6-in. drop is about 1¾ in., while for the same number of drops at 3 ft. per second, a 10.5-in. involute is indicated and the clearance is about 2⅝ in.; and at 4 ft., 14.1-in. involute and about 4½-in. clearance.

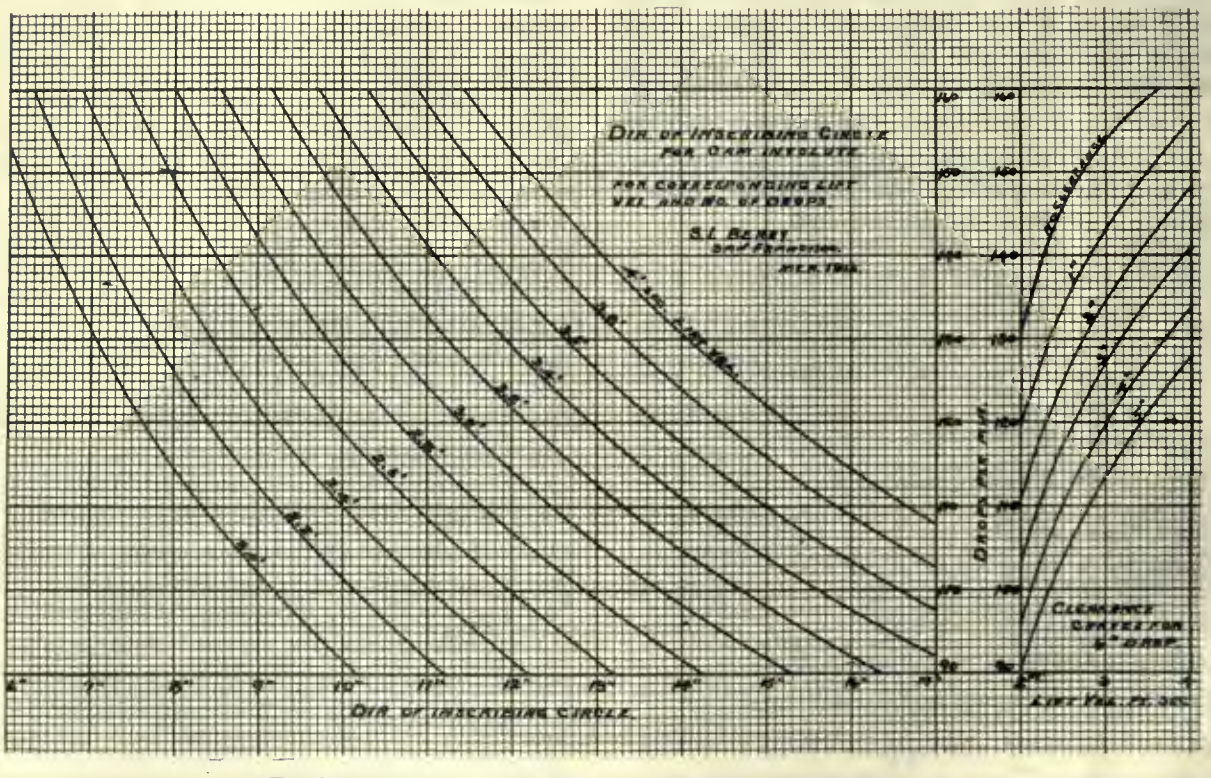


FIG. 3. DIAGRAM FOR CLEARANCE AND DIAMETER OF INSCRIBING CIRCLE.

The above analysis provides a means by which high-speed cams can be designed, but, as stated before, for speeds much above 2.6 ft. per second, it will be necessary to improve the method of holding the tappet and for the higher speeds to cushion the blow.

S. L. BERRY.

San Francisco, May 27.

Special Correspondence

REDDING, CALIFORNIA

MEETING OF THE MINING CONGRESS.—SMELTER FUME PROBLEM DISCUSSED.—EXCELLENT EXHIBITS.—EXCURSIONS TO SMELTERS.—PLANS FOR 1915.

Three days of important activity and accomplishments signalized the session of the Southern Oregon and Northern California Mining Congress at Redding last week. Originally scheduled to convene Tuesday morning, May 20, the meeting was not called to order until Wednesday morning, owing to a misunderstanding of dates by the executive officers. The session, occupying May 21, 22, and 23, was one of the most successful in the history of the Congress, and full advantage was taken of the opportunity presented to pay especial attention to the question of smelter fumes. This matter, of paramount importance to the majority of districts represented, was thoroughly considered, and following a comprehensive report by a special committee, resolutions were adopted approving the efforts of the Mammoth Copper Co. to eliminate destructive fumes from its Kennett smelter, and pronouncing the method completely successful. The inability of several Oregon delegates to attend prevented the delivery of a number of promised addresses, but several interesting papers were nevertheless read at the session.

In the absence of the president, H. I. Herizinger, of Grants Pass, Oregon, the session was called to order by the first vice-president, I. J. Luce, of Etna Mills, California. W. D. Egilbert, the district secretary, recorded the proceedings. Following the tendering of the hospitality of the city of Redding to the delegates by the Mayor, H. W. Glover, the address of welcome was delivered by Charles M. Head, of the Superior Court of Shasta county. One of the first acts of the convention was the appointment of a committee to examine agricultural conditions in the smelting zone, and report on the alleged damage caused to vegetation by the fumes. The committee, consisting of Fred Grotofend and M. E. Dittmar of Shasta county, R. S. Taylor and R. H. Towne of Siskiyou, and J. R. Goddard of Trinity, immediately inspected conditions as far south as Cottonwood and Ball's Ferry, and reported on Friday. The statement was to the effect that a most careful and comprehensive examination of agricultural conditions throughout the smelter-smoke district had been made, with every precaution exercised to obtain absolutely fair and impartial evidence. Everywhere the committee found crops flourishing as luxuriantly as elsewhere in the Sacramento valley, and the crops of 1912 had been the best in the history of Shasta county. The report held that while smelter smoke in the past had unquestionably caused damage to vegetation, it was apparent that the fumes escaping from the Kennett smelter of the Mammoth Copper Co., the only plant operating in the county, are not detrimental in any way to the agriculturist. The report ended by deprecating the smelter-smoke agitation, declaring it not only inimical to the mining industry, but also harmful to the farmer, as the uncalled for complaints can only result in lowering the market value of the lands. The report was adopted with applause.

Interesting addresses by R. S. Taylor, of Yreka, the state mineralogist, F. McN. Hamilton, of San Francisco, and John Crawford, Jr., of Heroult, Cal., attracted much attention. Mr. Crawford's address, 'Iron Smelting in Electric Furnaces as Conducted by the Noble Electric Steel Co. at Heroult, Shasta County, California,' claimed particular attention, dealing as it did with a new departure in metallurgy, of particular interest to the Congress. The paper by Mr. Taylor on 'Mining in Siskiyou County' presented many new angles of the gold and copper resources of this section of California. Thursday morning the delegates visited Heroult and Kennett. At Heroult they were shown the electric smelter of the Noble Electric Steel Co., and were interested spectators of the production of pig iron, and the numerous by-products of the auxiliary plant for the extraction of coke, wood alcohol, turpentine, and other substances from wood. On the return trip the party, numbering approximately 300, inspected the Mammoth smelter at Kennett, and partook of a barbecue as guests of the Kennett Chamber of Commerce. Friday morning the delegates visited Anderson, Cottonwood, and Happy Valley. There were 30 automobiles in line and the delegates were given an ideal opportunity to personally examine the agricultural conditions of the richer farming portion of the county. Practically all the land lies within the smoke belt, and the magnificent crops growing on every hand eloquently testified to the merit of the contentions that the Mammoth plant is not causing any damage. Cottonwood provided a barbecue, while in Happy Valley the delegates were the guests of the Ehman Olive Co. Each guest received a bottle of pickled olives as a souvenir, and at Anderson a box of preserved plums was also presented to each.

THE BULLY HILL SMELTER.
(Closed on account of smelter-fume trouble.)

The closing hours of the Congress were devoted to election of new officers, and selection of next meeting places, Ashland, Oregon, being the final choice. The meeting is to be held in the fall of the present year. In the spring of 1915 the Congress will convene in San Francisco. I. J. Luce, Etna Mills, California, was elected president; L. L. Ray, Medford, Oregon, first vice-president; W. H. Roberts, Redding, second vice-president; H. H. Noonan, Weaverville, California, third vice-president; W. D. Egilbert, Redding, secretary; John E. Pashburg, Yreka, treasurer.

The mineral display was particularly good, and in general profusion, diversity of minerals, and value of exhibits eclipsed any like exhibition ever seen in Redding. Siskiyou county made a particularly fine display. The supervisors appropriated about $10,000 for the purchase of some unusually excellent gold-bearing specimens, and the display of the county and private individuals brought the value of the gold collection to about $40,000. Among the best specimens were two large pieces of rich gold-studded quartz from the Homestake mine, owned by R. S. Taylor, the Yreka delegate. Several pans of nuggets from Siskiyou placers, and a quantity of copper-bearing ore from the Blue Ledge mine, completed the Siskiyou exhibit. The Shasta county display was another attractive feature. Practically every gold mine in the county sent specimens, and the collections from the Midas and Gladstone mines were particularly striking. Both of these properties are generally regarded as low-grade producers, but the rich ore displayed indicated that bonanza is not a stranger in either mine. Attractive exhibits of copper ores were made by the Mammoth Copper and the Mountain Copper companies, and the iron ore and pig iron shown by the Noble Electric Steel Co. claimed much interest. Besides gold, copper, and iron, silver, zinc, lead, and other ores were displayed. The mines of Trinity county had on view excellent collections of quartz and gravel, with a few individual pieces of particular attraction. A fairly interesting display of mining machinery was made by several manufacturers, machinery and mineral exhibits being displayed in Armory Hall, where the Congress convened.

During their stay in Redding, the delegates were entertained by a Carnival, embracing six days. Gorgeous

parades by fraternal societies, airship flights, Wild West exhibitions, automobile and motorcycle races, baseball, and other attractions were provided. The city was well illuminated and decorated, and every effort made to make the visit of the delegates a memorable and pleasant one. The honorary committee of the Congress follows: Frederick Lyon, G. W. Metcalfe, W. H. Roberts, Morgan Thomas, Harvey J. Salee, E. V. D. Johnson, George Bayha, H. O. Cummins, L. C. Parker, Jesse Peter, F. Hurst, G. R. Milford, J. H. Kervin, R. E. Hanbey, William Kett, W. L. Cole, N. E. Lamus, M. Murphy, D. M. Riordan, J. B. Keating, H. R. Hanley, Charles T. Dozier, James Sallee, H. H. Noble, A. L. Fulton, Clifford Wiegel, H. E. Musser, F. L. Wilson, I. O. Jillson, Wade Moores, H. Waste, M. E. Dittmar, Fred Grotofend, W. D. Tillotson, S. D. Furber, P. Bouery, H. E. Goodale, T. M. Gilbert, John Crawford, Jr., S. E. Bretherton, R. E. Frickey, E. Young, E. E. Todd, I. J. Johnson, and H. F. Rogers.

At the next meeting of the Congress a number of interesting questions briefly touched upon at the Redding session will be given particular attention, and the members are planning to make the San Francisco convention, in 1915, a particularly notable event. Organized to bring in closer and mutually helpful contact the mining men of the bordering counties of California and Oregon, the Southern Oregon and Northern California Mining Congress has already accomplished much in the upbuilding of the industry in the districts represented. The Congress marks the first concerted effort of the mining men of the California-Oregon border counties to work together for mutual benefit, and the success of the organization is having an excellent effect in many ways.

The resolutions adopted recommended that a commission be created to investigate all smelter-smoke complaints and aid in an equitable adjustment of controversies developing between the agricultural and smelting interests; that at least one member of the commission be a representative of the smelting industry; that the railroads holding land grants place them upon the market at a price not to exceed that asked for similar land by the federal Government; that the U. S. Land Office be re-established at Redding; that the State Highway Commission order a survey and report on the highway from Redding to Oregon, on the route of the old Oregon state road, to connect with the Oregon state highway; that measures be taken for elimination of all conflicting authority among government officials in passing upon applications for patents of mineral lands.

BUTTE, MONTANA

General Activity in Butte.—Preparation for A. I. M. E. Meeting.—Clark's New Zinc Plant.—Butte Central.

The whole Butte district gives more evidence of activity than at any time in its history. In a mining, and therefore in a business way, things are booming. Many new shafts are being sunk by new companies and old companies are deepening theirs. Lessees along the Rainbow lode are as thick as flies, especially on the Alice and Moulton properties. Horse whims and windlass workings are plentiful, and it is plain to be seen that deep mining is not the only kind profitable in Butte. Of course all these activities are not profitable, but a sufficient proportion are, so that Butte can truly be said to be prospering. This prosperity is pleasantly reflected in the growth of the city, which is taking on a decidedly cosmopolitan air, with parks, boulevards, cement sidewalks, and the continual building of new and expensive dwellings and business blocks. While not selling real estate or mining claims nor thinking that Butte is the most beautiful place in the world to live in, it may nevertheless be held that the past ten years have brought remarkable changes and betterments, and the future of Butte is brighter now than ever. Probably less has been written about mining and metallurgical methods at Butte than about any other mining camp of equal importance. This silence has been due as much as anything to the restraint necessarily brought on by the bitter and hard litigation which harassed the mining industry for so many years and encouraged the engineers in silence and secretiveness. This condition has now pretty largely passed, and the companies are becoming willing that their technical methods should be made known. In consequence, many papers are being prepared by local members of the American Institute of Mining Engineers to be read at the August meeting of the Institute in Great Falls, Butte, and Anaconda. These papers give promise of being of great value to technical men unfamiliar with Butte methods, and will probably receive wide attention and discussion.

After an exhaustive series of experiments extending over more than a year's time and including trial of nearly all available types of concentrating machinery, the W. A. Clark interests have finally decided in favor of the froth flotation process for the treatment of their zinc copper ores in the Elm Orlu mine. They will begin at once the erection of a mill south of the city. The care and thoroughness with which all processes were tried out in experimental plants should be an object lesson to mill builders. The ore in the mine is blocked out and has been waiting to pour into the mill, yet the owners have shown no haste to begin the erection of the mill until completely satisfied that the process to be used would be the best known for the reduction of the ore. The froth flotation plant will be erected by Minerals Separation, Ltd., under a contract which provides for royalties, and with proper protection in case that concern loses in the pending litigation over the Hyde process of the Butte & Superior Copper Co. In any case, Butte is soon to have the most modern and up-to-date flotation mill so far erected.

Butte Central Copper Co. stock is sulking worse than ever, having dropped below $2. The wheels of the mill are still running and the ore-bins are full of something, but somebody seems to have lost faith, and the market is without support.

MELBOURNE, AUSTRALIA

Wages and Cost of Living.—Gold Stealing.—Big Share Transaction.

Readers of the *Mining and Scientific Press* will perhaps be interested to some extent in certain statistics issued by the Commonwealth statistician, G. H. Knibbs, to show the relation of increased wages to the increase in the cost of living. Mr. Knibbs deals particularly with the costs in the six state capitals, and shows that in 11 years from 1901 to 1912 there has been a very serious rise in the price of commodities. Taking the purchasing power of the sovereign in 1911 as the basis, the weighted average of the six capitals is shown to have advanced from 17s. 7d. in 1901 to 22s. in 1912, so that the rise in the past twelve months amounted to as much as 10%. Or, to put it in dollars and cents: 1901, $4.26; 1911, $4.85; 1912, $5.33½. Generally speaking, the cost of living in the provincial towns is lower than in the capitals (at Beaconsfield, in Tasmania, it is as much as 24% below the average); but there are exceptions, the most extreme instance being that of Kalgoorlie (Western Australia), where it is 22½% above the average. Wages throughout the Commonwealth has since 1891 advanced nearly 6%, and practically the whole of that advance has been since the establishment of the Federation in 1901. Anyone, then, who likes to work out the figures given above will see that the worker is not one whit better off today, for all his higher wages, than he was in the year of grace 1901.

Although much has been done to minimize gold-stealing in Victoria, the crime is still rife enough, and there are plenty of complaints of its occurrence, especially at Bendigo, where the gold is apt to be coarse and is always free. The miners, however, resent searching as an imputation upon their honesty; and recently a deputation from the Victorian Miners' Association waited, by invitation, upon the acting-premier, John Murray, to protest against proposals to strengthen the Gold Buyers Act and the Police Offenders Act, so as to make theft more difficult. Among the proposals of the Government is one providing for the searching of miners in the presence of the police. Mr.

Murray was not altogether sympathetic in his reply to the representations made by the deputation. He pointed out that the alteration of the Police Offenders Act so as to enable a person suspected of having gold in his possession to be searched would only have the effect of conferring on the authorities powers they already possessed in two other states. The fact is that the gold-stealer will never be suppressed until the receiver is done away with. In Victoria, the open trade of this gentleman has been suppressed, but he has merely removed into another state, and still goes on receiving as before. In Victoria itself the business has to be conducted secretly, but it *is* being done, mostly by hotel keepers.

The biggest share transaction ever recorded in Australia is announced; this is the purchase of the entire estates of the late W. R. Hall and T. S. Hall in the Mount Morgan gold mines, Queensland. An English and Australian syndicate is the purchaser, and the number of shares involved is about 400,000. As the purchase price is $14.55, the transaction involves an amount of nearly $6,000,000. One-third has been paid in cash and the balance runs over a period, at 4% per annum. The deal has been negotiated through Lionel Robinson, Clark & Co., of London, and E. L. and C. Baillieu, of Melbourne. W. L. Baillieu will join the Australian board of the Mount Morgan company, and Lionel Robinson the London board. The register of the Mount Morgan company consists of 1,000,000 shares of $4.85 each. These are at present worth about $17.50 per share on the Stock Exchange.

LONDON

A Government Report on Waihi.—The Company Report.—Kolar Mines.—Tharsis Increases Reserve.

After a delay of nearly two years, the New Zealand Government has issued the report on the Waihi mining district, prepared by the then director of the Geological Survey, J. Mackintosh Bell, and his assistant, Colin Fraser. The Government throws the blame for the delay upon the two authors, stating that the report was written after the severance of their connection with the Survey and their departure from the Dominion. There is a widespread belief, however, that the delay, if not caused by the Government, was at least not distasteful to it. Another mystery to the public is in connection with the termination of Mackintosh Bell's engagement. When the examination was being made, the Waihi Gold Mining Co. had just entered the period of exhaustion of the orebodies, and it was to the interest of everybody connected with New Zealand enterprise that the impoverishment should prove, or be proved, to be only temporary. G. A. Richard was brought from Mount Morgan in Queensland to report, and he fell back on the theory expressed in early days that the gold was of pneumatolytic origin. It was, however, fairly well known among scientists that Mackintosh Bell had proved by close examination what was generally surmised, namely, that the deposits were geologically recent, and that the country rock was dacite of Tertiary age; consequently, judging by experience with similar deposits in other parts of the world, the profitable ore-shoots could not be expected to go far down. When the ninth level showed impoverishment and the tenth gave no results, the scientific geologist had no option but to be skeptical as to the prospects for deeper sinking. Mr. Bell's examination did not disclose any startling discovery; it only confirmed pre-conceived notions. But the public in general, and shareholders in particular, are not sufficiently perspicacious in the judgment of men and of scientific laws, and they knew nothing of the previous experience with Tertiary gold deposits. They would, however, believe a government report, so that government report was suppressed in the interests of the Dominion. Selling of shares by local holders became notorious, and the Englishman, as usual, has been left to hold the baby. Attempts have been made to secure other properties; 60 have been examined. Unfortunately, the shareholders have demanded that no purchase shall be made without their consent, so in many cases trouble arises. The company has a reserve fund of £340,000 invested in first-class securities, so it is evident that would-be sellers of properties will not expect to be treated in a niggardly way. This, of course, is the reason for many of the other hitches. The report of the company is reviewed on another page.

The present position of the gold-mining companies in the Kolar district of India may be described as satisfactory. The Mysore, the oldest of all of them, is still in a remarkably healthy state, as I have recorded recently. The Ooregum is attracting attention at present, owing to the fact that during the past few months the threatened danger of impoverishment has vanished. Some months ago it was deemed advisable to reduce the output owing to the poor results of development. Since then a remarkable change has taken place, and at the present time profitable ore is being found at every point. It is notable that at one point, 4400 ft. deep on the incline, a new shoot of ore has been found, and this after sinking for 1000 feet.

At the present time most of the copper and sulphur mines in the south of Spain are doing well, and the value of the ore from its sulphur content is prolonging the life of many. The most interesting developments recently have been done by the Tharsis company, which has increased the ore reserve at the Calanas mine during the past two years by 8,000,000 tons, by a systematic underground development, as contrasted with the older method of mining by open cut. At the present rate of output this will last for twenty years. The ore disclosed is higher in quality, both in sulphur and copper, than that which has been extracted above. This company was started in 1868, and has distributed £9,750,000 as dividends, besides amortizing the property and plant by writing off £2,500,000 out of profit. The reserve fund in cash and securities stands at over £1,000,000, and the mines appear in the balance sheet at £20,000. The controlling power is with Tennants, who buy the pyrite for alkali manufacture. Tennants have, since the earliest days, been the main financial stay of the Indian gold mines, managed by John Taylor & Sons.

NEW YORK

Copper Prices Readjusted.—Exports and Consumption.—Alaska Gold Mines and Dome Mines Report.—Mining Litigation in Many Directions.

Copper prices in New York were readjusted at the beginning of last week, May 19, the large sellers advancing their quotations to 15⅞c. for electrolytic, delivered 30 days, while at the same time quotations in the foreign market were lowered from 15.90c. to the same figure as in New York. C. S. Henry & Co., representing both the Amalgamated Copper Co., and the A. S. & R. representative both quoted £73 5s. for June shipments, a decrease of 5s. per ton, while Aaron Hirsch & Sohn cut the price of August metal to £72 17s. 6d., or 15⅞c. In New York the usual price-cutting in small lots that marks a quiet market was in evidence. On Wednesday the market dragged again, but the companies were able to maintain the price set, being sold well ahead. At the end of the week the market was still dull, though exports were large throughout the week, a total of 10,112 tons, an increase of 1736 over the preceding week. The total exports from January 1 to May 22 of this year amount to 158,727 tons, an increase of 23,037 over the corresponding period of last year. The National Cable & Conduit Co., one of the large users of copper, in its monthly circular to the trade states as follows: Domestic consumption continues on a large scale, and this favorable feature of the situation has contributed material strength to the market. The heavier export movement began in such pronounced fashion during March continued during April and is still in active progress. Europe has demonstrated her ability to absorb all the metal this country can possibly ship without creating any serious pressure on foreign consumptive capacity. Despite recent enormous exports, European copper prices improved lately, and it looks as if Europe is able to take care of all the copper the United States can spare. The high record of copper exports was reached in March, when, according to Custom House figures,

shipments of copper to foreign countries during that month reached the enormous total of 95,038,720 lb. April exports were also heavy and the total quantity exported during the last two months aggregates 169,012,480 lb., which is more than 62% of all the marketable copper produced in this country during March and April. These remarkable shipments indicate the extent and importance of the European demand for American copper. It is not probable that the entire amount exported has gone directly to consumers, but even admitting that a portion of the shipments represent consignments awaiting future disposal, there is no denying the fact that European consumption is at a rate requiring a steady stream of American supplies in heavy volume. This view of the case is no guesswork. If the present rate of home consumption and export shipments can be maintained, the danger to market stability should be reduced to a minimum. Present prices allow a reasonable profit for production, and around the current level are apt to prove more satisfactory to all concerned than fictitious or extraordinary values which ultimately disturb the equilibrium of trade.

The Alaska Gold Mines report was a feature of the week. Most of the important information contained in it had already been disclosed in connection with the listing of the stock in Boston, and was given in the *Mining and Scientific Press* of May 17. The balance sheets of the company show current assets of $681,295 and current liabilities of $85,734. Upon the organization of the company it was estimated that $4,500,000 would be required for equipment. Of this $1,250,000 has already been paid to the Alaska Gastineau, the operating company. When the remainder due on the half-paid shares is received, July 1, the funds thus realized will be turned over the Alaska Gastineau for development and equipment purposes. By a sad coincidence the report appeared immediately following the death of A. F. Holden, who was one of the chief movers in the organization of the company. His death will not seriously affect the enterprise, however, since for a number of months he had been too ill to take any active part in business affairs and in writing his friends at Christmas last he practically bade them farewell. He began his career in Bingham and throughout his life was prominent in Salt Lake City affairs, becoming interested in many Utah companies in addition to the United States S. R. & M. Co. of which he was managing director. A special meeting of the Dome Mines, Ltd., was held at Toronto, May 27, for the purpose of considering the proposal to increase the capital stock of the company to $5,000,000, so that an amount of not over 50,000 shares, par $10 may be offered to shareholders for subscription. The funds thus provided will be used for extensions and changes in the equipment of the mill. An unusual departure in the case of the Dome was the publication, for the first time, of full data concerning the mine, which appears elsewhere in this issue.

Charles B. Flynn has won his suit for $416,350 damages against W. H. Brevor, Willis McNormick, C. K. McNormick, T. T. M. Raborg, G. M. Luther, Otto Germer, Barnard M. Baruch, Payne Whitney, and Samuel Newhouse. Flynn, who is an experienced Alaskan prospector, was commissioned to select promising territory in the Cobalt district for the syndicate, on a verbal agreement for 10% of the profits. Among the ground selected was the King Edward and Watts, and it was for his share in the profits of the promotion of these that Flynn brought suit through George Niner, as assignee. Possibly incident to this suit, or for other reasons, the *Sun* has again related the history of the Harney's Peak tin mines, in which Samuel Untermyer was the chief promoter. The story is ancient history, but is so remarkable that it is always interesting. A number of claims in the Black Hills, containing narrow and shallow tin-bearing veins which had previously been under option by the Phelps-Dodge people but then abandoned as worthless, were taken up by Untermyer and a group of associates and British investors were induced to put $2,000,000 into the Harney Peak M. M. & M. Co., Mr. Untermyer receiving $55,000 as a fee for his success in placing the shares in England. Trouble was not long in developing, and in 1894 the English investors brought suit in the federal District Court for an accounting, praying for an injunction to prevent the American directors from foreclosing the mortgage on the property. A. R. Ledoux was appointed receiver for the property and this fortunate circumstance was perhaps the only good luck the English investors had, for in some way the suit could never be brought to trial, counsel after counsel finding that pressure of other engagements prevented him from continuing to act. It was over 15 years before the suit was finished and the receivership terminated. Under Mr. Ledoux's management the property produced some spodumene and amblygonite, but tin in profitable quantities was never found. The story goes that the tin ore used to salt the dumps for the examining geologist was purchased with the funds of the company and was carted about from dump to dump as the examination progressed. Mr. Untermyer's part in the transaction is far from reflecting any credit on him, but he is far too clever a lawyer for anyone to 'get anything on him' unless they arise very early in the morning indeed.

THE BLACK HILLS, SCENE OF THE HARNEY PEAK TIN EXCITEMENT.

Another property of unhappy memory is the Union Copper Mines Co., which owns over 1000 acres in Rowan and Cabarrus counties, North Carolina. The Stock Exchange house of S. H. Rosenblatt & Co. undertook a booming campaign of Union stock two years ago and ended in bankruptcy, though W. G. Newman, who also industriously rigged the market, came off much better. The deposits consist of rather narrow veins of oxidized ore and chalcopyrite in schist, and are regarded as of some promise if properly managed and developed. The shareholders were asked last week to contribute 10c. per share to furnish money for development, which has been suspended from lack of funds, as the directors do not care to advance any more of their own money. Judgment against the company has been obtained and it is in rather a low state. Other litigation of the week is the suit of the Union Bank of Brooklyn against F. Augustus Heinze to recover the principal on notes issued by him to the Mechanics & Traders National Bank, the predecessor of the Union Bank, of which Heinze was a director, and D. A. Sullivan, now in enforced retirement at Sing Sing, president. The district court of Portland, Maine, has denied the petition of G. M. Hyams for an injunction to restrain the Old Dominion Co., of Maine, from voting its stock at the adjourned annual meeting of the Old Dominion Copper M. & S. Co., of New Jersey. This is another suit which has dragged out for many years with no immediate end in sight. A. S. Bigelow and the estate of Leonard Lewisohn are suing the Old Do-

minion for recovery of promotion profits, and the suit is as complicated as it has been protracted. In the case of the Nevada-Utah M. & S. Co., the court has affirmed in the order of the referee in bankruptcy in allowing the claim of McCormick & Co. for $25,000. Reorganization of the Boston & Corbin is proposed, since it has been found impossible to float the proposed issue of $150,000 in convertible bonds. The company has an indebtedness of $190,000, but has $150,000 due it for concentrate shipped. It is suggested that an assessment of $1.50 per share be levied, which would provide $100,000 working capital after clearing off all debts. A feature of the reorganization will probably be the elimination of N. L. Amster as president.

Reports from the Braden state that production for the first half of May amounted to 20,640 tons of ore, yielding 1884 tons of concentrate and 488,000 lb. of fine copper. Recovery in the Minerals Separation plant is reported as only 69.8%, but no reason is assigned. At the Ohio Copper, 71,225 tons of ore averaging 1.045% copper was handled during April at a total cost for mining, transportation, and milling of 82c. per ton. The company is now making about $20,000 per month, the concentrate in April having yielded 690,000 lb. copper.

Another case of corporation profits, in this case putative, is seen in the financing of the Chili Copper Co. It will be remembered that there are $95,000,000 in shares, and $15,000,000, in convertible bonds to be issued, for equipment and operation. In some quarters much disquiet is felt over the "great profits of the Guggenheims," who, by clever technical knowledge and skill, reap $95,000,000 in share profits from an enterprise in which they risk only $5,000,000 in cash, their share of the bond issue. As to this alone there is no just cause for disquiet; if John Smith could borrow $5000 on the strength of a promising outcrop of quartz, and proceed to take out $100,000, it would be an evidence of good luck and good mining. It may be argued that in the latter case the risk is greater and the profits are therefore legitimate, but the greater security of corporate undertakings is scarcely a logical reason why corresponding profits should not be reaped, if they are so fortunate as to produce them. So long as the $95,000,000 in shares remains in the hands of the promoters of the enterprise, nothing but approval is merited. If, however, it should chance that they filter gradually into the possession of the public at a price near par, and the estimated working profit, which has thus been capitalized, eventually fails to reach the amounts expected, the results would be deplorable. There is every reason to believe that the Chuquicamata property will prove an immensely profitable one, but the promoters would do better to take their profits in the form of 200% dividends on a capitalization of $5,000,000, than to anticipate all possible profits by a large stock issue.

BOSTON

GIROUX CON. BRINGS STRONG INTERESTS TOGETHER.—DAVIS-DALY IMPROVING.—'ANOTHER BUTTE' PROMISED.—HAYDEN-STONE COMPANIES.—IRON CAP.—SOUTH LAKE.

A feature of the merging of the Giroux Consolidated and Coppermines companies at Ely is the probability of James Phillips, Jr., being one of the principals in the company. Mr. Phillips made a gallant but unavailing fight against the control of Nevada Consolidated being acquired by the Utah Copper Co., and ever since that time has been but little quoted in connection with the Ely district, where he was formerly one of the foremost factors. He has since been engaged in developing a copper property near Chitina, Alaska, and not long ago he gave copper mining interests a surprise by acquiring control of the Tennessee Copper Co. The new Ely merger will bring together a number of the most important copper groups in the country, such as the Gunn-Thompson, the Cole-Duluth, the Giroux family, and the Phillips.

There is a strong belief in Boston that the Davis-Daly property has at last developed from a prospect to a mine, and this feeling has been reflected in a better price for the stock, which is now selling at more than double the quotations of last February, when a report was circulated to the effect that the management had abandoned the workings on the 1900-ft. level. Charles G. Schirmer, secretary of the owning company, has returned from a trip to the mine and confirms the news that the Hesperus orebody on the 1400-ft. level assays about 4½% copper and from 8 to 10 oz. of silver per ton. Davis-Daly is understood to be making a profit of around $200, with a mine payroll of $600 to $650 per day. It is expected that by July 1 shipments, which are now 200 tons per day, will be increased to 300 tons, which will result in the doubling of earnings. Davis-Daly has about 3000 stockholders, the majority of whom reside in New England, and there has been a better feeling toward the company since the executive offices were removed from New York to Boston, following Mr. Heinze's relinquishment of the presidency. In October 1911, Freeman I. Davison, of the Butte Central Copper Co., left here on May 21 for Butte and Beaverhead county, Montana, where he goes to organize a $10,000,000 corporation to be known as the Montana Mining & Development Co., and a $3,000,000 corporation to be known as the Montana & Pacific Railway Co. The mining and development company will take over 120 claims in Beaverhead county, where it is said rich outcroppings exist and from which limited shipments of high-grade ore already have been made. The railway planned is to be an electrified standard-gauge road connecting the new camp with the railroad. It is said that prominent Montana officials, former Amalgamated financiers and Canadian magnates, will be on the boards of these two companies. The promoters are already claiming that they have another Butte in prospect.

The first annual reports of the Alaska Gold Mines Co. and the Butte & Superior Co., known here as Hayden-Stone specialties, have been made public. Butte & Superior claims a supply of zinc ore averaging 21.7%, which will last the company for six years. Its balance shows $519,000 cash on hand. The company is making rapid progress with its mill. The original territory of 89 acres has been increased until the company now controls, through ownership or option, 245 acres. The Alaska Gold Mines Co. claims that it will have $3,250,000 cash after the second and final payment of $5 per share has been made on July 1. It expects to get upon a full operating basis the latter part of next year. The directors of the Shattuck-Arizona company will meet June 14 to declare a dividend payable on July 20, and it is said that it will be the policy of the management to declare thereafter regular quarterly dividends.

The Iron Cap Copper Co. has resumed shipments to the smelter at El Paso upon notification that the ore could be handled there. The company is employing 17 men at the property in Globe and the ore shipments are paying all costs of production. This company is a reorganized one, which is being managed in Boston by plain old-fashioned business men who expect to place it on a strong footing. The company has sufficient cash to provide for its immediate needs and $18,000 on subscription to its shares, a portion of which is due June 1 and the remainder in installments thereafter. The 10,000 shares of treasury stock recently issued by the South Lake Mining Co. and offered to stockholders at $6.60 per share, were underwritten for a commission of 10% by a group of interests understood to be close to the United States S. R. & M. Co. It is understood that practically all of the stock was taken by the underwriters, the response from the stockholders being very small.

Much attention is directed from time to time to the United Verde Extension property, at Jerome, Arizona, where strenuous efforts are being made to develop a commercial mine, notwithstanding the oft-repeated saying that W. A. Clark has preëmpted everything of value in that district. Since the Douglas and Ryan interests have taken hold of United Verde Extension, there has been a disposition here to await developments with more confidence and seriousness. It is said that shaft-sinking is proceeding rapidly, and that the workings are being driven through an oxidized formation containing copper, silver, and gold.

General Mining News

ALASKA

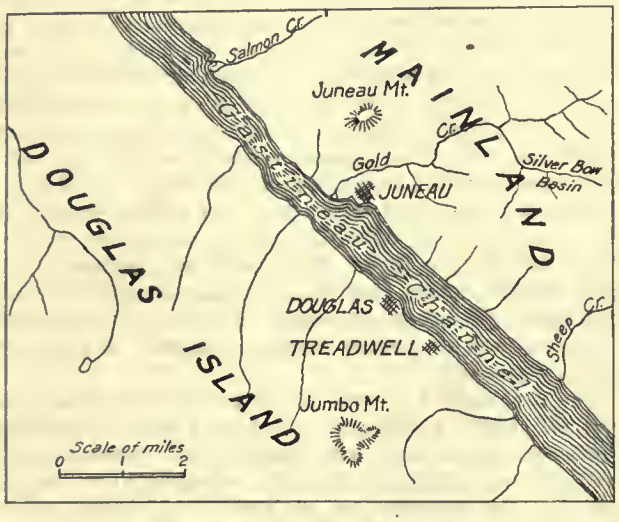
Coal consumed or imported into Alaska during 1911 totaled 1,440,104 tons, of which 36,314 tons was produced in the territory.

FAIRBANKS

Drilling on the lower end of 3 Above Discovery, Fairbanks creek, has proved gravel to be 175 ft. wide, averaging $4 per square foot. The Manley hotel and natatorium at Hot Springs, on the lower Tanana river, has been destroyed by fire. The loss is estimated at $125,000.

JUNEAU

The Alaska Mexican, Treadwell, and United companies paid dividends of 30c., $1, and 60c. per share, respectively,



SITUATION OF THE TREADWELL GROUP.

on May 28. During April, the Mexican and United mines produced the following results:

	Mexican.	United.
Development work, feet	122	945
Stock of broken ore decreased, tons	12,834	9,157
Stamps working	120	240
Days	29.73	29.55
Ore crushed, tons	18,795	37,968
Concentrate saved, tons	395	849
Total gold production	$48,075	$85,663
Operating expenses	21,394	51,007
Construction	1,705	1,705
Net profit	24,975	32,950

During April the Alaska Treadwell 240 and 300-stamp mills crushed a total of 60,452 tons of ore in 25 days, the loss of running time being due principally to an accident to the head-frame, since repaired. Production by amalgamation was $79,205 and by cyaniding 1253 tons of concentrate, $72,522, a total realizable value of $150,209. The average per ton milled was $2.51. Operating expenses were $85,162, and construction, $6618, leaving a profit of $58,429. Development covered 944 ft., and the stock of broken ore decreased 498 tons.

An association of employees known as the Treadwell Club has erected a building 56 by 206 ft., which contains a reading-room, pool and billiard-room, bowling alleys, an auditorium with a seating capacity of 500, baths, and lavatories. A natatorium containing a swimming pool 70 by 30 ft., tub, shower, and steam baths is maintained in conjunction with the club. The membership fee is $1 per month, which entitles the members to all privileges of the club and free admission to the entertainments.

ARIZONA

GILA COUNTY

(Special Correspondence.)—At the main east and west shafts of the Inspiration mine, surface work is progressing rapidly, excavation for the crusher and railroad building being near completion. When built, the crusher will reduce the ore to 1-in. size. It will then be conveyed to a 25,000-ton bin along the railroad, whence it will be hauled by rail to the mill. The ore-bin will be 250 ft. in length. The American Smelting & Refining Co. has commenced operating its third converter at the Hayden smelter.

Miami, May 22.

The Ray Consolidated Copper Co. has started the erection of a large launder for the purpose of carrying tailing from the local mill. This will be a permanent structure and is being lined with cement so as to prevent leakage. Heretofore, launders have been erected only temporarily, with openings in the bottom for the purpose of building dams, back of which the tailing was dumped. As the available ground around the mill has been all filled up, it has become necessary to carry the tailing down into the valley.

GRAHAM COUNTY

At the Old Reliable mine of the Calumet & Copper Creek Mining Co. at Mammoth, three stope leads are cut through the orebody, a length of about 500 ft. Two others are partly opened for 400 ft. in length, two others are approximately 100 ft., and two additional leads have just been started. There are also about 300 ft. of cross-leads completed, and the raise which is being driven to the surface is now up 70 ft. The shaft from the surface is about 60 ft. in depth, leaving 110 ft. of ground to be broken through. The lower adit has been timbered throughout, and driving has been in progress during April, about 50 ft. of advance being made. This adit will connect with No. 2 winze, 100 ft. below the present adit level, and will add greatly to the ventilation of the stope workings. No. 2 adit will open more than 1,000,000 tons of commercial ore below No. 1 level, and will greatly increase the capacity of the mine. During March and April an air-compressor was installed. The annual production of copper is about 2,500,000 lb., and a steady increase is predicted.

MARICOPA COUNTY

(Special Correspondence.)—On account of the Carrey mines being situated in the forest reserve, it will not be possible to erect the smelter at the mines, so it is understood that the reduction works will be built at Queen Creek station on the Arizona & Eastern railroad, 36 miles east of here, or at least in that vicinity. Water is found in large quantities at a depth of about 100 ft. or less, and a large plant will be erected at that point. Queen Creek station is only about 16 miles from the mines, down grade all the way, and no difficulties are expected in transportation, and there is no reason why the undertaking should not prove successful. Suit has been filed in the office of the clerk of the United States District Court by the Mine & Smelter Supply Co., of Denver, against the Miami Mining Co. for infringement on certain patents held by the former, to protect an invention for a concentrator. Suits in the same case have been previously filed against other mining companies doing business in this state.

Phoenix, May 22.

PIMA COUNTY

Eighty oil claims in the Catalina district have been located by John Mets, a banker of Tucson.

PINAL COUNTY

(Special Correspondence.)—Just south of Superior, the Calumet & Arizona's new 3-compartment shaft is now 325 ft. deep, and is passing through a quartzite and iron formation. The shaft is being sunk at the rate of 180 ft. per month. The large working adit is 650 ft. long. The new transmission line and the recently installed electric machinery are working satisfactorily. The Magma Copper Co. has increased its mining force, and is extracting high-grade ore in such quantity that its present freighting equipment has proved inadequate. Three auto-trucks have been sent for, to aid the teams that formerly carried the company's output between the mine and railroad station at Florence. From Florence, about 30 miles from the mine, the ore is shipped by rail to the smelter at El Paso. In the Mineral Hill district, about 10 miles south-

west of Superior, considerable development is now in progress. At the Ajax mine, men under Frank Benedict are sinking a new shaft, which is now down 125 ft., and a contract has been let for further development on the property. The Magma company, of Superior, has taken over the Ramett mine adjoining the Ajax property, and men are now employed at road construction and erection of tent houses, in preparation for development of the group. The chief engineer of the Gunn-Thompson company has recommended an expenditure of $200,000 for development on the Reynart group.

Superior, May 20.

SANTA CRUZ COUNTY

A 50-hp. hoist has been installed at the Three R. mine. There are 128 men employed, and shipments will soon average 100 tons per day of 9% copper ore.

YAVAPAI COUNTY

During the first three months of this year, at the Vulture mine, development has covered 310 ft. on the 850-ft. level, 76 ft. at 900 ft., 510 ft. at 950 ft., and 117 ft. at 1050 ft. Gold bullion produced in the mill totaled $135,000, not including concentrate.

Additions to the Climax mill will consist of 10 stamps from the Hidden Treasure mine, a tube-mill, and a 50-ton cyanide plant to treat accumulated tailing. The Safe Mining Co. is erecting a new mill. The Cherry Creek district is active at present.

The Humboldt smelter will resume operations in June. The Bluebell mine has sent as much ore as the plant could handle, and a concentrating plant was erected. This mine is developing well.

CALIFORNIA

BUTTE COUNTY

The Ophir Gold Dredging Co., of Oroville, has filed a suit for $500 damages against James H. Leggett, and a restraining order, preventing him from stopping the plaintiff using a highway south of the town, known as Leggett's lane. An agreement in 1903 gave the company permission to use the lane, which is on property owned by Leggett. Various allegations are made on both sides.

CALAVERAS COUNTY

(Special Correspondence.)—A friendly suit has been started by the owners of the Morgan mine on Carson hill, against the Melones Mining Co., to settle a question as to the exact position of orebodies in their respective properties. The Melones Mining Co. deserves a great deal of praise and encouragement for its progressive methods, and is meeting with the success it deserves. There was recently opened a rich vein, which promises to make this mine one of the most valuable on the Mother Lode. Suit has been filed by the Aetna King Mining Co. against the Utica Mining Co. for trespass. The Aetna King mine has been idle for a number of years, and is full of water. It is equipped with a 10-stamp mill and steam hoist. G. McM. Ross, of Stockton, is the consulting engineer. Joe Curtis, of Los Angeles, and Walter Curtis, of Stockton, are pumping out the old Tullock mine of Albany Flat. This is one of the promising properties of this district, and their work is being watched with interest.

Angels Camp, May 20.

The Calaveras Copper Co. is treating about 300 tons of copper ore daily at its Copperopolis smelter.

PLUMAS COUNTY

An expedition has been planned to explore the Bald Rock canyon, which lies below Fall River falls, on the middle fork of the Feather river. It is suggested that, as a large quantity of gold has been recovered from the Feather river district, there should be more in the canyon to be prospected.

An adit 400 ft. long is being driven at the Glacier mine, in the 'lava cap' district on the north fork of the Feather river. Prospecting is to be done on the Cameron property, which is a few miles from the Nevis dam of the Great Western Power Co. Shafts will be raised every 50 or 60 ft. to cut the old gravel channel. At the Mother Lode mine, the cyanide plant is being put in order for the season's work.

SHASTA COUNTY

Three farms of 160 acres each, near Gas Point, have been bonded by the Shasta Mining & Dredging Co., which has operated a large dredge at Horsetown, 10 miles north, for several years. Shafts will be sunk to bedrock, an average depth of 16 ft. The new furnace at the Heroult smelter has been running uninterruptedly for 22 days, turning out 24 tons of good iron per 24 hours. Four carloads, or 220 tons, were shipped last week, consignments being made to points as distant as Utah. The old furnace will soon be in shape to run. The company plans to have five furnaces in all, running three all the time. The ore averages 70% iron. At the refinery, charcoal is burned and wood by-products are saved in the process. There are 20 retorts, each of a capacity of 2¼ tons of wood. Important by-products saved are creosote, wood alcohol, tar, acetic acid, acetate of lime, and wood oil. About 4000 hp. is used at the smelter.

SIERRA COUNTY

Reconstruction of the Rainbow surface plant, near Alleghany, is being rushed, and may be in operation during the summer. The Keystone quartz mine is to be further developed by the main adit. Good progress is being made in the Herkimer adit, at Bunker hill. The drift at the Monte Cristo gravel mine is being extended about 195 ft. to open the channel worked by the old company. Good gravel has been opened at the Mountain House property. Drifts have been driven 250 ft., while cross-cuts have been driven 95 and 10 ft. without reaching the limits of the deposit. At the Dragon Fly mine, eight miles from Downieville, rich gold-bearing gravel has been opened. An adit was driven 1000 ft. to cut this channel, and nuggets are now being found.

TEHAMA COUNTY

A. L. Conard shipped a specimen of ore, weighing about 1000 lb., to Redding, to be exhibited at the mining congress held there last week. The ore is a piece of the product of the Tom Head mines, near Red Bluff, and shows a high percentage of copper.

COLORADO

CLEAR CREEK COUNTY

(Special Correspondence.)—A streak of ore from 2 to 3 in. wide was recently uncovered on the Donaldson vein on Donaldson mountain, showing assay values of 1671 oz. gold and 699 oz. silver per ton. Since then, the drift has been extended 40 ft., with the shoot still being in evidence. John Larsen is manager. The Argo mill, near the portal of the Newhouse tunnel, is treating $4 ore. A shipment of 100 tons of this material from the Seaton mine brought a settlement of $1.48 per ton net. E. D. Jayne is lessee of the mine, and A. H. Roller manager of the mill. The Commodore holdings on Red Elephant mountain, embracing 60 acres of mineral-bearing land, have been sold to Mrs. H. Etta Minier, representing the Little Giant G. M. Co. Among the mines included are the White, Boulder Nest, Free America, Young America, and Shenandoah, two adits, one of which has been driven 3000 ft., power-house, and other buildings. It is proposed to convert the power building into a mill. The Tabor adit is to be driven 800 ft. to undercut the Little Giant shaft by 400 feet.

Idaho Springs, May 20.

CONEJOS COUNTY

It is stated that the Golden Cycle Mining Co. of Cripple Creek has options on a number of properties at Platora. From various reports, it would seem that the district will prove to yield low-grade ore.

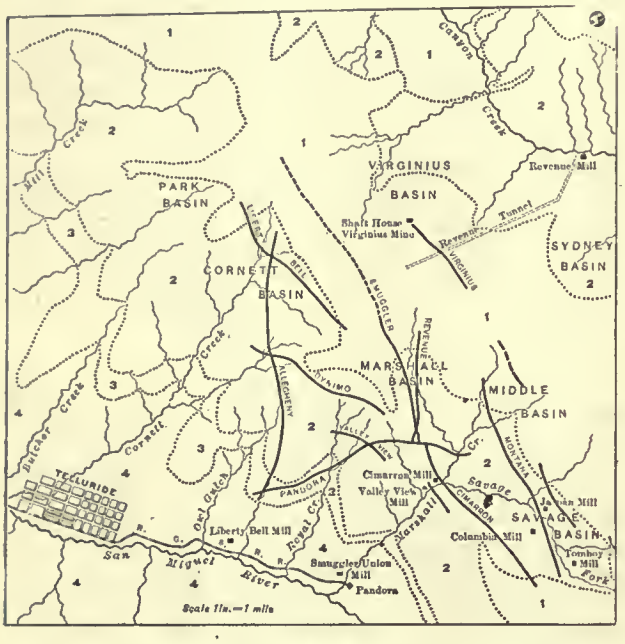
TELLER COUNTY (CRIPPLE CREEK)

At the El Paso mine, work is under way cleaning out the 'muck' in the bottom of the shaft from the 1000-ft. level to the Roosevelt drainage tunnel. This was made possible by the recession of water. The Joe Dandy and Raven

Hill companies, controlling 126 acres on Raven hill, are being amalgamated. The Cripple Creek District Aerial Tramway Co. has been formed with a capital of 250 shares of $100 each, to erect a tramway and transport ore from the Battle mountain mines.

THE SAN JUAN

The Tomboy mill treated 11,000 tons of ore in April, yielding $31,000, and $47,000 from shipment of 1550 tons



PART OF THE SAN JUAN.

of concentrate. The total realizable value was $78,000. Operating expenses were $48,500, leaving a profit of $29,500.

IDAHO

BONNER COUNTY

The Idaho-Continental Mining Co. has borrowed $200,000 from the International Smelting & Refining Co. of Utah, and is now asking for another $125,000 for work at its property at Porthill.

The H. & M. Mining Co. has commenced development of its claims at Buckhorn. The ore carries gold and silver averaging $20 per ton. The company will spend $25,000 on road construction and development. Bad roads have hindered ore shipments so far.

SHOSHONE COUNTY

The 2200-ft. cable for the aerial tramway of the Tyler lease, above Wardner, required an eight-horse team to haul it from Kellogg. Miners employed at the Sidney Shonts lease, on Big creek, are on strike, demanding $4 per day. Work is to be resumed at the Laclede mine, near Wallace. This property lies between the Hercules and Tamarack & Custer. The Idaho-Knickerbocker Mines Co. is in trouble on account of numerous labor liens against it. The Nabob Mining Co. held its annual meeting at Kellogg on May 19, and reëlected all old officers with one exception.

The long adit being driven by the Hercules Mining Co. from the Humming Bird ground, through the Stanley, into the Hercules, is now in 7500 ft., and will be ready for work in November. This adit will serve as the main working outlet for the Hercules. Operations have been resumed at the Moonlight, near the Hercules, which was temporarily shut down on account of water troubles. The adit into the Trade Dollar ground is in 1000 ft., and is being extended. The Stewart Mining Co. has declared a dividend of 10c. per share, amounting to $125,000.

MISSOURI

JASPER COUNTY

The St. Louis-Joplin Lead & Zinc Co. owns 400 acres of property in the Chitwood district. Drilling has cut good ore and is being continued. In parts, the galena was found within 6 ft. of the surface, and the formation seems to be general to a depth of 40 ft. Zinc ore is found at 155 ft., and continues to 206 ft., with a thick stratum of low-grade mineralized country below that point. The company has started mining operations in the shallow lead ore.

ST. FRANCOIS COUNTY

(Special Correspondence.)—At the annual meeting of the St. Joseph Lead Co., May 15, 89% of the stock was represented. The old directors were reëlected by a three-to-one vote. W. F. Sheehan, representing the Holmes interests, urged the formation of a new committee to bring about a consolidation of the various companies affiliated with the St. Joseph concern. The majority stockholders offered instead representation on the existing committee. The report of the president, Dwight A. Jones, for the year ended April 30, 1913, which was presented at the meeting, showed that the company's smelter at Herculaneum, Missouri, had produced 60,847 tons of lead. The net income, after paying all expenses and charges and setting aside $75,000 for depreciation, was $637,910, in comparison with $598,082 in 1912. Dividends amounting to $597,300 were paid, being 6% on the capital stock. The combined assets of the company and its two subsidiaries, the Mississippi River & Bonne Terre railway, and the Bonne Terre Farming & Cattle Co., are placed at $19,000,000 in the report, while the total indebtedness of the three companies is $3,000,000. Lands purchased by the company for $300,000 in 1899 have since yielded lead of a gross value of $15,000,000.

St. Louis, May 23.

MONTANA

SILVERBOW COUNTY

(Special Correspondence.)—The payroll of the Butte mining companies for the month of April aggregated $1,350,000, which is within $150,000 of a record month. The miners at the present time are being paid at the rate of $3.75 per day, according to agreement, wages being regulated by the price of copper. Advices have been received in this city that C. S. Bradley, who is still in the East, has promises from men of financial standing, of assistance to operate the plant at Anaconda for the treatment of slime and tailing. It will be at least several months yet before the Anaconda company is sending its ore to the Washoe smelter by electric haulage, though the yards of the railway company in Anaconda have been equipped for the operation by electricity, and a few days ago, in the presence of a large number of railway officials, tests were made with two electric locomotives. The electric locomotives pulled trains of ore even larger than those hauled by steam, and even then were not working to full capacity. Every effort is to be made to have the electric cars running by September 1.

Butte, May 17.

The North Butte has recovered ore in the faulted Adirondack vein on the 2400-ft. level. It is 10 ft. wide and has an average copper assay of 5%. The company was searching for the vein for some time, and the find shows it has a continuation much farther west than has been anticipated.

NEVADA

CHURCHILL COUNTY

The Broken Hills district is about 15 miles north of Lodi, and rich silver-lead ore has been opened by C. Read and J. H. Woodmansee of Salt Lake City. There are 12 lessees at the property, seven of whom are working in ore. Shipments are being sent out.

ELKO COUNTY

(Special Correspondence.)—The Flaxie mine is one of the most promising in the Jarbidge district. On the 50-ft. level and in a winze 35 ft. deep, a rich shoot, 18 in. wide, has been opened. At the Buckeye group, a vein showing gold has been opened for about 1500 ft., being 2 to 10 ft. wide. Three separate shoots were found on the surface. The property is easily developed by adits. The

first shoot is 32 ft. long and 8 ft. wide, and the second about 90 ft. long and 2 to 6 ft. wide. The Enterprise Mine & Tunnel Co. is driving a tunnel 7 by 9 ft. in the clear, to act as an outlet for the ores of mines on its course. C. E. Hayden is president. Eastern people are interested. The Legitimate group, near the Flaxie, is developing well. An adit cut 3 ft. of ore, and a winze has opened 4 ft. averaging $33 per ton.

Jarbidge, May 22.

NYE COUNTY

A 500-kw. transformer at the sub-station of the Nevada-California Power Co. at Tonopah was burned out on May 18, having been struck by lightning. This plant has been unfortunate, as twice in the latter part of 1912 it was badly damaged by fire. During April, 9 mines at Tonopah produced 45,481 tons of ore. During the week ended May 24, 11,114 tons of ore, worth $245,050, was treated. In the western section of the Merger mine, on the 1070-ft. level, a new shoot was opened. The orebody in the West End is averaging $30 per ton. At 600 ft. in the MacNamara 4 ft. of $100 ore has been opened.

STOREY COUNTY

The Mexican Gold & Silver Mining Co. is the cause of a suit between George E. Ames, a shareholder, and the five directors of the company, the former alleging wrongful use of the company's cash. During the week ended May 24, the Comstock Pumping Association's pumps worked full time. The east drift from the C. & C. shaft 2500-ft. station was cleaned out, and repaired 79 ft., making a total of 279 ft. The Mexican company has refused to pay its proportion of maintaining the pumping association, and men have been laid off in consequence.

WHITE PINE COUNTY

At a depth of 380 ft. in the McDonald Ely, and 170 ft. east of the station, an ore-shoot containing chalcopyrite, bornite, and glance was found in the porphyry. The ore varies from 13 to 40% copper, and $2.20 per ton in gold and silver. The several shafts at this property are down 65, 80, 165, 250, and 400 ft. The 218-ft. cross-cut from the Robust shaft has opened good copper ore; and in the Wall adit there is a vein of iron ore 21 ft. wide. Ore-bins are being built at the Golden Gate shaft.

OREGON

JACKSON COUNTY

Ashland, in this county, has been chosen as the meeting place for the next annual session of the Northern California and Southern Oregon Mining Congress, which has just concluded a four-days session at Redding, Shasta county, California.

JOSEPHINE COUNTY

(Special Correspondence.)—New York and Chicago people are bonding 840 acres of ground in the Waldo district, on the Illinois river. This property will be tested for hydraulicking and dredging. On the Rogue river, 140 acres has been purchased by Washington and Oregon people for $50,000. Prospecting has proved this ground to be valuable, and $50,000 will be spent in equipment. Los Angeles people have been testing property on the lower Rogue river for about three years.

Philomath, May 22.

UTAH

GRAND COUNTY

The reported oilfield in this county, southeast of the Green river, has been examined by members of the United States Geological Survey.

JUAB COUNTY

The Gemini company at Tintic has paid a dividend of $10 per share, making $50,000, and $2,180,000 to date. Rich gold and silver ore has been opened for 90 ft. on a drift 40 ft. below the 1300-ft. level of the Eagle mine. Shipments are being made. From stopes between the 500 and 600-ft. levels of the Iron Blossom, 185 tons of ore returned nearly $25,000 net. This ore was rich in horn silver, contents being 214 to 265 oz. silver, and $7 to $8 gold per ton.

SUMMIT COUNTY

A suit has been filed by the Silver King Consolidated Mining Co. against the Silver King Coalition Mines Co., for $750,000, for alleged wrongful extraction of ore from the Electric Light claim, Cumberland, and Ural mining claims, and lots No. 666 and 732, during the past five years. The defendant company denies that any work has been done within 100 ft. of the claims mentioned, and declares that the suit is a stock-jobbing scheme.

CANADA

BRITISH COLUMBIA

The Labor Commission has been investigating the situation in this province, to report to the provincial Government. The general feeling seems to be an amicable one between employers and employees.

For the first 21 days in May, Granby treated 71,619 tons of ore from its mines at Phoenix, and 899 tons of custom ore, from which was extracted 1,046,000 lb. of blister copper.

ONTARIO

Experiments made by C. Spearman, of the Haileybury High School, on the Kirkland Lake ores, showed the presence of tellurium. While not of commercial value, this mineral will add to metallurgical troubles. The Foster 5-stamp mill is treating 15 tons per day. The Porcupine power situation has improved during the past week. Probably the Dome mill will be enlarged to 1000-ton daily capacity. Ore reserves are 315,528 tons of $7.53 per ton value above the 45-ft. level. The Porcupine Reserve company is testing its Tisdale properties by diamond-drilling. The McKinley-Darragh mill treated 4600 tons of ore, yielding 171,028 oz. silver in April. During the four weeks ended April 22, the Hollinger mill treated 11,357 tons of $23.44 ore, with 95% extraction. The profit was $179,942, and for the first four months of the year, a total of $549,894.

YUKON

The transportation companies operating between Dawson and the head of navigation on the Yukon river are making preparations for a traffic rate war. Passenger fares will be reduced 50 per cent.

MEXICO

CHIHUAHUA

Owing to the scarcity of fuel and other necessary supplies for the various mines and mills at Parral, the managers are seriously contemplating closing down their plants. The Alvarado Mining & Milling Co., one of the largest in the district, can operate only eight days more with the present supply. Other properties must close very shortly unless supplies are received within four or five days. It is estimated that in the event supplies are not received within a few days 4000 men will be thrown out of work.

PUEBLA

Frank F. Vaugh, an American residing at Teteia de Ocampo, has applied to the Department of Fomento of the Mexican Government for a concession to use 500 litres of water per second from the Isecahuasco river. A hydroelectric plant is proposed to supply power to the Puebla Mining Company.

SONORA

At Cananea, about 2300 men are employed by the Greene-Cananea company. One section of the concentrator, three blast-furnaces, and two reverberatory furnaces are in operation, the daily output being 70 tons copper. Work at the Zepiiote mine, near Tepic, is undisturbed, but supplies are short. The Arizpe and Chispas properties are also operating full time.

The Tigre Mining Co.'s mills and cyanide plants at El Tigre treated 5567 tons of ore and 7224 tons of current and dump tailing, yielding a total of $156,821. Mining, milling, concentrate treatment, and general expenses totaled $76,043, leaving a profit of $80,778.

Schools and Societies

THE TWENTY-SIXTH ANNUAL COMMENCEMENT of the South Dakota State School of Mines will be held on June 4, at Rapid City. On June 2, there will be an alumni banquet, and on the following day, a faculty reception at the institution, when everything will be open for inspection.

COLORADO MEMBERS of the American Institute of Mining Engineers met on May 15 at Denver, and organized a local section. Victor Alderson and Philip Argall were principally instrumental in bringing about the organization. The use of the rooms and library of the Colorado Scientific Society in Denver has been tendered.

A MONTHLY MEETING of members of the Geological Society of South Africa was held in the council chamber, Chamber of Mines, Johannesburg, on April 21. The following papers were discussed: 'The Occurrence of Sideroplesite and Ankerite in the Cassiterite Lodes at Roolberg,' by David P. McDonald; 'Note on the Origin of the Iridosmine in the Banket,' by R. B. Young; 'Structural Features of the Western Witwatersrand,' by E. T. Mellor; 'Notes on the Sea-Point Granite-Slate Contact,' by E. H. L. Schwarz; 'Note on Diamonds in the Banket,' by R. B. Young. A paper on 'Notes on a Section from Barberton to the Komati River,' by David Draper, was read.

MEMBERS of the American Institute of Mining Engineers and of the Mining and Metallurgical Society of America resident in and near San Francisco, signalized the recent vote of the two institutions in favor of affiliation by participating in a joint dinner at Hotel Bellevue, May 23. H. C. Hoover presided at the dinner. J. A. Holmes, Director of the United States Bureau of Mines, and also one of the directors of the Institute, was present as the guest of honor. Addresses were made by Mr. Holmes and by F. W. Bradley, H. Foster Bain, S. B. Christy, C. E. van Barneveld, and others, and a petition for a local section of the Institute was prepared and signed. A committee consisting of S. B. Christy, H. Foster Bain, E. H. Benjamin, F. W. Bradley, H. C. Hoover, W. C. Ralston, and M. L. Requa was appointed to prepare a plan for organization and submit it to a future meeting. There were thirty-seven members and guests present.

THE JOINT MEETING of the Spokane section of the American Institute of Mining Engineers and the western branch of the Canadian Institute of Mining Engineers, held at Rossland on May 22, was well attended. Besides the engineers, there was a considerable number of practical miners of the camp. Among those present were R. S. McCaffery, chairman of the Spokane section, of Moscow, Idaho; L. K. Armstrong, F. C. Bailey, George Crerar, J. Cleveland Haas, and D. F. Strobeck, of Spokane; H. W. Newton, of Republic; S. S. Fowler, manager at the Blue Bell mine at Riondel, British Columbia; E. E. Ward, of the Silver Hoard, Ainsworth; John Vallance, of New Denver; James McGregor, inspector of metalliferous mines, Nelson; C. A. Banks, of the Jewel mine, near Greenwood; R. H. Stewart, manager for the Consolidated company; Graham Cruicksbank, manager of the concentration plants of the Canadian Consolidated company; Alfred McMillan, of the Le Roi smelter at Northport; F. S. Peters, superintendent of the Le Roi; M. E. Purcell, superintendent at the Center Star and War Eagle; E. Jacobs; C. W. Drysdale, of the Geological Survey of Canada; C. Lonx, of the Consolidated company; and mining students of Washington and Idaho universities. M. E. Purcell called the assemblage to order and welcomed the visitors. E. Jacobs read a history of the district. An interesting demonstration of the Draeger pulmotor was given. S. S. Fowler read a paper on copper smelting by J. Campbell, superintendent of the Canadian Consolidated company's smelter at Trail. M. E. Purcell read an excellent paper on how the ore is handled at the surface of the Center Star. The attending engineers visited the Center Star mines.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

PHILIP ARGALL is in New York.

J. F. THORN is living at San Rafael.

ROSS HOFFMANN has gone to Alaska.

C. C. BROADWATER is at Santa Barbara.

POPE YEATMAN is returning from Chile.

C. W. MERRILL was in the city Tuesday.

HARRY LEE HUSTON has been in San Francisco.

HOWARD D. SMITH has returned from London.

J. F. NEWSOM was in San Francisco this week.

MAX J. WELCH is at Hotel Utah, Salt Lake City.

F. LYNWOOD GARRISON was in New York last week.

E. H. NUTTER has returned from British Columbia.

F. H. PROBERT is in the Patagonia district of Arizona.

THOS. H. LEGGETT has returned to New York from Mexico.

T. A. RICKARD sailed from Boston for London last Saturday.

FREDERICK B. REECE has returned to New York from Ontario.

RALPH STOKES is in Nevada and will go to British Columbia.

M. M. CARPENTER has returned to Tucson from Colombia, South America.

J. A. HOLMES and F. G. COTTRELL left for Los Angeles last Sunday night.

R. H. ELLIOTT has joined the staff of the Marysville Dredging Company.

JOHN B. FARISH has gone to New York, but will return to San Francisco early in June.

H. C. HOOVER has left San Francisco for London. He will return in about two months.

W. H. HARRISON mill superintendentent for Stratton's Independence, Ltd., spent April in the South.

FRANK G. WILLIS has been appointed consulting engineer for the Mary McKinney M. Co. at Cripple Creek, Colorado.

CYRIL H. JAMES has returned from Auk bay, Alaska, and is examining mining conditions along the Mother Lode in California.

HENDERSON SCOTT and D. GORDON SMITH have joined the staff of the Breitung Mines Corporation in Colombia, South America.

R. C. WARRINER, manager for the Crown Mines, Ltd., is in the United States on vacation. He will return to Johannesburg in October.

MONCRIEFF FINLAYSON, who has been in the Burma oilfields for the past three years, is visiting the California oilfields on his way to London.

LLOYD B. SMITH has resigned as professor of geology in the Carnegie Institute of Technology to join the staff of the Associated Geological Engineers.

F. B. WEEKS, who has been studying the iron ores of southern California for the State Mining Bureau, has completed the field work and gone to Hornbrook on other business.

JOHN C. MCLEAN, an old-time hoisting engineer on the Comstock Lode, died of heart failure last Sunday. He was one of the heroes of the Gould & Curry fire of 1887 and holder of a gold medal presented in appreciation of his services in rescue work on that occasion.

SAMUEL L. MOYER, first vice-president of the Lunkenheimer Company, died at his residence at Cincinnati, May 12. Mr. Moyer was born and educated in Cincinnati, and worked his way up from the ranks in the company that he served. He was a member of the American Society of Mechanical Engineers and an active member in the National Metal Trades Association, but also found time to devote to public affairs in his home city, where he was an important factor in many enterprises.

The Metal Markets

LOCAL METAL PRICES

San Francisco, May 29.

Antimony	12—12½c	Quicksilver (flask)	$41
Electrolytic Copper	16¼—16¾c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Spelter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES.

(By wire from New York.)

NEW YORK, May 29.—Copper is now easier and is being pressed for sale. Lead is unchanged. Spelter is decidedly weak, with pressure on the part of producers who find stocks accumulating. Gold shipments abroad have ceased, temporarily at least, as two steamers have gone out without any gold for Europe. Recent shipments to Paris alone have amounted to $12,000,000.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
May 22	60.00	April 16	59.80
" 23	60.00	" 23	59.77
" 24	60.25	" 30	60.56
" 25 Sunday		May 7	60.08
" 26	60.25	" 14	60.25
" 27	60.00	" 21	60.66
" 28	60.00	" 28	60.08

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	59.26	Oct.	63.16	....
May	60.88	....	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
May 22	4.33	April 16	4.33
" 23	4.33	" 23	4.39
" 24	4.33	" 30	4.50
" 25 Sunday		May 7	4.40
" 26	4.33	" 14	4.33
" 27	4.33	" 21	4.33
" 28	4.33	" 28	4.33

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.84	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	....	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as apelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
May 22	5.23	April 16	5.50
" 23	5.20	" 23	5.42
" 24	5.20	" 30	5.36
" 25 Sunday		May 7	5.31
" 26	5.18	" 14	5.28
" 27	5.18	" 21	5.28
" 28	5.18	" 28	5.19

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	....	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
May 22	15.50	April 16	16.37
" 23	15.45	" 23	15.44
" 24	15.45	" 30	15.26
" 25 Sunday		May 7	15.30
" 26	15.40	" 14	15.54
" 27	15.40	" 21	15.50
" 28	15.40	" 28	15.43

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	....	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
July	1912	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720
April	"	104,269,270	106,565,760
May	"	75,549,108	102,654,720

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
May	1912	126,737,886	72,702,237	69,485,945
June	"	122,315,240	66,146,229	61,449,650
July	"	137,161,920	71,093,120	60,121,600
August	"	145,628,521	78,722,418	70,485,150
September	"	140,089,819	63,460,810	60,264,796
October	"	145,405,453	84,104,734	47,621,342
November	"	134,695,440	69,369,795	55,906,550
December	"	143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February	"	130,948,881	59,676,402	72,168,623
March	"	136,251,849	76,585,471	77,699,306
April	"	135,333,402	78,158,837	85,894,727

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
April 30	41	May 15	40
May 8	40	" 22	40
		" 29	41

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	40.25	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	....	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

GOLD PRODUCTION FOR THE QUARTER

African gold production for the first quarter of 1913 shows considerable increase over that for the corresponding quarter of 1912. For the Rand the figures are 2,223,699 oz. and 2,180,995 oz. for the two years, respectively, though the output for March 1912 was unusually high owing to extinguishment of gold reserves. For the whole of the Transvaal the figures are 2,314,064 oz. and 2,271,949. For Rhodesia, the totals are 687,317 oz. and 639,764. In West Africa, the production was 193,690 oz. in 1913, and 78,335 in 1912. In India, there has also been a slight increase from £552,894 in 1912 to £557,606 in 1913. Western Australia for the quarter shows a small increase, the figures being £1,282,412 and £1,289,013, though Australasia as a whole probably will show a decrease. In the United States accurate figures by months are not available, but there has apparently been a decrease, especially notable in Nevada, where the Goldfield Consolidated produced $1,828,713 gross, as against $2,158,448. On the whole, the world's output, however, continues to rise.

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, May 28.
Associated Oil 5s	98
E. I. du Pont 4½s	83½
Natomas Con. 6s	90
Unlisted.	
Associated Oil 1st ref	80
General Petroleum 6s	59½

Unlisted.	Closing prices, May 28.
Natomas Dev. 6s	100
Pacific Port. Cement 6s	99
Riverside Cement 6s	77
Standard Cement 6s	91⅝
Santa Cruz Cement 6s	85
So. Cal. Cement	78

STOCKS.

Listed.	Closing prices, May 28.
Associated Oil	40½
Amalgamated Oil	82
E. I. du Pont Powder pfd	88
Pacific Coast Borax, pfd	100½
do com	80
Pacific Crude Oil	35c
Sterling O. & D.	1.00
Union Oil of Cal	80
West Coast Oil, pfd	70

Unlisted.	Closing prices, May 28.
Mascot Copper	1
Noble Electric Steel	10
Natomas Consolidated	9½
Pacific Coast Borax, old	206
Pacific Portland Cement	59
Riverside Cement	45
Standard Cement	17
Standard Oil of Cal	187
Santa Cruz Cement	34¾

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, May 29.

Atlanta	$ .16	Mizpah Extension	$ .50
Belmont	6.75	Montana-Tonopah	1.70
Big Four	.53	Nevada Hills	1.02
Buckhorn	1.30	North Star	.69
Con. Virginia	.11	Ophir	.12
Florence	.37	Pittsburg Silver Peak	.48
Goldfield Con	1.92	Round Mountain	.50
Halifax	1.20	Sierra Nevada	.07
Jim Butler	.82	Tonopah Extension	2.25
Jumbo Extension	.23	Tonopah Merger	.77
MacNamara	.17	Tonopah of Nevada	6.00
Manhattan Consolidated	.06	Union	.11
Mexican	.65	West End	1.15
Midway	.43	Yellow Jacket	.25

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	May 29. Bid	Ask
Adventure	$ 1⅛	2
Allouez	31	32
Calumet & Arizona	64½	64¾
Calumet & Hecla	440	445
Centennial	12	13
Copper Range	41⅞	42¼
East Butte	11¼	11⅝
Franklin	5	5⅛
Granby	61⅝	62
Greene Cananea	6¼	6⅜
Hancock	17⅞	18⅜
Isle-Royale	23	23½
Mass Copper	3¼	4

	May 29. Bid	Ask
Mohawk	$ 48	49
North Butte	28½	28½
Old Dominion	46	47
Osceola	81	86
Quincy	61	62
Shannon	8⅛	8⅜
Superior & Boston	2¼	2⅜
Tamarack	26	28
U. S. Smelting	38⅛	38¾
Utah Con.	7⅞	8
Victoria	1	1¼
Winona	1¼	1⅜
Wolverine	50	52

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

May 29.

	Bid.	Ask.
Alaska Mex	10⅝	11⅜
Alaska Tread	40⅛	42⅛
Alaska United	20	21
Alaska G. M.	11⅜	11¾
Braden Cop. 6s	138	142
B. C. Copper	3	3⅛
Davis-Daly	2⅝	2⅝
Dolores	2	4
El Rayo	1	2
Ely Con.	5	8
First Nat.	1⅞	2
Giroux	1⅞	2
Green-Can.	6⅝	6¾
Hollinger	17	17½
Iron Blossom	135	140
Kerr Lake	3½	3½
La Rose	2⅜	2½

	Bid.	Ask.
Mason Valley	5¾	6
McKinley-Dar.	1⅞	2
Miami 6s	168	173
Mines Co. Am.	2⅝	2⅞
Nipissing	8¾	8⅞
Ohio Copper	¾	⅞
San Toy	19	20
Sioux Con.	2	5
S. W. Miami	5	7
So. Utah	¼	⅜
S. O. Calif.	176	178
Tri Bullion	⅛	¼
Tuolumne	2⅛	2⅜
United Copper	⅜	¾
Wettlaufer	12	14
Yukon Gold	2⅝	2¾

LONDON QUOTATIONS

(By cable, through the courtesy of Catlin & Powell Co., New York.)

	May 29. £	s.	d.
Alaska Mexican	2	7	6
Alaska Treadwell	8	12	6
Alaska United	4	12	6
Arizona	1	18	9
Camp Bird	0	18	9
El Oro	0	15	0
Esperanza	1	1	3
Granville	0	13	9

	May 29. £	s.	d.
Mexico Mines	5	12	6
Messina	1	7	6
Oroville	0	6	3
Rio Tinto	77	0	0
Santa Gertrudis	1	5	0
Stratton's	0	2	6
Tanganyika	2	10	0
Tomboy	1	6	3

AUSTRALIAN

	May 29. £	s.	d.
British Broken Hill	2	2	6
Broken Hill Props	1	18	9
Golden Horse-Shoe	2	16	9
Great Boulder Props	0	12	6
Ivanhoe	3	1	3
Kalgurli	2	3	9

	May 29. £	s.	d.
Mount Boppy	0	17	6
Mount Elliott	5	1	3
Mount Lyell	1	5	0
Mount Morgan	3	10	0
Waihi	2	0	0
Waihi Grand June	0	17	6

CURRENT PRICES FOR CHEMICALS

The Roessler & Hasslacher Chemical Co., of New York, report as follows under date of May 13: The fair volume of business and the steady market which continues to prevail gives further evidence of the present sound basis of business conditions in general. That the position in the tariff has not so far affected the chemical line is probably due to latest Washington advices, which indicate that it will be still some time before a final decision is reached. Shipments of arsenic white have been resumed to Mexico. Tin oxide had reached 'bottom' at last advice, and has since advanced, the present price being 52c. per pound for original barrels.

Prices of chemicals, etc., of interest to the mining industry are as follows:

Alum, chrome, casks of 900 lb., per lb	$0.05
Ammonia, anhydrous, cylinders of 100 lb., per lb	0.30
Ammonium, sulphocyanide, commercial, barrels, 300 lb., per lb	0.25
Antimony, needle, fine powder, in barrels, per lb	0.05
Arsenic, white powder, barrels, 500 lb., per lb	0.05
Chromic acid, crude, tins, 50 lb., per lb	0.24
Cobalt oxide, black, tins, 10 lb., per lb	0.90
Cyanide, potassium, 38.4% cyanogen, cases 224 lb., per lb.	0.24
Cyanide, sodium, 51 to 52% cyanogen, cases 100 and 200 lb., per lb	0.26
Cyanide, mixture, 39.5% cyanogen, cases 112 lb., per lb.	0.21
Lime, chloride (bleaching powder), electrolytic, iron drums or casks, per lb	0.0175
Oxalic acid, in casks, per lb	0.085
Potash, carbonate, calcined, 80 to 85% in casks, per lb.	0.04
Potash, carbonate, 99 to 100% in casks, per lb	0.06
Potash, caustic, 90% KOH, fused in drums, 560 lb., per lb.	0.06
Potash, permanganate, large crystals, cylinders 112 lb., per lb.	0.16
Zinc dust, barrels 1600 lb., per lb	0.08

COPPER RANGE CONSOLIDAED COMPANY

This company controls operations at the Baltic, Champion, and Trimountain properties, and the Copper Range railroad, Houghton county, Michigan. Results from the individual mines are as follows:

	Baltic.	Champion.	Tri-mountain.
'Rock' stamped, tons	652,433	765,306	366,663
'Mineral' produced, lb.	24,444,810	28,460,500	12,417,575
Copper, contents, lb.	13,373,961	17,225,508	6,980,713
Price for copper, cents per lb.	16.16	16.16	16.16
Cost per pound, cents	10.94	8.88	11.73
Total receipts	$2,165,503	$2,785,411	$1,132,718
Operating expenses	1,406,679	1,471,592	783,564
Net profits	697,393	1,251,619	308,472
Total surplus	1,006,106	2,043,875	831,394
Dividends	700,000	1,100,000	300,000
Final surplus	306,106	943,875	531,394

DIVIDENDS PAID BY COPPER COMPANIES

Calumet & Hecla, payable June 20, quarterly of $10 per share.

Champion, paid May 21, $1 per share.

Chino, payable June 30, 75c. per share.

Nevada Consolidated, payable June 30, 37.5c. per share.

Ray Consolidated, payable June 30, 37.5c. per share.

Utah Copper, payable June 30, 75c. per share.

Company Reports

WAIHI GOLD MINING COMPANY

This is an important company operating 765 acres of mining property at Waihi, New Zealand, a 90-stamp mill in the same district, six miles of narrow-gauge railway to the 200-stamp mill at Waikino, extensive water-powers in these districts, and a 10,000-hp. hydro-electric power-station 51 miles from the mine. The report covers operations during 1912, which were considerably affected by a strike of miners, which has been noted from time to time in this journal. Reports issued by this company are models of 'how to do it,' and let shareholders know the general situation in a readable manner. Each department has its report published separately in the general report, and reference is easy. These are by H. P. Barry, superintendent; J. L. Gilmour, mine manager; E. G. Banks, metallurgist; and S. E. Fraser, W. P. Gauvain, W. Russell, and H. Roche, engineers at the various plants. Results may be summarized as follows:

WAIHI AND VICINITY.

Stamps in mills	290
Stamps working, 196, days	281
Tube-mills working, 16, days	281
Ore crushed, through 10-mesh screens, tons	147,828
Avearge value of ore:	
Gold, per ton	$ 8.50
Silver, per ton	1.69
Total	$10.19
Total recovery, per cent	89.70
Bullion from amalgamation and cyanidation, oz.	384,938
Bullion from 2094 tons of concentrate cyanided, oz.	99,240
Total value of bullion recovered	$1,385,130
Total expenditure at mine, mills, offices, etc	$835,500
Dividends paid	$715,200
Ore treated to March, 1913, tons	4,240,000
Value of bullion produced	$48,566,400
Dividends paid, including English and Colonial income tax	$22,769,300

At the mine, the principal development work was done on No. 10 level. East and west drifts have been driven on the Empire lode, and cross-cuts at regular intervals were disappointing. This also applies to the Martha lode. Gas on No. 9 level cross-cut interfered with work. The four working shafts are down 1179, 1214, 1268, and 1023 ft., respectively. There are 24 3.25-in. machine-drills in use and 9 'popper' or stoping drills, the latter being highly efficient. Development covered 7274 ft. Eight lodes contributed to the tonnage mined, the principal producers being the Martha, 74,821 tons; Royal, 28,096 tons; Empire, 25,557 tons; Edward, 22,387 tons; and Welcome, 11,171 tons. Ore reserves total 750,634 tons; broken ore in shrinkage stopes, 54,114 tons; and on surface dumps, 32,478 tons. The Cornish pumps raised 292,245,832 gal., and the electric pumps 20,920,235 gal. of water, equal to 1,565,830 short tons, or 10.5 tons of water per ton of ore raised.

MOUNTAIN QUEEN, LTD.

This company operates a gold mine near Southern Cross, in Western Australia, and the report covers the year ended December 31, 1912. During the term, the slime plant was erected and started, and the Transvaal mine, of 150 acres nearby, was acquired. This property has been well developed, and contains refractory ore, which requires special treatment. In the Mountain Queen mine, development covered 1986 lineal feet, and 15,145 cu. ft. of stripping and station-cutting was done at a cost of $15,500. On No. 1 level ore has been opened for 310 ft. On No. 2 the area exposed is a little less than on No. 1, the north drift being 246 ft. long, and from 126 to 160 ft. the ore averages $6.24 per ton over 68 in. Winzes have proved a good extension of the shoot. The 300-ft. level cross-cut has cut the vein, which assays $7.32 over 65 in., and $3.12 over 30 in. No work was done on No. 4 level. A claim of 12 acres was acquired for limestone, to be 'burned' and used in the mill. Ore reserves are estimated at 23,780 tons, worth $6.24 per ton, while the Transvaal mine has 48,500 tons, worth $10.56 per ton. The mill is equipped with two Holman pneumatic stamps and slime plant with a vacuum filter driven by a Kynoch gas-engine. Results were as follows:

Ore treated, tons	43,393
Gold production from ore and accumulated slime	$193,000
Operating costs	120,000
Surplus	43,000

ESPERANZA MINING COMPANY

This company is controlled in London by Esperanza, Limited, and operates a mine and mill at El Oro, Mexico. Results during 1912 were as follows:

Ore reserves, including 56,000 tons in old workings, tons	166,618
Ore treated, tons	124,888
Tailing treated, tons	85,838
Gold and silver production	$1,361,308
Net profit	298,325
Brought forward from 1911	348,312
Dividends paid	506,250

No development of importance was made on the San Rafael vein, the only ore opened being in the San Carlos vein. On No. 11 level the ore-shoot is 1100 ft. long, and extends from No. 9 to 12 level. The position is fairly promising. The directors are examining other mines for acquisition.

WAIHI GRAND JUNCTION GOLD COMPANY, LTD.

This company operates a property containing extensions of the Waihi company's vein system, on the east, at Waihi, New Zealand. After about 15 years general development, the company paid two dividends, but during 1912 operations were suspended on account of a frivolous miners' strike. The 40-stamp mill treated 41,712 tons of ore, yielding $360,000 and a profit of $100,000. Ore reserves total 187,750 tons. Development showed good results from the Empire vein; but the Royal vein is in disturbed ground.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

RESIDUE from the large number of mills treating copper ores in the United States is said to contain metal of more value than has been paid shareholders of the various companies in dividends.

THE CROTON WATER-SUPPLY for New York is to be filtered at the Jerome Park reservoir, if the recommendations of the engineers and Board of Estimate are passed. This scheme will cost about $9,000,000.

FELDSPAR is a compound of silica, alumina, and one or more of the bases potash, soda, and lime. There are two principal commercial varieties, the potash spar and the soda spar. The production in 1912 was 86,572 tons, valued at $520,562.

THE DONETZ COALFIELDS in southern Russia supply 40% of the fuel required by the government railways. During 1912 the locomotives and other equipment used 5,205,276 tons of coal, about 2,400,000 tons of mineral oil, and 340,000,000 cu. ft. of firewood.

ON manufacture of magnesite brick little has been published. The 'burning' of magnesite is much more difficult than that of lime, and it requires special skill and knowledge, to be able to burn the raw product, and then make bricks that will stand abrasion.

SAND-LIME BRICK was manufactured by 71 firms in the United States in 1912. There were 164,140,000 common and 10,221,000 'front' bricks made, worth $1,058,590 and $106,394, respectively. Michigan led in quantity of bricks made, followed by New York, Minnesota, Florida, Indiana, and Wisconsin.

LEACHING copper ore at the Braden mine, Chile, consists briefly in manufacturing sulphuric acid in a contact plant, leaching, and precipitation of the metal by an electric current. Essentially this process is being used at the Bullwhacker mine at Butte, and one or two other plants in Montana.

EXTENSIVE COAL DEPOSITS have been discovered at Udi, southern Nigeria, West Africa. Tests have proved the coal equal to 66% of the best Welsh coal. The lignite deposits are said to be from 15 to 20 ft. thick. This discovery is important for the general development of Nigeria, which country last year produced 2500 tons of tin.

FATAL ACCIDENTS in quarries in the United States are about 50% less than those occurring in metal mines. During 1911, there were 110,954 men employed in and about the quarries. Of these, 188 were killed, or 1.69 per 1000 men employed, compared with 3.73 and 4.19 per 1000 employed in coal and metal mines, respectively. The death rate in Great Britain was 1.08 per 1000, there being 79,010 employed.

BRIQUETTED FUEL made in the United States in 1912 amounted to 220,064 short tons, valued at $952,261. The industry showed no material gain over the previous year. Nineteen plants were in operation, 7 using anthracite culm, 9 using bituminous slack, 1 using carbon residue from gas plants using oil, 1 using anthracite culm and bituminous slack, and 1 using peat. Coal-tar pitch is mostly used as a binder.

EFFICIENCY of both white and black labor in Rand mines increased during 1912. At the City Deep, the tonnage broken per underground employee was 1362 and 151 tons in 1911, and 1773 and 184 tons in 1912, for white and black, respectively. At the Modder B, a prominent feature of the past year's work was the high efficiency obtained in breaking ore by machine-drills and hammer boys, and the cost of stoping was low.

Two Holman pneumatic stamps at the Mountain Queen mine, Western Australia, crushed 43,393 tons of ore in 6984 hours during 1912. The average duty per stamp per 24 hours was 74.56 tons. These stamps absorb from 15 to 22 hp. each, working at 123 to 135 drops per minute, and use 1200 gal. of water per ton of ore crushed through 12-mesh screens. Costs of treatment in this mill, including stamping and slime treatment, was $1.28 per ton during 1912.

ROASTING lead ores to a complete transposition of the lead sulphide to the oxide or sulphate form is practically impossible in any commercial type of furnace. A hand-worked reverberatory will, under special conditions, be able to reduce galena to as low as 1.5% sulphur. None of the ordinary mechanical furnaces work well on roasting galena, as the charge becomes too sticky. The Dwight-Lloyd sintering machine is, in some cases, able to reduce certain material from 9 to 1% sulphur.

PHOSPHATE ROCK must be tested to ascertain the percentage of phosphate of lime and carbonate of lime it contains, before proceeding with the erection of a plant or making shipments. In order to get soluble phosphoric acid, the carbonate must be converted to the sulphate form by acid. Hence, enough acid must be used to do this, and convert the tri-basic into a mono-basic phosphate of lime. In treatment, the rock is ground through a 30-mesh screen and treated with 50 to 55° sulphuric acid, to render the phosphoric acid soluble.

THE ASSUAN DAM, across the River Nile in Egypt, is primarily for irrigation purposes. It is stated that the Egyptian Irrigation Department proposes to use the water flowing through the dam for generating electric power. During five months in the autumn and winter, water is accumulated in the reservoir. It is estimated that 150,000 hp. could be generated by turbines and electric generators. The powder produced is to be employed in manufacturing chemical fertilizers from atmospheric nitrogen. In 1912, $3,250,000 was spent on fertilizers, 56,000 out of 70,000 tons imported being nitrate.

HAULING ore from the Codd mines at Rochester, Nevada, by Knox-Martin tractors costs $6.86 per round trip of 18 miles over rough mountainous country. The self-dumping wagons carry 10 tons of ore, so the cost per ton is 68c. This includes the wages of a driver and helper, distillate (8 gal.), oil, depreciation, interest and insurance, and repairs. The machines are equipped with steel tires. The West End company, at Tonopah, uses a Pierce-Arrow 5-ton auto-truck to carry ore from the mine to the mill, a distance of a half-mile. The machine makes 30 trips daily, or 30 miles. Actual running costs are 50c. per mile, or 10c. per ton. Repairs and renewals are under $100 per month.

AIR-LIFTS are used for the water supply of Griffon, Georgia, with a population of 7478 people. Four wells, each 500 ft. deep, are in use, No. 1 and 2 being 6.5 in. diam. at the top and 5 in. at the bottom, and No. 3 and 4, 8 in. and 6.5 in. respectively. The discharge and air-pipes are as follows: (1) 402 ft. of 4-in. and 365 of 1.25-in. drain; (2) 188 and 307 ft. of 4 and 3-in., and 307 ft. of 1.25-in; (3) 213 ft. of 4.75-in. and 179 ft. of 1.25-in.; and (4) 201 and 10 ft. of 3 and 3.5-in., and 201 ft. of 1-in. pipe. A compound compressor with cylinders 9 and 14 by 12 in. is used. Starting and working pressures are: No. 1 and 2 wells, 150 and 80 lb.; No. 3, 64 and 45 lb.; and No. 4, 85 and 70 lb., respectively. The total water pumped per 24 hours is 270,000 gal., at a cost of $8.77, equal to 3.25c. per 1000 gal. distributed in the city mains.

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINING PARTNERSHIP—RECEIVER

In a suit for dissolution of a mining partnership and accounting, upon application for the appointment of a receiver, it was held that as it did not appear from the record that the properties were being worked or that any royalties were or would become due to the members of the partnership, the application should be denied.

Greenberg *v.* Lesamis (Alaska), 203 Federal, 678. February 24, 1913.

MINING LEASE—LABOR STRIKE EXCUSES PERFORMANCE

A mining lease contained the clause that "this lease shall also be forfeited if this mine remains idle for more than 60 consecutive days, unless said second parties shall be prevented from operating the same by reason of strikes of employees." Owing to the failure of a preceding holder of the lease to pay its miners, the property was boycotted by the miner's union until the wages, for which the present lessee was in no way liable, should be paid. Held, that this constituted a sufficient excuse for not working the mine under the terms of the lease, and the lessor was denied the right to declare it forfeited.

Smith *v.* Eagle Coal & Mercantile Co. (Missouri), 155 Southwestern, 886. April 21, 1913.

MINING LEASE CONSTITUTES AN INCUMBRANCE

Under the laws of Colorado which prohibit the directors of a mining corporation from incumbering the property of such corporation except with the assent of a majority of the stockholders, a mining lease of all the property of a corporation for a term of five years made by the directors of a corporation without the assent of a majority of the stockholders is invalid. A mining lease granting to another to take and extract ore from the claims during the life of the lease to the exclusion of the owner, conveys the right to take from the body of the property all its value and to leave it at the end of the term a worthless shell, and constitutes a distinct incumbrance on the property within the meaning of the law.

Westerland *v.* Black Bear Mining Co. (Colorado), 203 Federal, 599. January 13, 1913.

PHOSPHATE DEPOSITS—LOCATABLE AS LODES

In an action to adverse the claim of applicants for a placer patent to certain phosphate deposits, the adverse claimants based their asserted title on lode locations made subsequent to the placer locations covering the same ground. The mineral deposit in dispute was a zone of calcium phosphate contained between walls of silicious limestone, having a well defined strike and dip. It was held: first, that the question was properly determinable in a court of law and not within the exclusive jurisdiction of the Land Department, on the grounds that a determination of the character of the land was necessary to a determination of the controversy; second, that the deposits in question constituted 'rock in place' subject to location under the lode laws only; third, that inasmuch as the lode locators had entered peaceably on ground covered by a location subsequently proved to be void, they were not trespassers in the sense that they could not make a valid location by such a peaceable entry.

Duffield *v.* San Francisco Chemical Co. (Idaho), U. S. Circuit Court of Appeals, Ninth Circuit, May 5, 1913. (Not yet reported.)

Note.—This decision reverses the decision of the trial court reported in our issue of November 16, 1912, and is in entire accord with the recent ruling of the Circuit Court of Appeals, Eighth Circuit, in another case between the same parties, San Francisco Chemical Co. *v.* Duffield, 201 Federal, 830, reported in the *Mining and Scientific Press*, April 19, 1913.

Catalogues Received

ALBANY LUBRICATING CO., 708 Washington street, New York. May issue of 'The Bearing.'

DODGE MANUFACTURING CO., Mishawaka, Indiana. Folder, 'Over the Seas.' 8 pages. Illustrated. 4 by 9 inches.

NATIONAL TUBE CO., Pittsburgh, Pennsylvania. Bulletin No. 12, 'Characteristics of National Steel Pipe.' 8 pages. Illustrated. 8½ by 11 inches.

B. F. GOODRICH CO., Akron, Ohio. 'Motor Trucks of America.' Containing photographs and more important specifications of the 1913 models of motor trucks made in America, which are equipped with Goodrich wireless motor truck tires. 68 pages. Illustrated. 7 by 10 inches.

CHICAGO PNEUMATIC TOOL CO., Fisher building, Chicago. Bulletin No. 34-L, 'General Pneumatic Engineering Information.' Contains tables giving efficiencies of air-compression at different altitudes, density of gases and vapors, mean effective pressures and horse-powers, loss of pressure due to friction in pipes, etc. Also information for intending purchasers, showing the data required for intelligent estimates. 48 pages. Illustrated. 6 by 9 inches.

Commercial Paragraphs

The REDWOOD MANUFACTURERS CO., San Francisco, has removed its engineering department to 811 Kohl building.

The HARDINGE CONICAL MILL CO. reports that the Braden Copper Co., of Chile, South America, has just given a repeat order for eight of the largest type of Hardinge pebble mills for use in its Braden plant. This makes a total of twenty-four of this type of mill being used in connection with the flotation process.

SUTTON, STEELE & STEELE, of Dallas, Texas, manufacturers of a dry process of concentartion, has organized a company in Denver called the SUTTON, STEELE & STEELE MANUFACTURING, MILLING & MINING CO., and has opened a factory there for the manufacture of its product. A 50-ton demonstrating plant has been erected, and the company is now ready to make tests of ores.

The STANDARD CHEMICAL CO., Pittsburgh, Pennsylvania, has acquired radium-bearing ore deposits in Montrose county, Colorado, and has a monthly output of 100 tons of carnotite ore, from which it extracts about a half gram of radium. In a recent account of the radium situation, *Mining and Scientific Press*, May 17, the statement was made that no American company was, as yet, refining radium. This was an error.

The WITTE IRON WORKS CO., 2409 Oakland avenue, Kansas City, Missouri, announces that it is now selling the Witte gasoline and kerosene engines and hoists direct to users instead of through dealers as heretofore. Among special features claimed for these machines is that all wearing parts are made in small units so that needed parts may be sent by mail or express. A new book issued by the company, entitled 'Witte Power,' will be sent on application.

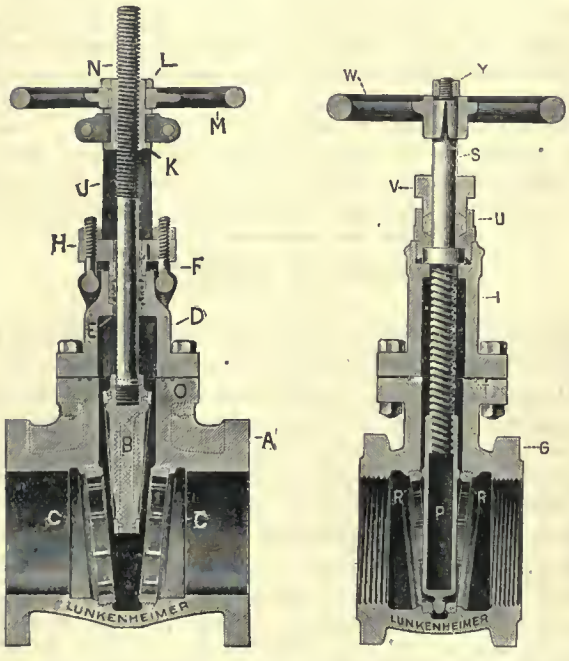
The POWER SPECIALTY CO., New York, reports that owing to the rapid increase in the demand for Foster superheaters, a new erecting shop, 300 by 96 ft., is being constructed and that among recent contracts received are the following: The Public Service Corporation, Burlington, N. J., 3600 hp. for installation in Edge Moor boilers; the Rhode Island Co., Providence, R. I., 5000 hp. for installation in Bigelow-Hornsby boilers; Narragansett Electric Light Co., Providence, R. I., 6000 hp. for installation in Babcock & Wilcox boilers; Havana Electric Railway, Light & Power Co., Havana, Cuba, 14,500 hp. for installation in Babcock & Wilcox boilers; J. I. Case Threshing Machine Co., Racine, Wis., 2000 hp. for installation in Wickes boilers; Rochester Railway & Light Co., Rochester, N. Y., 5250 hp. for installation in Bigelow-Hornsby boilers, 2400 hp. for installation

in Babcock & Wilcox boilers; Moline Rock Island Manufacturing Co., Moline, Ill., 9000 hp. for installation in Stirling boilers; Cleveland Electric Illuminating Co., Cleveland, Ohio, 20,148 hp. for installation in Stirling boilers; Jones & Laughlin Steel Co., Pittsburgh, Penn., 3528 hp. for installation in Rust boiler; the Brier Hill Steel Co., Youngstown, Ohio, 6000 hp. for installation in Erie City boilers.

An Improved Gate Valve

The Lunkenheimer company is now marketing a gate valve that is a marked improvement upon older types, and has supplied the following description:

As seen by the illustrations, the valves are made in two forms: one with stationary stem, and the other with outside screw and yoke. The seat rings, as well as the wedge disc, can be renewed when worn, thus making the valve as good as new. A desirable feature in the construction of the valves is the fact that when finishing the interior of the valve body, that portion which receives the seat ring is threaded to the correct angle of the tapers of the valve disc. The seat rings are threaded and faced off straight, and when screwed in place, they fit accurately to the tapers of the disc. This consequently makes it possible to easily renew the seat rings should they become worn or broken, thus prolonging the life of the valve.



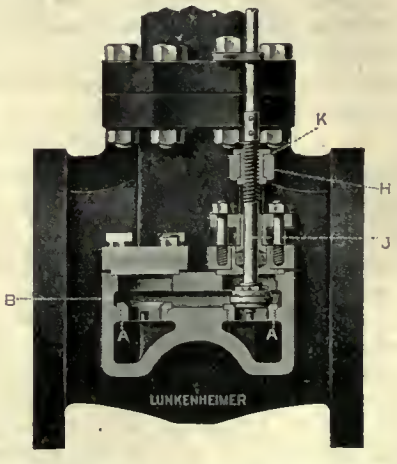
The discs in both forms of valves are made entirely of bronze up to and including the 6-in. size, on the medium, heavy, and extra heavy patterns, and up to the 3½-in. size on the standard pattern, above which size they are made of iron with bronze face rings. As the valves are double-seated, they will take pressure from either end.

Either pattern of the gate valves can be packed under pressure when wide open. The stuffing-box in the valve with stationary stem, is made of bronze, and is tightly screwed into the hub. In the valves with outside screw and yoke, both the gland and stuffing-box are lined with bronze bushings, which forms a perfect bearing surface for the stems. The discs are accurately guided in the bodies, and by means of the guides the stems are relieved of all side strains, which have a tendency to wear out the threads on same. The stems in both forms of valves are made of rolled tobin bronze, a material having the tensile strength nearly equal to that of steel. All parts of the valve are heavy, yet compact, and the strains on the connecting pipes, due to the weight of the valves, are minimized. The valves are not affected to any extent by expansion or contraction.

The joint between the body and hub is worthy of attention, for the reason that it is practically indestructible. It consists of grooves cut in the top surface of the valve body, in which are placed seamless copper gaskets. A joint made in this manner will never leak, and cannot wear out. The yokes and hubs are rigidly held to the body by large steel bolts, both the heads and nuts of which seat on spot-faced surfaces, insuring even and true bearing surfaces.

This valve is supplied entirely of brass, with iron body brass mounted, of 'puddled' semi-steel, or of cast steel. Medium pattern brass valves, sizes 2 to 8 in., inclusive, are guaranteed for working pressures up to 125 lb., and from 9 to 12 in. for pressures up to 100 lb. Extra heavy brass valves will safely stand 250 lb. pressure. The iron body brass mounted valves are made in standard, medium, heavy, and extra heavy patterns. The standard pattern, sizes 2 to 8 in., inclusive, are for pressures below 125 lb.; and sizes 10 to 24 in., for pressures up to 100 lb.; the medium pattern has been designed for 125 lb.; the heavy for 175 lb.; and the extra heavy for 250 lb. For high pressures and super-heated steam these valves are made of 'puddled' semi-steel, the tensile strength of which is 30,000 lb., sizes 1½ to 16 in., inclusive, and to meet the specifications of engineers who differ as to the metal used for the trimmings, they are made in two combinations. They are guaranteed for working pressures up to 250 lb. For extreme conditions of pressure and super-heat, the valves are made of cast steel, having a tensile strength of about 80,000 lb. per square inch. They are also made in sizes ranging from 1½ to 16 in., inclusive, and in two combinations—one for pressures up to 300 lb. and the other for 350. The valve can also be had with exterior by-pass, a detailed view of which is also herewith shown.

The by-pass used on the 'Victor' valves is not separate from the valve proper, but it is cast integral with the body, as will be seen by the illustration, and this method has many points of excellence. The additional metal required for the by-pass tends to strengthen the valve body; being self-contained, it is not affected by extremes of expansion and contraction, which tend to distort the valves used on exterior by-passes. It will be seen that, instead of the by-pass valve trimmings being screwed into the body, they are bolted thereto (as is also the flange above the reserve valve seat) by a number of large steel studs and nuts, the latter seating on the spot-faced surfaces. The stuffing-box is made of bronze and has a flange on the bottom, which prevents the iron flange above it from touching the iron body, and hence prevents the corrosion between these surfaces.



The outside screw and yoke H increases the durability of the threads on the stem J, owing to the fact that they do not come in contact with the stem. The bushing K, which is threaded to receive the threads on the stem J, not only prevents corrosion, but also makes it possible to renew the same, should the threads become worn. The discs in both forms of by-pass valves are constructed on the same principles as those in the re-grinding globe valves, and consequently can be re-ground when worn. The areas of the by-passes are sufficiently large to admit enough steam around the disc to quickly equalize the pressure on both sides. They are accessible at all times, and the use of a by-pass on large valves, or those of any size subjected to high pressures, results not only in making the valves easier to operate, but in largely decreasing their durability.

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EDITORIAL STAFF:

San Francisco

H. FOSTER BAIN - - - - - - - - Editor
EUGENE H. LESLIE
M. W. von BERNEWITZ } - - - Assistant Editors

New York

THOMAS T. READ - - - - - - Associate Editor

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EDWARD WALKER - - - - Correspondent

SPECIAL CONTRIBUTORS:

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Leonard S. Austin. James F. Kemp.
Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

IN commenting on the new leaching plant at Anaconda in our issue of May 3, we did inadvertent injustice to Mr. H. N. Thomson, who was associated with Mr. Frederick Laist in the earlier stages of the development of the process to be employed. It has fallen to Mr. Laist to carry the work out to its present stage of development at Anaconda, while Mr. Thomson has been engaged with the superintendence of affairs at Tooele. In work such as this, however, there is more than enough credit for one, and we regret overlooking the part which Mr. Thomson played in it.

INTERESTING comparisons appear in a table showing the status of the United States Steel Corporation in 1902 and 1912, as compiled by Dow, Jones & Company. At the beginning of the period the total capital stock and bonded debt of the corporation was $1,325,268,000; at the end, $1,448,175,000. Meanwhile, its blast-furnace capacity had increased from 7,500,000 to 16,500,000 tons, and the amount of iron ore mined from 13,000,000 to 26,500,000 tons. The average wage per man employed has increased from $717 to $857, the finished steel produced per man having increased from 49 to 56 tons. The gross receipts per ton of steel sold decreased from $68.37 to $59.61, the total earnings per ton of steel sold, similarly declining from $16.25 to $8.65 per ton. The net earnings available for interest and dividends were $6.67 in 1912, as compared with $13.25 in 1902.

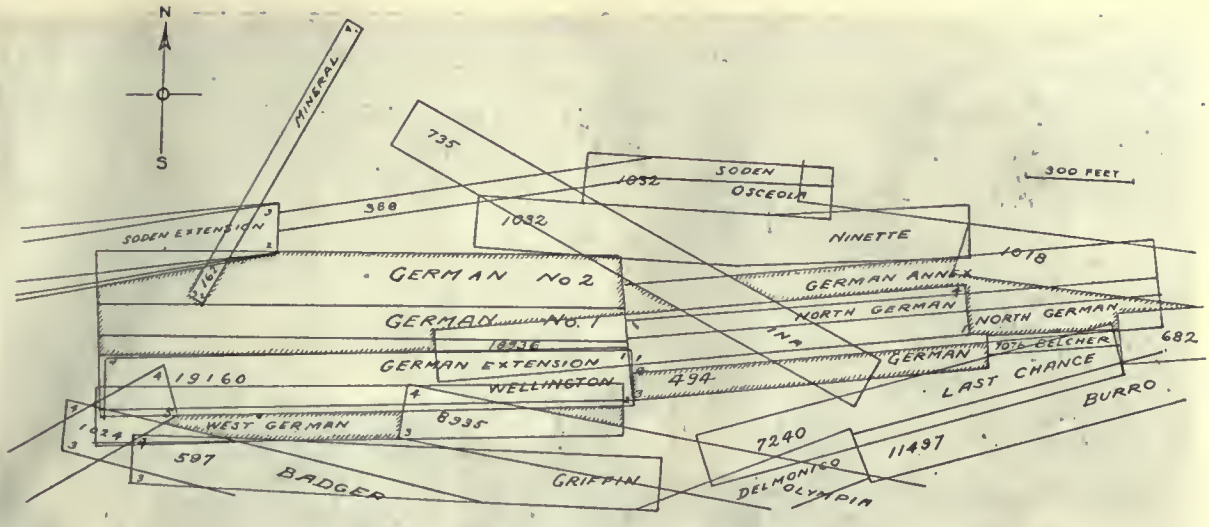
AT this season of the year, the mining fraternity has, among its many obligations, the task of moving the new crop of mining engineers. Armed with a sheepskin, the result of four long years of persistent effort, the young engineer is bidding a farewell to his *alma mater* and setting forth for the hills and back-blocks of civilization in quest of whatever Dame Fortune may see fit to bestow. That the trails are not strewn with roses is attested to by the large percentage of graduate engineers, who after two or three years spent in mining camps, lose courage, give up their profession, and enter into some more gentle walk of life. The profession of mining, as is true of others, has its ups as well as downs, and a strong heart and clear head will help a great deal toward 'getting there.' As a salutatory to the new members of the profession, we can think of no better words than those of Francis Bacon: "I hold every man a debtor to his profession; from the which, as men of course seek to receive countenance and profit, so ought they of duty, to endeavor themselves by way of amends to be a help and ornament thereunto."

CURRENCY reform is one of the most important features on the legislative program at Washington. It is understood that the assistance of skilled political economists has been invoked in drawing up the bill. Its provisions are not yet disclosed, but are known to include the creation of divisional banks, with the idea of preventing the concentration of funds in New York and other large centres. Vigorous protest from those interested in Stock Exchange speculation is expected, though there is ground for the belief that, if the plan works well, credit may be rendered enough more liquid so that metropolitan banks may be enabled to increase their loans on exchange collateral. The changes incident to any new currency scheme will render some readjustment necessary.

The Microscope in Mining

The practical value of the microscope as a ready tool for the study of the economic problems of mining and metallurgical work is daily becoming more clearly recognized, following the usual course of events, in which instruments of academic precision gradually create for themselves a field of usefulness in the conduct of business affairs, sometimes becoming of such primal importance that their early beginnings in the laboratory become all but forgotten. The use of the microscope in the study of the minerals that form the raw material of mining and metallurgical work has become of practical importance rather slowly because the mineral aggregates that constitute an ordinary ore are commonly made up of grains, some of which are opaque and others are translucent. Mineralogists have developed the technique of the study of translucent minerals to a high degree of precision, so that the constituents of an ordinary rock, of which a thin slice becomes transparent enough to permit the passage of light, can be determined with great accuracy. But this method of study has the obvious disadvantage that the preparation of a thin section of a mineral aggregate requires much time and even more skill, so that failing some strong reason for expecting results of value, the operator is not likely to devote the time and effort necessary. Nor is the ordinary engineer likely to possess the special knowledge required to perceive the significance of extinction angles, interference colors, and what not. For this reason the microscope, though of essential importance to the specialist, remained of little more service to the ordinary mining engineer than a speedometer on a wheelbarrow. This defect is gradually being remedied, and it is interesting to note that Mr. A. J. Moses, professor of mineralogy in Columbia University, has recently published a scheme for the determination of minerals of non-metallic lustre which includes the polarizing microscope as an aid to recognition of the mineral species. For this purpose the mineral is crushed so as to pass through a 100-mesh screen, and that portion which remains on a 120-mesh screen is taken for study. Grains of this size mounted in a drop of liquid can be subjected to practically all the tests of microscopic study, with the added advantage that the crushing develops characteristics of cleavage that are often a great aid to recognition. Practical use of this method is made in the concentrating plant of the New Jersey Zinc Company, where, under the direction of Mr. George C. Stone, it has been found possible through the microscopic study of the crushed ore in various stages of its passage through the mill to make valuable improvements in milling practice. The microscopic study of hand specimens or crushed fragments of minerals has been greatly facilitated by the recent introduction of an improved type of Leitz binocular microscope by which a good magnification can be obtained without the sacrifice of brilliancy of illumination or of area of field. Thus any fairly smooth surface on a hand specimen may be placed under the microscope without further preparation, and in many cases all the information needed may be obtained by examination by reflected light, using an instrument which can conveniently be carried in the field. This does away with the most common difficulty of laboratory study; the need for more material to solve problems raised by the study of that available.

Most of the minerals of economic importance are, however, opaque. Certain characteristics of these can be recognized by the observation of crushed fragments, but crushing unfortunately destroys the evidence of the relation of the minerals to their associates, a criterion of essential importance in economic geology. The microscopic study of polished surfaces of metal aggregates or alloys has been developed to a high degree of perfection, and during the past decade a number of investigators have been busy applying similar methods to the study of metallic minerals. The most notable paper that has so far appeared is a study of the sulphide ores of copper by Messrs. L. C. Graton and Joseph Murdoch, in the May *Bulletin* of the American Institute of Mining Engineers. The authors modestly disclaim credit for having originated their method of study, assigning it to Mr. William Campbell, who is known both for his investigations of alloys and as a geologist. Mr. Campbell would doubtless, in equally modest fashion, pass it on to earlier investigators, since the microscopic study of polished surfaces by reflected light has been attempted by many students. Mr. Jules Catherinet thus studied copper sulphide ore from British Columbia ten years ago, and Mr. A. H. Chester studied gold crystals by reflected light as early as 1878. But to the operator the latest refinement is much more important than the early beginnings, and Messrs. Graton and Murdoch, by studying nearly 500 specimens, have presented a volume of evidence that was previously lacking, and in presenting conclusions of great value to the student of copper deposits, open a rich field for further investigation. The paper is so important as to deserve separate discussion. The evidence presented controverts many accepted ideas of the origin and nature of copper deposits, and thus emphasizes the importance of the microscope in the study of minerals. The first essential of knowledge is precision, and the more general use of the microscope and other instruments of precision is one phase of the general advance of knowledge.



CLAIMS OF THE GERMAN AND BELCHER GROUP.

Pitchblende From Quartz Hill, Gilpin County, Colorado

By Forbes Rickard

Quartz hill is about 1½ miles west of the town of Central City, Colorado. It has an elevation of 9000 ft., and its mines are accessible over fair mountain roads. From the site of the German and Belcher mine buildings a view may be had, across the intervening rough country, to James peak, one of the highest of the Front range in Colorado. A narrow-gage branch of the Colorado & Southern railroad system passes close by the mines and makes connection at Denver with the main continental lines.

Mining in Colorado dates back to 1858, beginning with the diggings on Clear creek below the present town of Golden, and in a dry gulch six miles from Denver. In the spring of 1859 the work extended to North Clear creek, where the first profitable diggings were found, by a party headed by John H. Gregory.[1] The discovery of the Gregory lode was made on May 6, 1859: this was the beginning of mining in Gilpin county and of the tide of emigration that peopled Colorado. Other discoveries in less accessible districts, such as Leadville, Breckenridge, Boulder, Georgetown, Caribou, and the San Juan country followed. Creede was unknown and Cripple Creek was a sheep pasture at the time the Cushman and Waterman booklet was compiled. The three towns of Black Hawk, Central City, and Nevadaville are strung along the hills for two miles, to the west slope of Quartz hill. This almost continuous town is evidence of the many thousand miners who were once here, and in dwindling numbers still constitute what remains of a once famous mining camp.

Near the west end of Quartz hill are several mines which have been known to produce pitchblende, usually in small quantity but of high quality in respect to uranium content. Measured by present-day standards, these ores are known to be more radio-active than any others that have been found, notwithstanding that the search has been world-wide. Mr. Bolt-

[1]See 'The Gold Mines of Gilpin County, Colorado,' published in 1876 by Samuel Cushman and J. P. Waterman.

THE GERMAN HEAD-HOUSE.

THE GRANITE AND THE PITCHBLENDE STREAK.

wood, of Yale University, in some notes referring to pitchblende occurrences in Joachimstahl (Bohemia), Cornwall (England), and Colorado, says that while "these localities have been known for the past twenty years, it is a very significant fact that, although a diligent search has been made for new occurrences over the whole surface of the earth for the past six years, no other important sources of supply have been discovered." This was written something like 2½ years ago, and there is no reason to believe that it does not apply at the present time.

The Kirk, German, and Wood mines, all on Quartz hill, are among the more important and best known. There are several patented claims, on which a small amount of work has been done, that lie within a north-south belt less than 1000 ft. wide and possibly one-half mile long, which area includes all veins in any way identified with the production of pitchblende.

Geology of the District

This district is one in which gneiss and crystalline schist predominate, with numerous intrusive andesitic dikes of varying composition and texture; acid granitic dikes are less numerous, but their occurrence is important in this connection, for, in association with the veins of these mines there occurs, in intrusive form, a fine grained aplitic granite, which is closely associated with the pitchblende. This granite takes dike form, occasionally putting out tongues and more rarely taking the shape of connecting sills. That granite of this description is similarly identified with the tungsten occurrence in Boulder county, Colorado, has been established, and the following is a quotation from a communication from R. D. George, state geologist:

"The rock specimen * * * is a mashed granite in which the feldspars are quite largely kaolinized. The mica has been very largely, if not entirely, leached out, or in part changed to chlorite and in part distributed through the feldspars, where it appears to form both talc and chlorite. The rock is very similar to much of the fine grained dike rock of the tungsten area. * * * The rock containing the pitchblende, galena, sphalerite, etc., is a fine grained aplitic granite which probably once contained an appreciable amount of biotite in small flakes. It is a finer textured rock than the one just described and considerably more quartzose, although the proportion of quartz has been made greater by the disintegration and part removal of the feldspars. It is very likely that the chief difference between the rocks in their original condition was one of texture rather than composition. Both closely resemble the aplitic dike rocks or the fine grained pegmatites of the tungsten area. The coarser is at present a little

more like the tungsten rocks. I should have said that the rock with the pitchblende has been rendered much finer than it was originally by the process of granulation due to movement and fracturing."

The close identity of the granite rock in the pitchblende and tungsten areas of Gilpin and Boulder counties, respectively, suggests that the mines of these two districts lie within the same petrographic province in relation to the main granite mass underlying.

Respecting the correlation of the rocks of this formation, Archaen gneisses and crystalline schists are intruded by granitic dikes, and long subsequent to this belong the porphyry intrusions of the andesitic rocks. These later dikes are of the andesitic type—andesites, quartz-andesites, and dacites. In thin plates, examined under the microscope, they show a micro-crystalline groundmass, with porphyritic feldspar, phenocrysts, and much altered pyroxene. Nowhere in the mines, so far as mine workings have gone, do dikes of these two systems intersect.

The veins themselves, without exception, have a well defined northeast-southwest trend. Similarly, without exception, the fine grained granite intrusive is common to all sharing in the pitchblende distribution. It is significant that some intervening veins, yielding profitably gold-silver ores but not pitchblende, are bounded by walls of crystalline metamorphic schist, the granite intrusive being absent. This plainly suggests the derivation of the older fine grained granite from a main mass, which, in its intrusion into the fissures in the state of magma, favored some and not others of these veins.

The Ore Deposits

Ore deposits of this district furnish two types of ore: one being characterized by pitchblende, with accessory pyrite in varying quantity, with sphalerite and galena in subordinate quantities, and sometimes marcasite and stibnite, but in much less degree; the other type of ore includes the minerals pyrite, chalcopyrite, sphalerite, and galena, with varying gold and silver content. Quartz is plentiful in the gangue. It is also often found lining vugs or cavities in the vein.

It is axiomatic in these mines that as pitchblende comes in the gold goes out, and, as a matter of fact, the pitchblende ores seldom contain more than $2 to $4 in gold. What gold is present, is largely in metallic form, which makes it susceptible to concentration with pitchblende, making a comparatively high-

RADIOGRAPHS PHOTOGRAPHED THROUGH SEALED COVERINGS BY THE RAYS OF THE MINERAL. THE LOWER PICTURE ILLUSTRATES RELATIVE RADIO ACTIVITY OF DIFFERENT CONCENTRATES.

grade product. To illustrate, the following products were obtained by pneumatic jig treatment of a Wilfley table concentrate:

	Gold, oz. per ton.	Silver, oz. per ton.	U_3O_8, %
First-class concentrate	1.60	10.40	7.16
Final jig concentrate, exclusive of beds and hutch product	24.40*	35.60	58.81
Beds containing fine gold	131.50†	58.00	72.72
Hutch concentrate	50.50	40.50	64.29

*Including 9.87 oz. 'metallics.'
†Including 81 oz. 'metallics.'

That these products represent a high ratio of concentration may be judged from the fact that the original crude ore from which these concentrates were derived assayed: gold, 0.60 oz. per ton; silver, 2.75 oz. The presence of a small percentage of manganese oxide in this ore might account for the free gold in ore of such low grade.

Pitchblende from Gold Mines

In former times these Colorado mines were worked for gold, and only in the past 15 or 20 years has the rare element of uranium been generally recognized in the form of pitchblende and separately mined. The discovery of radium dates from 1896. The finding of the X-rays was the starting point of investigation upon radiation. On Christmas day of 1895 Röntgen, of Germany, exhibited the first X-ray photographs in Berlin. Within a year of the discovery of the X-ray, Henri Becquerel conducted experiments to test certain properties peculiar to this ray, and making use of uranium in the form of pitchblende, obtained (partly by design and partly by accident) some startling results in photography. He found that the pitchblende itself in a dark room would affect, in the course of days, a photographic plate from which it was separated by opaque black paper. While this radiograph was similar to the X-ray pictures of Röntgen, it had developed the new fact that the mineral uranium is all the time spontaneously emitting rays of some sort which are capable of penetrating opaque objects in just the way the X-rays do.[2] Becquerel named these the 'uranium rays.' A few months later came the discovery of radium by Mme. Curie, and all substances emitting radium rays were called radio-active substances. Mme. Curie found that of the other rare elements, thorium was capable of producing the same effect as uranium. Subsequently the rays from all this class of substances were called 'Becquerel rays,' in honor of the illustrious physicist who had pointed the way without reaching the goal. As radio-activity came to be studied, these phenomena, including the hardly less wonderful cathode ray, came to be known under the general head of radiation from radio-active substances.

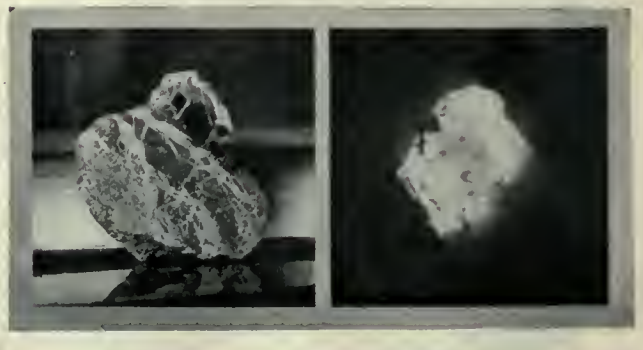
Radium is now produced by a process of fractional crystallization, and as many as a thousand successive reductions are made in reaching the elusive gram of radium in eight to ten tons of high-grade pitchblende. Rutherford, in a book entitled, 'Radio-Active Substances and Their Radiation,' 1913, says that 6600 lb. of metallic uranium contains but one gram of metallic radium. A factor more commonly used by buyers is 4½ milligrams. of metallic radium to 20 lb. of uranium oxide.

[2]R. A. Millikan, *Popular Science Monthly*, April 1904.

The German and Belcher Mines

The underground workings of the German and Belcher mines are connected at the first and second levels. As they are under the same ownership, they are worked as one mine. The pitchblende vein, as previously noted, is accompanied by a granite dike more or less shattered, and at times occupies a position which is central in respect to the dike itself. The dike varies in width from 5 to 9 ft. The vein varies from 4 or 5 in. to 18 or 20 in.; it is generally marked by a narrow gouge, or selvage, on its hanging wall side. Veinlets extend from the vein proper into the fracture seams in the granite.

The more solid pitchblende, either in lens form or in a well defined streak, seldom exceeds three to four inches in width. Where the vein reaches its maximum width the proportion of uraninite is inversely small, though for the whole width (apart from the high-grade bunches) the vein carries sufficient pitchblende to constitute a grade of ore for concentration; from 2½ to 4% U_3O_8. Concentration tests now in progress are proving satisfactory and give encouragement for the erection of a reduction plant on the mine premises.



ORE PHOTOGRAPHED IN SUNLIGHT AND DARKNESS, THE LATTER BY THE RAYS OF THE MINERAL ITSELF.

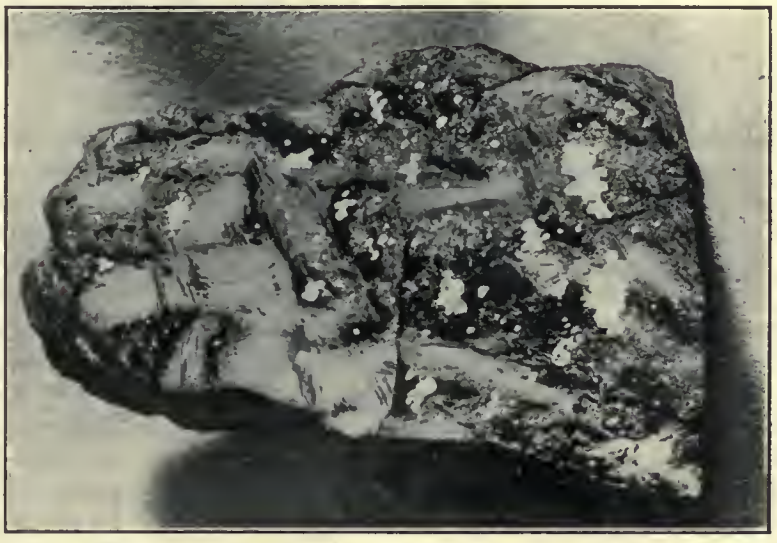
Outside of the general policy of development adopted by the management, a small amount of pitchblende ore is being mined. By crude hand-sorting within the shaft house, there is now being produced, in small but increasing quantity, a selected grade of pitchblende carrying 15 to 60% uranium oxide (U_3O_8). An average of approximately 30% U_3O_8 is established and can probably be maintained in quantity of several tons per annum. The bulk of ore suitable for mill treatment accumulates in the proportion of something like 40 tons to 1 ton of 'selected pitchblende.'

These mines of Quartz hill, though they may be small mines, have advantages over larger mines in other districts, in that: (1) there is no extensive faulting or dislocation of the veins; (2) no great investment is needed for a mill, or for railroad transportation; and (3) there is no extra pumping expense. While in the German mine, the partly massive pitchblende is streaked by pyrite, in the Belcher mine the reverse is true. These streaks run through the vein for practically the whole length of a stope, say 100 ft. long, and at intervals enlarge

into pockets of high-grade ore. The point of such enrichment corresponds with the swells in the vein itself. In both mines the gangue of the pitchblende vein is of pegmatic character; it is locally termed spar. Vein-quartz, which is plentiful in the gold-silver vein, is not seen in association with pitchblende ores.

The gold-silver vein plainly belongs to a post-mineral fracturing; that is to say, long subsequent to the building up of the pitchblende vein in association with the granite (aplitic), there was a fault movement along the plane of the vein which resulted in the reopening of the vein along lines approximating the northeast-southwest course of the already existing vein. Lines of least resistance would naturally govern in the creation of new channels for the later vein-forming agencies, and these have in the main followed the north or foot-wall side of the granite intrusive. While the gold-silver vein, in the main, occupies the foot-wall side of the mine, at a point between the German and Belcher shafts it crosses the pitchblende vein and diverges from it as it goes eastward. The gold-silver vein continues strong and productive beyond the intersection. The granite accompanying the pitchblende has a way of feathering out at times into the mica-schist rock; and while nothing like dislocation or faulting of the granite has yet been observed, this may exist and will probably be found as mine work is extended. The gold-silver ore-shoots have no definite boundaries and no great length, from 150 to 200 ft. representing their longest development in any single stope. They tend to recur at regular intervals, separated by unproductive ground.

It is remarkable that little or no placer pitchblende has been found in the vicinity, though in Nevada gulch, immediately to the north, much placer work was done in the early days of mining, and much surface work in pits and trenches has been done in connection with assessment work of later times. The surface is not covered by any great depth of slide, but the erosion must have been considerable in the long time intervening. This fact would argue that the pitchblende shoot reached the surface in few cases, and that the ground removed through the agency of erosion was comparatively barren in pitchblende ore.

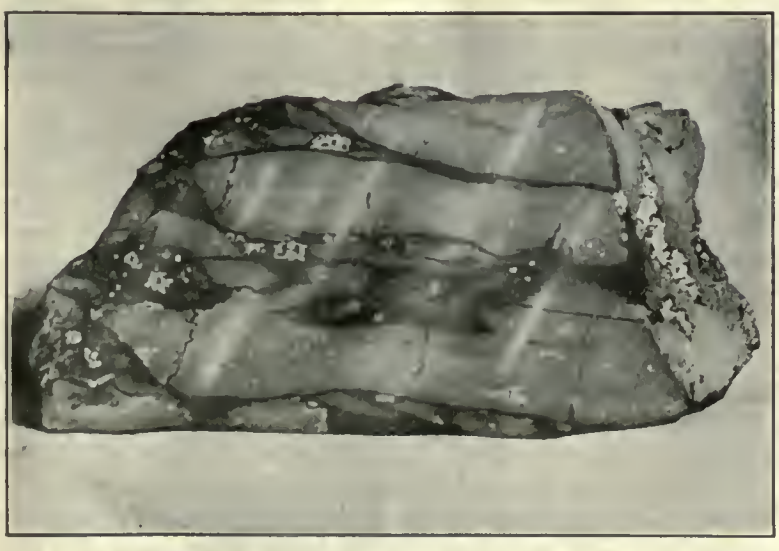


ORE FROM GERMAN MINE. BLACK, PITCHBLENDE; GRAY, GRANITE; WHITE, SPHALERITE.

In connection with the problem of the origin of this ore, it is an interesting speculation as to whether the pitchblende, massive, and in the form of uraninite, was crystallized directly from the magma, and is therefore of magmatic origin. There is much evidence to support the belief that the uraninite was separated out of a granite magma along centres of crystallization, long subsequent to the shattering of the earlier granite intrusive. One of the figures shows pitchblende ore of medium grade in which uraninite occupies the interstitial spaces between fragments of granite.

There is much about this that is similar to an ore occurrence rich in gold, described by Alexander M. Winchell, in a paper on the geology of the National mining district of Nevada.[3] To quote from Mr. Winchell's article:

"It is commonly believed that many ore deposits in veins have been formed by precipitation of metals, sulphides, or other compounds, from flowing water or from flowing aqueous vapor. It seems reasonable to believe that such a mode of origin would produce a banding or crustification in the ore. At Steamboat Springs, Nevada, where such a process is now forming deposits of stibnite, pyrite, meta-stibnite, and silica, and unrecognized minerals containing gold, silver, copper, lead, arsenic, and other metals, crustification on the walls of the fissure is distinctly visible through the recent sinter. * * * At National, crustification is not uncommon in the quartz of the main vein,



ORE FROM GERMAN MINE. BLACK, PITCHBLENDE; GRAY, GRANITE; WHITE, SPHALERITE.

[3] *Mining and Scientific Press*, November 23, 1912, p. 655.

but it is wholly lacking in the high-grade gold-quartz, so far as I observed. It seems improbable, therefore, that precipitation occurred from a flowing fluid. I would suggest that the gold-quartz was precipitated, not from a thin aqueous solution, but from a viscous and perhaps gelatinous mass which occupied the fissure in much the same way as an igneous magma fills an opening in the country rock."

Applying this suggestion to the German-Belcher vein system, I am strongly inclined to the belief that just such a process explains much in relation to the occurrence of pitchblende with the earlier fine grained granite; that is to say, separately from any connection with the gold-silver deposit, which came long after the consolidation of the granite within the fissure walls.

That this pitchblende ore contains little or no gold and silver would be accounted for in these mines, as in the National, by influences which tended to keep the gold and silver in solution; much carbonic acid gas that is still common to these mines suggests the presence of carbon dioxide in much larger quantity in the original ore-forming solution. Then there are also, in this case, chemical considerations that establish the probable existence of alkaline sulphides in the same solution, which, combined, would sufficiently account for the presence of a solvent of gold and silver.

The European pitchblende deposits, mainly at Joachimstahl, Bohemia[4], occur in mica schist, but with intercalated limestone. While they present similar characteristics in a few respects, mainly in that the enclosing rock is a crystalline schist (mica-schist and gneiss), and in their relation to certain igneous intrusives occupying the fissures of the vein system, they are in other respects quite dissimilar. The lime-containing rocks previously noted afford much calcite in veinlets in the enclosing rock and as a gangue constituent. The ores of their veins are infinitely more complex, carrying as they do high silver minerals, nickel, cobalt, bismuth, arsenic, each one of these in several mineral forms with which each particular metal is identified. Where veins are numerous, a network of veins is formed. Of these vein series, the cobalt-nickel ores are said to be the oldest, and the silver ores the most recent; the uranium ore being intermediate in point of succession.

Mining in Bohemia and Saxony dates back to the year A.D. 1517. A treatise on the subject states that in the mines of Joachimstahl silver was the first quest, then bismuth and cobalt; later on, particularly in the past ten years, these mines have been worked, under government subsidy, for the ore of uranium (pitchblende). Uranium content in turn has become a secondary consideration, these ores now being principally valuable as a source of radium.

[4]Richard Beck, 'Lehre von den Erzlagerstaetten.'

Operation of Some of the Leading Rand Mines in 1912

The Rand is the greatest gold-producing district in the world, and the following data are from the 1912 reports of the respective companies. There are many important subjects requiring attention in this centre, such as labor, power, deep sinking, rapid hoisting, ventilation, pumping, miners' phthisis, and the treatment of enormous tonnages of fairly low-grade ore.

	Ore reserves, tons.	Stoping width, inches.	Value, dwt.	Ore treated, tons.	Product.	Profit.	Tax on profits.	Dividends.
Bantjes Consolidated	840,800	40-43-47-76	7.00	327,710	£ 423,021	£ 77,746	£ 6,899	£ 56,509
City Deep	2,123,650	55-58	8.70	479,630	852,030	292,654	26,871	156,250
Crown Mines 10,607,670		62	7.09	1,932,700	3,071,217	1,314,247	141,619	1,034,117
Durban Roodepoort Deep..	1,306,100	42-56	6.90	293,100	439,699	82,085	6,724	44,000
Geldenhuis Deep	1,909,700	40-49-57	6.30	627,960	946,155	141,987	9,290	87,863
Knight Central	647,000	62.5	6.10	286,500	333,877	54,427	.....	.....
Modder B.	2,594,000	54	7.20	388,570	725,220	382,100	38,958	140,000
Robinson	1,373,100	64-83	11.00	577,340	1,260,530	808,760	64,640	618,750
Rose Deep	3,695,100	40-47-54-60-61	6.10	782,200	1,128,127	446,824	36,465	315,000
Village Deep	2,235,300	50-59	6.90	596,900	889,246	294,810	25,101	185,617

There are three vein systems mined, namely, the Main Reef, Main Reef Leader, and South Reef, of the several widths given. Besides the reserves noted, many mines have a large tonnage of low-grade ore, too poor at present to be profitable; the Robinson has 1,160,800 tons of 4.3, and the Rose Deep 497,000 tons of 3-dwt. ore. Sand-filling of stopes is now common, and at the Robinson, 230,950 tons was used for this purpose. Ventilating fans are being installed at many mines, and the City Deep, Bantjes Consolidated, and Geldenhuis Deep, are erecting fans of 75,000, 50,000, and 150,000 cu. ft. of air capacity per minute. The main and tail-rope system of haulage has been a success at the Modder B mine; while at the Village Deep, the Whiting hoist, at the Turf shaft, is working well. The Village Deep stamp-mill averaged 9.5 tons per stamp day, and the total extraction by amalgamation and cyanidation was 97.3%. Since the Boer War, the Transvaal Government has imposed a tax on profits.

Tin-plate exports from England in 1912 were 480,910 tons, valued at $33,220,412, a decrease of 3445 tons compared with the previous year. There are 590 tin-plate and sheet mills in operation, an increase over 1911. Exports to Canada are decreasing, being 12,426 tons in 1911 and 7039 tons in 1912. The Standard Oil Co. has placed an order with English makers for 70,000 boxes of tin plates for April and May delivery, at $3.43 to $4.83 per 100-lb. box.

Work of the Seoul Mining Company, Korea

This company was incorporated with a capital of $500,000, of which $400,000 was issued, in April 1908, at Hartford, Connecticut, and is operating mines in the Hoang Hai province, Korea. The report of the general manager, A. H. Collbran, of the engineers, Hooper, Speak & Co., and the superintendent of prospecting work, Edwin W. Mills, contains the following information.

The Suan Concession

The Suan concession embraces an area of approximately 260 square miles within which the company

MAP OF KOREA.

has the sole right to stake as many mineral claims as it pleases until the end of January 1916. After that period, all areas retained by the company are subjected to an annual tax of about 30c. per acre. The concession is for 35 years, with the right of renewal for a further period. The terms of the concession are remarkably liberal: no labor conditions; free use of available water; no restrictions on the cutting of timber; freedom from all customs duties on machinery imported, as well as exemption from export duties. The only tax, beyond the trifling one previously referred to, is the inconsiderable royalty of 1% upon the gross value of the output. Within the next three years the company must delimit the land it desires to retain. By paying $50,000 per annum the concession could be held for 70 years, but this is unnecessary. The property is situated within 50 miles of a railway; small river boats can bring goods to a point 7 miles distant from Suan mine during nine months of the year. The climate is excellent and country fertile. There is a sufficient supply of labor. It is tractable, intelligent, and is most efficient, notwithstanding its cheapness. Few countries exist where there are such favorable conditions for carrying on mining operations. The only improvement that could reasonably be desired would be to have more timber and fuel on the property. The concession includes a granite-limestone contact, roughly in the shape of an oval, 6 by 8 miles, including about 20 miles of contact, all of which is favorable to the occurrence of valuable minerals. The Suan mine, which has already returned 100% in dividends to its shareholders, is situated on this contact. Although prospecting work outside of the Suan mine itself was only commenced in 1909, the Tul Mi Chung mine has been proved sufficiently to warrant the immediate erection of a mill to treat 120 tons per day, and that it promises to become quite as good a mine as Suan itself.

The Suan Mine

During the years 1910-11-12 this mine produced 177,454 tons of ore, the products realizing $8.66 per ton. The ore presents difficulties in treatment which have not yet been overcome. The orebodies are irregular in shape and reserves are difficult to estimate, but careful sampling shows the following, not including 40,000 tons not fully developed:

Ore, tons	266,530
Gold content, per ton	$7.32
Copper content, per ton	3.44
Bismuth content, per ton	1.80
Total value of reserves	3,349,782

During 1912 recovery of gold, copper, and bismuth was 86.20 and 20.34%, and 0.5 lb. per ton, respectively. The flotation process will probably increase the copper extraction to 80%, and improve that of gold and bismuth.

The Tul Mi Chung mine has only recently been opened, but the probable reserves are so large that a plant of 40,000 tons per annum capacity has been recommended.

The present cost of power generated on the concession is about $100 per b.hp. per annum. As the fuel supply is being rapidly depleted, and increased power will be required, a first installation of 900 kw. is to be erected at tidewater.

Development at the Suan mine during 1912 covered 5264 ft., and at the Tul Mi Chung a total of 2883 ft., while there was 600, 10, and 247 ft. of prospecting done at the Sang Dei, Paa Whan, and Tong Ahm sections of the concession.

The discovery of a 'split' in the Eastern orebody, extending from the surface to No. 3 level, a distance of about 550 ft. measured along the slope of the ore, was responsible for the large increase in the ore reserve. On No. 2 level the splits join, forming a body

with a maximum width of 110 ft, which becomes narrower eastward. This shoot has not yet been reached on No. 4 level, but all indications point to its not being far distant. From this body 60,400 tons was milled during the year, the total increase in its ore reserve being 211,600 tons, and the net increase 151,200 tons.

From the Western orebody 13,500 tons was milled during the year. The total increase was 14,600 tons, and net increase 1100 tons. While its dimensions have not yet proved large on No. 2 and No. 3 levels, it is confidently expected more ore will shortly be found. Except for a few tons, no ore was mined from the Central orebody, and its reserve remains the same, namely, 5000 tons. It was not found advisable to stope any of this ore from below the main-level workings during the year, but instead prospecting on No. 1 level west was resumed, in an effort to find the continuation of this orebody.

ORE RESERVES IN THE SUAN MINE

	Tons	Gold, per ton	Copper, %	Bismuth (lb. per ton)	Gross value, per ton	Total gross value
Eastern orebody	323,560	$9.65	1.07	3.00	$14.66	$4,743,170
Broken ore	19,050	8.96	1.04	2.90	13.83	263,595
Western orebody	13,100	8.83	1.04	2.14	13.23	173,330
Broken ore	3,000	7.50	0.90	2.00	11.40	34,200
Central orebody	5,000	20.00	3.00	12.00	36.20	181,000
Totals	363,710	9.71	1.09	3.10	14.83	$5,395,295

Distribution: gold, $3,531,263; copper, $1,188,261; bismuth, $675,771.

Broken ore in the stopes amounts to 22,000 tons, and this will be augmented when the new air-compressor is installed. The 74,432 tons of ore mined during the year came from the following workings:

	Tons.
Eastern orebody	60,420
Western orebody	13,562
Central orebody	950

The sorting house building is finished, and is 24 by 61 ft., costing $4910, and has a capacity of 200 tons in 12 hours. A new hoist for the main shaft has been ordered to replace the present engine.

The Tul Mi Chung Mine

At this mine development resulted as follows: No. 1 shaft was sunk to a depth of 108 ft. upon the silver-lead deposit. A large amount of water was encountered in a cross-cut on the 50-ft. level, but on the 100-ft. level the additional flow of water was more than the pump could handle, necessitating the abandonment of the shaft. In the upper workings a number of solid seams of galena ore were found, separated by barren limestone; while on the 100-ft. level the width of this ore was from 4 to 6 ft. While the cross-cut adit is mineralized throughout its whole extent, the average, as a whole, will not pay. At certain portions pay ore exists, the best of which was found in the No. 1 cross-cut south, which reached the continuation of the ore, cut in No. 2 shaft. Cross-cutting to the north is now being carried on in an effort to reach the continuation of the main orebody, upon which the east drift from No. 2 adit was driven. No. 2 adit is about 800 ft. north of No. 1. A few feet from the mouth in the No. 1 cross-cut west, a large low-grade orebody was reached. Sinking was done to a depth of 60 ft., and while the width so far is 70 ft., and the length 50 ft., the full horizontal dimensions have not yet been determined. It is evident that this body will yield a large amount of low-grade ore. At a point about 300 ft. from the mouth of the adit, what is now known as the main orebody, was cut. Driving east and west developed a continuous ore-shoot for a length of 197 ft., with ore still in the face of the east drift. The gold and copper content is remarkably uniform for this type of deposit. Regular samples taken at intervals of two feet, for a continuous distance of 187 ft., showed the lowest gold content to be $3.60 and the highest $25.90 per ton. The average width of this orebody is 32 ft., and it has been developed to a height of 20 ft. above and to a depth of 30 ft. below the drift. In the west drift the ore gave out, but it continued strongly eastward, and it is hoped will eventually be reached in No. 1 adit, 800 ft. distant. No. 3 adit, which is 100 ft. vertically above No. 2, cut an orebody about 5 ft. wide, and it is expected this ore will shortly be reached, as cross-cutting is continued north in No. 2 adit.

ORE RESERVES OF THE TUL MI CHUNG MINE

	Tons	Gold, per ton	Copper, %	Gross value, per ton	Total gross value
E drift orebody	25,600	$10.35	1.75	$15.60	$399,360
W cross-cut orebody	24,500	3.50	1.50	8.00	196,000
Cross-cut So. orebody	7,500	5.50	2.25	12.25	91,875
Total	57,600	$6.80	1.71	$11.93	$687,235

The bismuth content of this ore is 2 to 3 lb. per ton of ore, but sufficient determinations have not yet been made to allow this to be relied upon.

Mill Test of the Ore

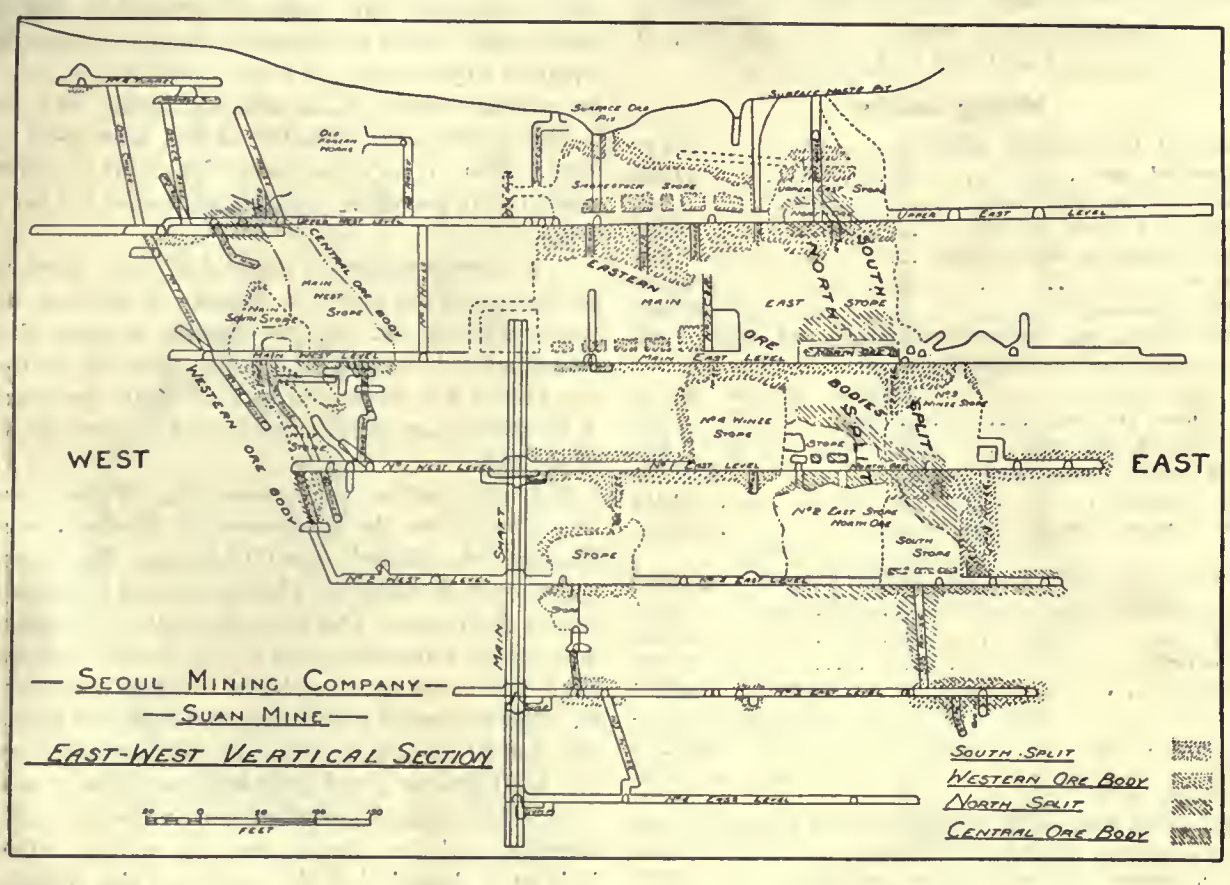
In order to determine if the ore could be milled, and the gold amalgamated in a similar manner to that of the Suan mine ore, 59 tons from No. 2 adit, east drift workings were treated in the Suan mill with the following results:

Dry ore treated, tons	58.98
Stamp duty, tons	3.63
Assay value, gold, per ton	$14.80
Assay value, copper, per cent	2.28
Weight of fine gold recovered, oz	18.71
Concentrate produced, tons	3.01
Assay value concentrate, gold, per ton	$94.37
Assay value concentrate, copper, per cent	15.69
Assay value tailing, gold, per ton	$3.80
Assay value tailing, copper, per cent	1.60
Extraction, gold, by amalgamation, per cent	44.30
Extraction, gold, total theoretical, per cent	75.64
Extraction, gold, total actual, per cent	76.84
Extraction, copper, total theoretical, per cent	33.40
Extraction, copper, total actual, per cent	35.11
Total theoretical extraction, gold and copper, per cent	62.29
Total actual extraction, gold and copper, per cent	63.65

New 16-mesh diagonal-slotted battery screens were used for this work. The ore is undoubtedly harder

than from the Suan mine, but the low stamp duty of 3.63 tons was partly caused by the straw from the straw shipping bags clogging the screens. The treatment was the same as given the Suan mine ore, with the exception that the concentrating table area was increased by 50%. The battery pulp after passing through Pierce amalgamating traps, and over flat amalgamating tables, was dewatered, classified, and run to four Deister sand tables. A black concentrate was caught at the upper end of the tables, while the middling was saved and re-concentrated. The tailing was re-ground in a tube-mill, passed through Pierce traps, and over flat tables. About 25% of the total gold recovered by amalgamation was caught below the tube-mill. The tailing from the slime tables passed directly to the canvas plant, but it was not possible to keep this material separate from the Suan mine ore, which was being treated at the same time, so that the actual recovery was greater than shown. It is evident that the gold is amenable to amalgamation, and that the ore can be given a treatment similar to the Suan mine ore with success, but that heavier stamps and a larger concentrating table area are necessary.

The work will be energetically pushed this year, and if developments continue satisfactorily, preparations should be begun to install 20, or possibly 40, 1250-lb. stamps in the autumn. As soon as possible, the work of driving the main adit will be resumed from a point near No. 1 shaft, which will reach No. 1 and No. 2 adits at a depth of 100 ft. This will have the additional advantage of prospecting the intervening territory. In the meantime it is not advisable to go to the expense of mining machinery until the matter of obtaining power has been decided.



Prospects

It has now been shown that the mineralized zone, that is, the granite-limestone contact, called the 'Collbran' contact, borders a central granite mass. The various prospects, including the Suan and Tul Mi Chung deposits, are upon this contact, which encloses a more or less circular area of about 10 miles diameter. It is unlikely that the Suan and Tul Mi Chung mines are the only profitable deposits along the contact. It is evident that this mineralized zone offers great possibilities, and energetic prospecting work at various points should be continued. A complete geological survey of the Collbran contact will be made during 1913, its course plotted, and the different claims connected. Early in 1912 it was found advisable to push the development of the Tul Mi Chung, so that it was not possible to carry on as much work elsewhere as desired. Outside of the Tul Mi Chung development, the sum of $4081 was spent for prospecting, of which $3584 was expended on Sang Dei. The various prospects which have not yet been definitely proved are Unsan, Sang Dei, Paa Whan, Chan Na Kol, Tong Ahm, and Kung Kol.

Power Requirements

With the increasing difficulty of obtaining wood for fuel and its higher cost, it is necessary that arrangements should be made for power to be transmitted electrically from Pying Yang, or from some point where coal can be cheaply obtained. It is recommended that a power-plant be erected at a point to be selected later, with a single transmission line to the Suan concession, a distance of about 60 miles. The first installation of two 750-kw. steam or gas-driven units should be considered. The operation of one unit will furnish sufficient power for present

needs at the Suan mine and mill, and at the Tul Mi Chung mine. The second unit can be kept as a spare, until power is required for milling at Tul Mi Chung, then an additional unit can be installed. It is desirable to keep the existing plants intact. This can be done by installing motors directly connected to new air-compressors at the mine plant, and by arranging the motor installation at the mill so as not to interfere with the present steam plant. In the event of a serious interruption in the electrical service the existing plants could be put in operation in a few hours. For this reason it does not seem neeessary to go to the additional expense of a double transmission line. Roughly, the estimated eost of a 1500-kw. power plant complete, with 60 miles of single transmission line, motor equipment, etc., at the Suan mine and mill will be $250,000.

Milling Results

Stamp-mill in operation, days			334.41
Ore treated, tons			74,432
Stamp duty, per day, tons			5.55
Gold content of ore, per ton			$8.53
Copper content of ore, per cent			0.89
Total value			$763,849
Bullion recovered			$471,969
Regular, black, and canvas concentrate saved, tons			736
Contents of respective concentrate:			
Gold, per ton	$80.91	$235.93	$87.04
Copper, per cent	17.96	26.24	9.69
Bismuth, per cent	1.77	4.70	4.03
Value received from concentrate			$120,494
Total recovery			612,463
Total revenue from all sources			620,055
	Per ton.		
Mining	$1.68		$124,647
Ore transport	0.04		3,024
Milling	0.74		55,303
Concentrate	0.31		23,031
General	0.75		56,107
Total	$3.52		$262,112
Profit			356,347
Dividends paid			180,000
Cash, sundry debtors, ore, concentrate, and supplies			253,562
Due to Japanese Government as royalty			6,185
Due to Korean Syndicate, Ltd., as royalty			24,514

Included in the total revenue is the return of $6054 from 57 tons of ore shipped to Liverpool. A total of $31,685 was spent on improvements to mine and mill equipment, houses, and roads. The hospital expense was 10c. per ton of ore. During the year 53 foreigners were treated, 11,572 Koreans, 1150 Japanese, and 980 Chinese, of whom 5236 were employees. At the Tul Mi Chung mine, there were 112 surgical and 430 medical cases.

The Copper Range Railroad had a revenue of $754,921, with a profit of $281,727 in 1912. The total surplus December 31 was $470,479. The Copper Range Consolidated Co.'s year may be stated as follows:

Total receipts from subsidiary companies	$6,084,202
Mining, smelting, freight, marketing, etc	3,661,837
Net income after paying taxes and adding other revenue	1,692,566
Dividends paid	788,428
Surplus	904,138

Operations at the mines and stamp-mills continue in a satisfaetory manner.

Philippine Dredging Proprietary

*The authorized capital of the company is £150,000 in shares and £50,000 in debenture stock. Shares were issued at 16s. and have sold as high as 23s. The ground to be dredged is at Paracale, and the area secured amounts approximately to 1000 acres, of which 800 is believed to be suitable for dredging operations. The large holdings of the eompany includes a number of elaims, the most important being the Paracale, wherein the estimated dredgable contents amount to nearly 16,000,000 cu. yd., while the contents of a similar character in what are known as the second option elaims amount to 20,500,000 cu. yd. Altogether, the estimated dredgable area, excluding two of the claims which have not prospected equal to expectations, is over 32,000,000 cu. yd., of an average value of 1s. 2d. per yard. The total working costs are estimated at the rate of 2d. per yard. There is an expected net profit of £1,637,000, equal to £10 per share, making allowance for the debenture issue.

It is expected that by the end of June there will be three dredges at work, capable of treating altogether 180,000 cu. yd. per month, so that if the estimated net returns of 1s. per yard be realized, the profits will be at the rate of £9000 per month. A fourth dredge should be at work toward the end of the year.

The examination and prospecting of the ground was done under the supervision of Bertinshaw and Hanlon, who drilled over 60 holes on the Paracale claim, over 50 upon the Philippine, and 33 upon the Nueva California. The average depth of the ground was, on the Paracale, about 17 ft.; on the Philippine, over 8 ft.; and on the Nueva California, about 12 ft. The success of this company, which has been for the last 18 months carrying on the necessary steps for treating the great gold-bearing deposit, would be another evidence of Victorian judgment and enterprise, and for that reason (as well as others) it is to be hoped that the results of the operations will be well up to expectations.

Gold production of the Mysore, India, group of of mines during April was as follows:

	Ore milled, tons.	Tailing treated, tons.	Gold production, value.
Balaghat	3,550	8,021	$16,000
Champion Reef	18,514	27,977	198,000
Mysore	25,352	21,902	347,000
Nundydroog	7,500	7,665	120,000
Ooregum	12,770	11,623	142,000

The Burma Ruby Mines, Ltd., in April washed 90,000 'loads,' producing rubies valued at 68,000 rupees, equal to about $20,100. Royalties paid to the Indian Government amounted to $14,000. This company operates in the Mogok valley, upper Burma, India. Costs average about 15c. per 'load' treated.

Wolfram exports from Burma, India, during 1912 totaled 1862 tons, valued at $698,185.

*Abstract from the *Australian Mining Standard.*

Zinc-Dust Precipitation Equipment

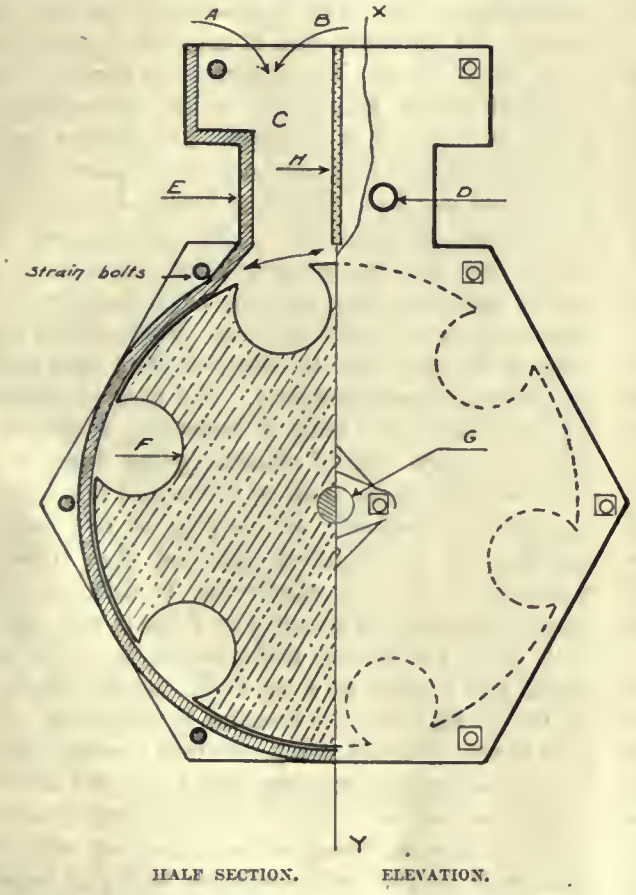
By Donald F. Irvin

Many of the departments of modern cyanidation have become practically standardized in the course of widespread construction of mills in the past five years, but among them all there exists a considerable divergence of opinion on the method of feeding zinc-dust to the solution pumps for precipitation according to the Merrill system.

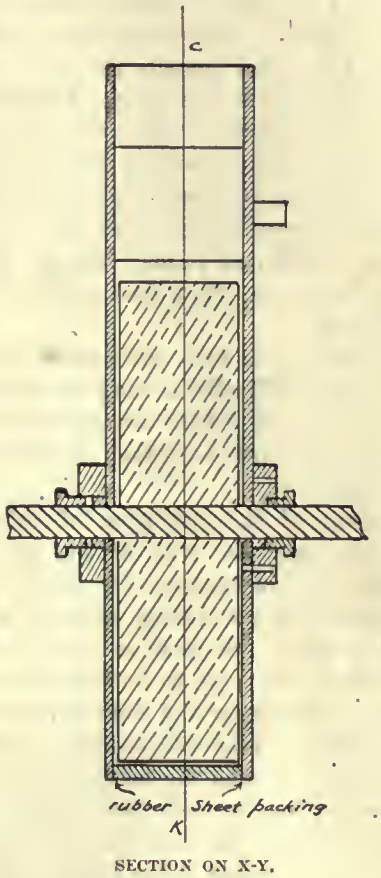
When this method of zinc-dust precipitation was first put on the market, the accepted form of zinc-dust feeder was a slowly moving continuous belt, which carried the dust and which was operated by a series of pulleys and cords attached to floats in the solution tanks. This feeder spilled the dust, in the required amount, into a shallow cone, which was filled by a small steadily flowing stream of solution, and the whole was emulsified by a light jet of air. The emulsion flowed from the upper edge of the cone to the suction of the solution pump supplying the zinc presses. While apparently simple, this method was not altogether satisfactory because of slippage of pulleys, spilling of zinc, and the inevitable clotting and incrustation of zinc-dust, wherever moisture reached it, before entering the pump suction. Furthermore, it was not a positive method of feed, and therefore not absolutely under control.

Various other zinc-dust feeders have been described, for example, those used at Zambona in Sonora, and Mocorito in Sinaloa, differing from each other and from the standard type above mentioned. Apparently realizing the defects of the earlier apparatus, the Merrill company has supplied a new device, which relies upon positive methods of feed, and, with some slight changes, it has been found satisfactory at the plant of the Tigre Mining Co., S. A., in Sonora.

Essentially, it is a covered hopper which holds the zinc-dust and discharges it through a slot in its lower side into a horizontal tube. This tube is provided with a central auger or screw, which, revolving slowly, forces out the zinc-dust at the end of the tube at a given rate of discharge. The auger is keyed to a gear driven by a worm that is keyed in its turn to a shaft, upon the other end of which is fixed a large friction disk. Motion is imparted to this disk by a friction roller carried on a small shaft, which is belted to a line shaft. A considerable variation in speed is made possible through shifting the friction roller across the face of the disk.



HALF SECTION. ELEVATION.



SECTION ON X-Y.

The only change found necessary in the machine as supplied to the Tigre company was a replacement of the auger which forces out the zinc-dust, and the tube containing it, as the original tube was too small for the requirements of precipitation, if the friction disk was to be run at any reasonable rate of speed. The tube as supplied had an available diameter of about 1 in., and was changed for one of 1¾ in. The original machine would doubtless do good work on a solution derived from the treatment of gold ore, but on silver ore containing copper in solution as well, it was too small, especially when the solution pumps are steadily run at top capacity.

With the above described zinc-dust feeder was also supplied a new emulsifying device in the shape of a small tube-mill about 2 ft. long by 8 or 10 in. diameter. The zinc-dust was to be emulsi-

fied in this small machine with a stream of solution and thence to flow to the pump suction.

This tube-mill was not found to be entirely satisfactory and it became necessary to devise a substitute for it. The idea of a tube-mill was considered good as a means of polishing and still further subdividing the zinc, if possible, as well as of emulsifying the solution. So a machine was built embodying this characteristic, though differing in some features from the original tube-mills.

The accompanying sketches show the essentials of the machine, though not a duplicate of the one built. The solution *A*, and dust *B*, drop into the small hopper *C*, in which the emulsion always stands at the level of the outlet pipe *D*. The lower part of the machine, with which the hopper connects by the neck *E*, is a flat box, circular in plan, inside which revolves a disk *F*, of the shape shown in the sketch. This disk has round pockets cut in its margin, some of which contain small pebbles. Pebbles may be put in any or all of them at will. The counter clockwise motion of the disk, revolving on the shaft *G*, carries the emulsion at least once around the machine before passing out through the outlet pipe *D*. This is effected by a baffle of rubber belting *H*, which prevents the emulsion, when first formed, from passing directly to *D*.

This machine has been quite satisfactory in operation, the only difficulty arising in case the solution supply be cut off, when the machine would stick. This seldom occurs, however, and when it does is easily rectified.

One result of the operation of zinc-feeding and emulsifying may be seen in the amount of zinc present in the precipitate—7% in the main precipitation circuit, and a general average of 9% in both circuits recently. Several months average show a ratio of total zinc used to bullion produced of 1.042 to 1.000. On the score of cleanliness and avoidance of waste of zinc, it should be noted that all the zinc and solution fall into the hopper *C*, and is immediately washed inside, and there is much less chance for loss of zinc by clotting than in the hitherto prevailing methods adopted for feeding zinc-dust. This plan is especially well adapted to solutions which precipitate readily, and removes the necessity for the purchase of the comparatively expensive equipment required by the method of precipitating alternate tankfuls of solution, with the tilting box arrangement, first introduced, it is believed, at the Gold Roads cyanide plant in Arizona.

Costs at the Horse-Shoe Mine, Kalgoorlie

During 1912, development covered 6481 ft. in ore, and 3287 ft. in country, and the mills treated 280,868 tons of ore at the following costs:

Mining, per ton	$2.58
Shaft-sinking, per foot	$95.22
Driving, cross-cutting, raises, and winzes, per foot	$18.06
Rock-crushing, stamping, concentrating, fine grinding, per ton	$1.07
Sand treatment, per ton	$0.61
Slime treatment, per ton	$1.38
Concentrate treatment, per ton	$2.50
Extraction, per cent	83.17

New Jig Classifier at the Quincy Mill, Michigan

A machine has been designed at the Quincy stamp-mills which will greatly improve the treatment of the so-called roughing-floor material, and is described as below in the *Houghton Mining Gazette*. It has been in successful operation for eight months.

The machine takes up a space of about 4 by 12 ft. and has a capacity of 500 tons per day. It is called a sectional positive jig classifier, and is made up of a number of sections so that it can be added to at any time without dismantling. The sections are all divided into pockets of 6 by 12 and 12 by 12 in., each having a positive plunger and an independent adjustable stroke. This is essential as to the treatment of the different sizes of material ranging from ⅝-in. to 100 mesh. The plungers are made of brass, and each carries an oil bath inside, submerging the pin on the plunger at all times. The plunger casings are made of cast iron, and are independent of each other, and can be removed or replaced at any time if necessary in quick time. The sections are lined with a cast iron box to protect them from wear, and at the same time they conform as to shape with the partitions in the hutch pockets. Each pocket has a plug of its own, and the material from each pocket is discharged independently. The present roughing jig practice in the mills is imperfect, inasmuch as there is a good deal of material going down on the 'roughs' that ought to go on tables and into a grinding machine instead. The mixing of this material together on the roughing jigs and then trying to separate on the jig afterward, is difficult. This Quincy machine takes only 3 to 4 hp. to run, against 25 to 30 in the present mill practice to do the same work, and a space of 4 by 12 ft., against 25 by 40. At the present time the machine is taking the mixed feed direct from the stamp, the feed coming through a ⅝-in. screen and running direct into the machine.

The trommel screens have been discarded together with all the shafting, belting, gearing, etc., that goes with it, also the ponderous bull jig, together with its shafting, hangers, and belting. The roughing jigs can all be discarded, as this machine does all the work of these machines. It classifies the material to about 20 different sizes and at the same time takes out between 65 and 70% of the total copper direct from the stamps, copper ranging in size from ⅝ in. down to 'table copper.'

This simplifies the present practice, as the copper at the mills on Lake Superior is scattered all over the different machines, amounting in some cases to as many as 20 to 30 on the roughing floor alone. This machine by taking out so much copper and sorting out the material to be ground, and confining it in a small space simplifies the treatment of the roughing material to a great extent. Grinding machines can be placed directly in front of this machine on the roughing floor, and the material coming from the different plugs can be sampled, assayed, and if rich enough to be ground can be turned directly into the grinding machines after the free copper has been taken out.

Slow-Speed Milling

By E. E. Carter

The Chilean mill is an old and familiar machine. In its crude form it consisted of a heavy stone wheel, pulled around by animal power. While the capacity of these mills may have been small, they doubtless embodied the principles which are carried out in the modern machine. There are a number of mills in use which have the same general construction, the principal difference being in mechanical details. The most common type is the three-wheel mill, which runs upon track with a diameter of five or six feet. These mills are driven by bevel gears and have their wheel axles hinged so that any obstruction on the die will not cause an injurious strain. The average speed of these mills is about 35 revolutions. At this speed in a 6-ft. mill the pulp is traveling at a rate of approximately 665 ft. per minute or about a mile in eight minutes. A fair gait for something you are trying to catch. The pulp is splashed against the screens and agitated under the wheels until any amalgam that is formed is scoured off and re-ground, and put in fine condition to float over the plates without being caught. The quicksilver flours under these conditions, and once floured it is hard if not impossible to catch it. The power used to drive a mill of this type is excessive. The uneven wearing of dies and tires, making it necessary to discard these parts when but partly worn out, has made these mills somewhat unpopular.

It is easy to find plenty of millmen who will say. "If you want amalgamation, there is nothing like an arrastre." But the arrastre has no capacity. It is adaptable only to high-grade ores, and is a crude affair, though it saves the gold. What are the reasons that it does so? Why can't these same principles be retained in a machine that will have capacity?

Principles of the Arrastre

The most striking feature is that it goes slowly enough to allow the gold to settle and come into contact with the quicksilver. When the gold does find the quicksilver and unites with it to form amalgam, it is not immediately re-ground. However, even an arrastre will flour quicksilver and lose gold if it is crowded, or the pulp is not of the proper consistence. The Mexican, the mule, and the arrastre presented a combination that eliminated the 'hurry it through,' and gave the arrastre its good name for amalgamating efficiency. A feature that should not be overlooked is that the gold has been rubbed and brightened so that it presents a clean surface for amalgamation. Now, admitting that the arrastre principles are correct, and bearing in mind that 'haste makes waste,' even in the gold industry, turn attention to getting more ore through and still save the gold.

Why doesn't the arrastre crush more? The drags do not pass over the unbroken ore often enough. They wear out too fast, even with its small capacity. The machine pulls hard. Retain the elements that make the arrastre a good amalgamator and give the machine a capacity that will compare favorably with stamps and other milling machinery, and the result is a slow-speed Chilean mill. One must realize that mills of small diameter cannot have capacity and slow speed. There are many of these slow-speed mills in operation.

Where Amalgamation is Preferable

There are many cases where concentration and cyanide treatment have been adopted, but where simple amalgamation would be preferable. Ores are being treated by cyanidation that were formerly considered unamenable to it. Many carry the use of the process to extremes, when they should have remained with their old standby, amalgamation. There is an old saying that you can't beat stamps when it comes right down to real milling, year in and year out, but one does not have to look far to see signs of the passing of the stamps. Some of the best mills in the world have abandoned them. Few are using them for what they are supposed to excel in, amalgamation. On the contrary, they are being put into a lower class. They have been faithful old friends, and operators dread to let them go, so they make secondary crushers of them, because they are simple and easily understood. However, there are better secondary crushers. The wear and tear that goes with an ordinary stamp-mill is not considered.

The perfecting of suitable filters for slime treatment, with the corresponding increase in fine grinding, has brought the tube-mill to the front, and it has proved an excellent machine. It is simple and runs most of the time, and that appeals to the majority of millmen. It is a power consumer, but it does the work required at the cyanidation plant; that is, it crushes fine, and as long as it gets results, high power costs are condoned. It is evident that the tube-mill is the machine, if the ore is a cyaniding type. Of ores that will amalgamate if crushed finer, it is surprising how many will amalgamate if given the same opportunity.

For cyaniding, the ore is crushed to 100 mesh, and often much finer. This liberates the particles of gold and presents them bright and clean to the action of the cyanide. Why not give quicksilver the same chance? It will get the gold if given even one-half the attention that cyanide solutions require. Solutions must be tested constantly, but the consistence of the pulp is rarely tested, and it is important that it should be thin enough to allow it to unite with the quicksilver.

The arrastre crushes the ore to 100 mesh or finer and does not flour the quicksilver or force the pulp away so fast that it does not give the quicksilver a chance. Amalgamation has been tried many times in tube-mills, but it has always been found that inside amalgamation is impractical because of the flouring of the mercury. This puts the otherwise efficient machine out of the amalgamating class. There has recently been brought out a tube-mill having its grinding compartment separate from the amalgamating end. It is possible that this machine

may offer advantages. Results will be watched with much interest.

Returning to the mill which will grind to 100 mesh or finer and save the gold, both coarse and fine, I will say that a slow-speed Chilean mill having six wheels and not running over 8 revolutions per minute, on a 10-ft. die, will accomplish the required results as to amalgamating efficiency, capacity, and power consumption. Much credit is due C. C. Lane, its inventor. Such a mill will run on from 8 to 10 hp. Its average capacity will exceed 50 tons per day. Experience at the Gold Hill & Iowa mines has shown that 90% or more of the gold is retained within the mill pan as amalgam and rich concentrate.

In the Lane mill the tank above the wheels is loaded to the desired weight, which is varied in accordance with the hardness of the ore. It should be run as light as possible, bearing in mind that so long as the weight of the roller is sufficient to crush the hardest and largest particles, any additional weight means pulling an excessive load. For this reason it is a decided advantage to have the feed as uniform in size as possible. The wheels are so arranged that they may be run at a slight tangent; this gives a rubbing action to the ore, and also serves to true the uneven wear on tires and dies.

Screens were tried and abandoned in favor of the overflow discharge. The slight wave and agitation were not sufficient to clear the screens. The size of the discharged product is regulated entirely by the height of discharge, which in turn is somewhat dependent upon the feed and quantity of water. The pulp is kept thin, and the feed is so arranged that about one inch is over the die at all times. Over feeding causes the concentrate and quicksilver to be thrown out upon the outside plates, causing a loss. Over feeding may be readily detected by observing the coarse particles passing over the plates and also by the position of the large driving gear which raises with the wheels.

Regulating Quicksilver Feed

The outside of the mill pan is flared so that the pulp becomes less active as it nears the surface. Quicksilver is fed into the mill pan (not through the feed pipes) and the amalgam is carried somewhat softer than in a stamp-battery. A frequent inspection of the inside copper plates will give a direct line on the quantity required, and an excess does not seem to have a marked injurious effect. It is only the finer particles that are carried in suspension sufficiently high to be washed over the discharge lip, the heavier particles being carried around at the rate of about 250 ft. per minute until they become lodged upon the copper side plates or settle in the recesses around the die. The discharge opening is raised slightly on the side receiving the first action of the wave; this insures an even splash across the whole opening.

The feed is through pipes leading from the centre to, and distributing the pulp ahead of, each wheel. Centrifugal force throws the particles into suspension and the whole mass is slowly rolled around until they are either crushed by the wheels or worn out by the abrasion. When the mill is shut down and the particles are examined, it will be found that they are worn round and that all metallic surfaces are bright and in an ideal condition for further treatment. Screen analysis of the discharged pulp at the Quartzburg mines shows the following:

Mesh.	Per cent.	Mesh.	Per cent.
Through 40	97.5	Through 100	89.5
" 60	97.0	" 150	60.0
" 80	91.5	" 200	51.0

Size of Feed

The size of the feed may vary with different ores; it should never be finer than ½ in.; on most ores, ¾ to 1 in. will be found to give the best results. It seems somewhat strange, but greater capacity is obtainable when the mill is fed with ½ to ¾-in. material than when 30 to 40 mesh is fed. The fine material seems to follow the wheels. The coarser particles tend to retard the finer and aid in the grinding similar to the action of pebbles in a tube-mill. These slow-speed mills have been extensively fed from stamps having coarse screens. The Chilean mill in such cases is depended upon wholly for amalgamation. More economical results may be expected from stage crushing and having crushers of the gyratory type and a set of roughing rolls. A form of disc crusher has recently been put upon the market which crushes to a uniform size with comparatively little wear, and has great capacity per horse-power. Jaw crushers, generally speaking, have not been found successful for this kind of work, as the plates wear hollow rapidly and the product is uneven.

No exact data have been kept of the water used, but it is safe to assume that to get the best results the pulp must be kept as thin as in stamp-mills. It is an advantage to feed the water as early in the crushing as possible. Repairs and maintenance are comparatively small, due to the slow speed of the mill. The mill is so constructed that it is easily transported, the greater part of it being structural steel, the wheels being hollow, and the fact that the weight is derived from a tank which is loaded with rocks offers an advantage in mountainous countries.

The clean-up is made by running the mill down until the die is clear. The plugs on the sides are then opened and the mill is allowed to run, cutting down the water-supply until the entire content has run into the tanks placed to receive it. The power is then shut off, the side plates removed, and a hose having a good pressure is used to sluice out the remaining contents, previously loosened by suitable scrapers.

Gold production of several Rhodesian mines in April was as follows:

	Ore treated, tons.	Gold produced, value.	Profit.
Giant Mines	11,580	$62,000	$29,000
Globe & Phoenix	6,550	212,800	137,000
Lonely Reef	*10,212	196,000	100,000
Sheba Gold	6,340	62,000	21,000

*Quarter ended December 31, 1912.

Net Recovery From Porphyry Ores

By Heath Steele

The foundation of any estimate of the value of porphyry copper mines is the amount of net recoverable copper to be realized from the ores. To solve this question, great care has undoubtedly been taken by the companies to obtain a correct estimate of the average contents of their orebodies. This work has necessarily been limited to hand sampling and sampling by drilling, and, therefore, is subject to error. It is not intended to question the methods of arriving at these estimates, but to determine a general per cent factor that may be used by the investor in estimating the amount of refined copper that may reasonably be expected from the gross copper contents as indicated by the estimates published. This factor would naturally cover any error in sampling as well as losses in milling and smelting, and will simplify such calculations, which are at best only approximations.

Mill extractions given in the reports as well as notices given out by financial papers certainly create a wrong impression among laymen and among some engineers. During 1911 it was stated that the mill extraction for the month of August at the Miami Copper Co.'s mill was 76%, and the prediction was made that it would later reach 80%. As a matter of fact, the annual report for the year 1912 states that the mill extraction was 69.39%. From a file of clippings and numerous reports at hand, it is observed that mill extractions for the porphyries are all reported at about 70% of the mill-heads. These figures may be accepted with confidence, but not as a basis for the estimation of refined copper that may be expected from the estimated gross contents of the ore reserves.

To prove the assertion that even those familiar with mining are deceived in this manner, a statement published in the *Boston News Bureau*, on April 13, 1911, that, allowing for all losses, Miami's ore should yield 37.5 lb. copper per ton, may be cited. This was when the ore was estimated to contain 51.6 lb. per ton, and would mean a net recovery of about 73%, and, after deducting smelter losses, a mill extraction of about 76.5%. As a matter of fact, the actual net recovery based upon the estimated contents of the ore in reserve has been, 66.7% in 1911, and 61% in 1912, when about 5.8% of the total 1911 ore reserve was milled. A mill extraction of 70% means a recovery in refined copper of about 66.5% of the mill-heads, but this figure will make no allowance for an apparent difference in the estimated contents of the ore and the actual results of mining. This difference may be seen in the table given herewith.

The per cent recovery is based upon the estimated contents of the ore reported in reserve at the beginning of the years; that is, the net recovery in 1912 is figured against the average contents reported at the end of 1911 for the ore reserve. In some cases, particularly in the case of Chino, some oxidized ores have been treated, which accounts for a low recovery. Nevertheless, the fact remains that in 1912, of the 437,899,000 tons of ore reported at the end of 1911 by the Nevada Consolidated, Utah Copper, Miami, and Ray Consolidated companies, and estimated to contain an average of 33.6 lb. of copper per ton, actual milling yielded only 20.4 lb. of refined copper per ton, or 61.4% of that estimated. This is the result of milling 10,809,000 tons of ore. Practically the same factor was obtained some time ago by another calculation, and it is worthy of notice that the Nevada Consolidated is the only one of the four that has done much better, while in the case of the Utah Copper the average has been much lower. Consideration has no doubt been given by all companies to the possibilities of errors in the estimated contents of these reserves; but the question, Have they made due allowance? is forced upon one by these facts when trying to get some idea of their present value.

Utah Copper Company

Reported in reserve.			Operating results.		
End of year.	Tons of ore reported	Cu per ton, lb.	During year.	Tons of ore treated	Refined Cu per ton, lb.
1909	90,000,000	35.0	1910	4,340,245	19.46
1910	203,500,000	33.4	1911	4,680,801	19.95
1911	301,500,000	30.0	1912	5,315,321	17.20

Per cent actual recovery: 1910, 55.6; 1911, 59.9; 1912, 57.4.

Miami Copper Company

1910	18,000,000	51.6	1911	445,036	34.40
1911	18,232,000	51.6	1912	1,040,744	31.50

Per cent actual recovery: 1911, 66.7; 1912, 61.

Ray Consolidated

1910	75,096,000	43.4	1911	681,519	21.90
1911	77,314,000	43.4	1912	1,565,875	22.20

Per cent actual recovery: 1911, 50.6; 1912, 51.2.

Nevada Consolidated

1909	29,000,000	40.0	1910	2,237,028	28.10
1910	40,360,000	34.0	1911	3,338,242	23.60
1911	40,583,000	33.2	1912	2,887,731	21.90

Per cent actual recovery: 1910, 70; 1911, 69.5; 1912, 66.

Chino Copper Company

1911	54,970,000	44.8	1912	1,122,666	24.70

Per cent actual recovery: 1912, 55.

The effect of lowering or raising the grade of the ore upon the present value of a property would be approximately as shown in the following table:

Error, per cent.	Estimate.	Present value.	Per cent.
5	above	raised	2.16
5	below	lowered	2.43
6	above	raised	2.70
6	below	lowered	2.97
7	above	raised	2.98
7	below	lowered	3.50
8	above	raised	3.38
8	below	lowered	4.05
10	above	raised	4.06
10	below	lowered	5.10

For example, if mining and milling costs $1.70 per ton of ore, and smelting, refining, marketing, etc., 4c. per pound of copper, the cost of producing

copper from an ore yielding 50 lb. per ton would be 3.4c. per pound for mining and milling, and 4c. for smelting, etc., making a total cost of 7.4c. per pound. On an ore averaging 50% less copper, or 25 lb. per ton, the cost would be 6.8c. per pound for mining and milling, and 4c. for smelting, etc., making a total of 10.8c. per pound. This shows an increase of 100% in mining and milling cost, but with smelting, etc., at almost a uniform charge per pound of metal, the total cost is only increased 46%. This would mean that the present value would be only 54% of the original estimate, based upon the example assumed. In some cases a reduction of only a few points in the yield per ton would result in no profits at all.

Mineral Production of Great Britain in 1912

The following table shows the mineral output of England, Scotland, and Wales, where 1,089,165 men were employed in the industry. The death rate was 1.16 per 1000 employed, against 1.19 in 1911. The tonnage given does not include that from workings over 20 ft. deep, where artificial light is not used:

	1912, tons.	1911, tons.
Coal	260,567,552	271,878,924
Oil shale	3,184,826	3,116,803
Ironstone	8,417,246	9,710,693
Iron pyrites	10,522	10,114
Copper ore	1,912	3,244
Gold ore	170	2,752
Lead ore	25,323	23,804
Manganese ore	4,170	4,987
Tin ore	6,817	6,545
Uranium ore	42	67
Wolfram ore	189	260
Zinc ore	17,704	17,652
Arsenic	2,193	2,144
Arsenical pyrites	1,778	1,170
Barytes	42,767	42,550
Bauxite	5,790	6,007
Gypsum	243,811	232,510
Limestone	355,433	421,884

Weight of Tube-Mill Pebble Loads

By W. A. Caldecott

(From the *Journal* of the Chem., Met. and Min. Soc. of South Africa.)

Weight of Load in Tons of Pebbles (at 105 lb. per Cubic Foot).

Pebble load in 22-ft. tube-mill.	Internal diameter of tube-mill lining. 54 in.	55 in.	56 in.	57 in.	58 in.	59 in.	60 in.	61 in.	62 in.	63 in.
12 in. above axis of mill	14.21	14.65	15.10	15.55	16.02	16.48	16.96	17.44	17.92	18.42
11 " "	13.81	14.25	14.69	15.14	15.59	16.05	16.51	16.98	17.46	17.94
10 " "	13.41	13.84	14.27	14.71	15.15	15.60	16.06	16.52	16.99	17.47
9 " "	13.01	13.43	13.85	14.28	14.71	15.16	15.60	16.06	16.52	16.98
8 " "	12.60	13.01	13.42	13.84	14.27	14.70	15.14	15.59	16.04	16.50
7 " "	12.18	12.58	12.99	13.40	13.82	14.24	14.67	15.11	15.56	16.01
6 " "	11.76	12.15	12.55	12.95	13.36	13.78	14.20	14.63	15.07	15.51
5 " "	11.33	11.72	12.11	12.50	12.90	13.31	13.73	14.15	14.58	15.01
4 " "	10.90	11.28	11.66	12.05	12.44	12.84	13.25	13.66	14.08	14.51
3 " "	10.47	10.79	11.21	11.59	11.98	12.37	12.77	13.17	13.59	14.00
2 " "	10.04	10.40	10.76	11.14	11.51	11.90	12.29	12.68	13.09	13.50
1 " "	9.60	9.96	10.31	10.68	11.05	11.42	11.80	12.19	12.59	12.99
Level with axis of mill (*i.e.*, half full)	9.18	9.53	9.88	10.23	10.60	10.96	11.34	11.72	12.11	12.50
1 in. below axis of mill	8.77	9.10	9.45	9.79	10.14	10.51	10.88	11.25	11.63	12.01
2 " "	8.33	8.66	9.00	9.33	9.69	10.03	10.39	10.76	11.13	11.50
3 " "	7.90	8.27	8.55	8.88	9.22	9.56	9.91	10.27	10.63	11.00
4 " "	7.47	7.78	8.10	8.42	8.76	9.09	9.43	9.78	10.14	10.49
5 " "	7.04	7.34	7.65	7.97	8.30	8.62	8.95	9.29	9.64	9.99
6 " "	6.61	6.91	7.21	7.52	7.84	8.15	8.48	8.81	9.15	9.49
7 " "	6.19	6.48	6.77	7.07	5.38	7.69	8.01	8.33	8.66	8.99
8 " "	5.77	6.05	6.34	6.63	6.93	7.23	7.54	7.85	8.18	8.50
9 " "	5.36	5.63	5.91	6.19	6.49	6.77	7.08	7.38	7.70	8.02
10 " "	4.96	5.22	5.49	5.76	6.05	6.33	6.62	6.92	7.23	7.53
11 " "	4.56	4.81	5.07	5.33	5.61	5.88	6.17	6.46	6.76	7.06
12 " "	4.16	4.41	4.66	4.92	5.18	5.45	5.72	6.00	6.30	6.58

The above table is calculated as follows:

Assume R = internal radius of lined tube-mill in inches.

V = height in inches from top of pebble load to lining.

L = length of tube-mill in feet.

F = Weight in pounds of one cubic foot of pebbles.

Then the general formula for the pebble load in tons is:

$$0.0001\ L\ F\ \{0.1091\ R^2 - 0.0463\ V\ \sqrt{V(2R - 0.608V)}\}.$$

The pebble load in tons of a tube-mill 22 ft. long, and with pebbles at 105 lb. per cubic foot, is:

$$0.0252\ R^2 - 0.0107\ V\ \sqrt{V(2R - 0.608\ V)}.$$

The above formulae are derived from Molesworth's formula for the area of a segment, namely:

$$\frac{4\ V}{3}\sqrt{(0.626\ V)^2 + C^2},$$

when V is the height of the segment, and C is the semichord.

When the upper surface of the pebbles is below the axis of the tube-mill, find the weight of the pebble load whose upper surface would be the same distance above the axis, and deduct this weight from the weight of the pebble load required to entirely fill the tube-mill.

Western Australia Gold Production

The total gold return for February was $2,148,300, the chief producers being the following:

Name.	Tonnage.	Value.	Profit.	Div.
Gt. Boulder Proprietary	16,149	$216,500	$117,000	.....
Ivanhoe	17,927	185,600	80,000	.....
Kalgurli	10,100	102,100	46,000	.....
Yuanmi	9,700	85,700	32,800	.....
Victorious	8,600	62,400	31,500	.....
Sons of Gwalia	12,600	100,900	19,900	.....
Perseverance	19,314	120,000	19,000	.....
Lake View & Star	17,010	98,500	17,000	.....
Fenian	2,900	33,500	13,500	.....
Golden Horse-Shoe	23,197	163,100	10,400	.....
Associated Northern	1,398	28,500	10,200	.....
Mararoa	2,512	23,900	8,900	$25,000
Sand Queen	895	18,800	8,800	7,500
Mountain Queen	3,305	23,300	7,900	.....
Ingliston Consols	1,250	15,500	7,300	.....
South Kalgurli	9,242	52,600	7,200	.....
Associated	9,855	61,200	7,100	.....
Kyarra	606	12,000	5,600	.....
Golden Ridge	2,786	20,800	4,900	.....
Menzies Consols	1,874	19,400	4,400	.....
Hainault	2,267	14,700	3,600	.....
Lake View Consols	8,550	7,600	2,200	.....
Ida H.	1,225	13,900	1,900	.....
Boulder No. 1	2,390	4,000	800	.....
Commodore	1,130	6,500	600	.....
Marvel Loch	1,396	8,300	400	.....
			Loss.	
Great Fingall	5,526	45,000	60	.....
Lady Miller	1,423	7,900	600	.....
Burbanks Main Lode	1,898	17,900	3,200	.....
Burbanks Birthday	1,550	14,500	.....	.....
North Kalgurli	1,003	13,100	.....	.....
Hannans Reward	1,095	3,800	.....	.....

Goldfield Consolidated Report

Preliminary estimates of the May production of the Goldfield Consolidated are: Total tons mined, 30,890; gross value recovered, $421,000; operating expense, $202,000; net realization, $219,000.

During April, the results were as follows, according to Albert Burch, general manager:

Ore treated, tons	26,185
Net realization	$193.355
Costs per ton treated:	
Mining, including development	$3.79
Transport of ore	0.10
Milling	2.04
Marketing	0.06
General expense	0.31
Bullion tax	0.03
Construction	0.07
Marketing ore shipped	0.67
Total	$7.07

Miscellaneous earnings were 15c. per ton, leaving net costs at $6.92 per ton.

Development covered 3700 ft. in the mines. In the Combination, on the bottom level, 414 E. sill, about 200 ft. southeast of the shaft, produced 267 tons of ore averaging $19 per ton. This was the ore discovered in cutting the station for the 414 D. winze, and 414 E. raise was driven on it to the sill of the 414 C. stope 70 ft. above. The ore from the raise averaged $50 per ton. Filling was continued throughout the month in the 136 BX stope, and by the end of the month it was in good working condition. In the Mohawk, on No. 1 level, the 170 BX sill, about 600 ft. westerly from the shaft, was started, and produced 92 tons averaging $19 per ton. The 3 R. sill was slightly extended and produced 64 tons of $8 ore. The 293 D. raise, above the No. 2 level, about 500 ft. north of the shaft, cut a 6-in. seam, which, on driving, assays regularly 8 to 30 oz., and is in promising territory. Filling was continued throughout the month in the 202 HX stope, which is the highest grade stope in the Mohawk, and was nearly completed.

The 910 intermediate of the Clermont-Jumbo, below the 802 A. sill, produced 201 tons of $23 shipping ore. The filling of the 420 stope was practically finished at the end of the month.

During the month a change was made in the filter plant at the mill, necessitating the running of 80 instead of 100 stamps while the change was in progress. This work is now completed.

Mint Receipts for April

Gold receipts at the San Francisco Mint during April were as follows:

	Fine ounces.
Alaska	8,564.069
Arizona	9,047.426
California	17,476.025
Idaho	3.763
Nevada	3,939.196
New Mexico	554.066
Oregon	575.550
Philippine Islands	1,402.661
Washington	17.152
Refineries, government offices, etc.	115,189.914
Mutilated U. S. coin	31.373
Foreign coin	24,106.582
Jewelry	1,202.499
Central America	239.724
Mexico	821.140
Total receipts	183,165.140
Total value of gold	$3,786,359.36

According to William C. Ralston, United States sub-treasurer, there is lying in the San Francisco sub-treasury the sum of $77,760,806, of which $47,115,380 is in gold.

Indian Gold Imports

Figures have been compiled in New York showing that the net imports of gold into British India on private account in April were £1,405,933, compared with £1,985,866 in April 1912. The effect of India's gold absorption upon the Western world's banking reserves makes the statistics of much interest, and it is gratifying to note even a moderate recession in the rate of demand from the high amounts of last year. Appended are the net gold imports for the first four months of the last two years:

	1913.	1912.
January	£3,972,067	£ 3,434,466
February	2,049,133	5,174,660
March	1,340.000	3,701,200
April	1,405,933	1,985,866
Total	£8,767,133	£14,296,132

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Hydraulic Elevator Work on Anvil Creek

The Editor:

Sir—In my paper entitled 'Hydraulic Elevator Work on Anvil Creek, Nome, Alaska,' appearing in your issue of April 26, please note that an error occurs in the printing of the last column of the table on page 617. The first figure in the column headed "Per cent of total water used" should be 67.1 instead of 6.7.

London, May 10. C. W. PURINGTON.

Graphic Solution of Mine Problems

The Editor:

Sir—In an article published in the *Engineering and Mining Journal*, March 22, 1913, entitled 'Graphics Applied to Fault Problems,' E. R. Rice presents an interesting contribution to the literature of graphics applied to faulting. The article mentioned also presents an example of how the value of a contribution to technical literature is greatly diminished by neglecting to cite authorities and give references. Mr. Rice uses the fault nomenclature suggested in my book 'Methods of Investigating Problems in Faulting,' and unless the reader is familiar with this nomenclature and with the graphic method developed, he could not understand the article. The second problem discussed by Mr. Rice is of interest as a simple example of the use of the convenient 'equivalent pole' as developed in the textbook mentioned. Any solution of fault problems is difficult for one who is not familiar with the methods of graphics, but with that familiarity, apparently complex problems become simple.

C. F. TOLMAN, Jr.

Stanford University, May 24.

Mining on the West Coast of South America

The Editor:

Sir—Absence in the interior has prevented an earlier perusal of your issue of January 25, which contains an article by Howland Bancroft on the above title. As Mr. Bancroft has not been on the West Coast since October 1911, it is difficult to conceive that the account of conditions in 1912 in the republics of Peru, Bolivia, and Chile could be based on personal observations. The accounts given for Peru bear a remarkable resemblance to the Lima letters in *The Mining Magazine* (London) of August and November 1912. The above comment is made without malice aforethought, but it would seem that matters should be expressed as they really are.

Lima, Peru, April 29. LESTER W. STRAUSS.

[Mr. Bancroft prepared the article mentioned, in December, by request, supplementing his own notes by correspondence and later reading. If, as our correspondent thinks, he drew over-heavily on Mr. Strauss' letters in *The Mining Magazine*, we can only say he went to a good source and a good authority. —EDITOR.]

Working Costs at the Erie Mine

The Editor:

Sir—My attention has just been called to Charles Janin's article on 'Operating Costs of California Mines.' Although this article was published in the *Mining and Scientific Press* of October 26, 1912, I missed that number and therefore have not corrected certain erroneous impressions in regard to the costs at the Erie mine under my management.

My article, which Mr. Janin quotes, gives the total cost as $31,590.50, not $40,797.50, and our costs for the six months were $2.32 per ton, not $3. Mr. Janin has included the construction account in his total; this would be manifestly unfair, since it was charged to capital account, and as such paid interest, which was included in the administration charge. Mr. Janin was correct in stating that these costs did not include previous development, but if he had read further he would have found an estimate of 21c. for sinking fund and 21c. for amortization. These costs were estimated upon the tonnage of ore blocked out by all previous development and were an ample amount, if based on the full capacity of the mill, 3000 tons per month. Of course, if a less amount were mined and milled, all the costs per ton would be increased.

And this brings us to the last word in Mr. Janin's article, which might be misconstrued: "and for a short period, it is claimed, a working cost of $1.29 obtained, but the mine (Erie) soon afterward closed down." The mine was closed down because the owners persisted in a hand-to-mouth policy, and would not put up the money to develop ore ahead, so that the mine could be run at full capacity.

As well as illustrating some of the uncertainties of mining, it would be proper to say that after months of patient work the long-lost ore-shoot was uncovered, and the owners were asked for a small amount to develop it, but, although 40 tons were milled with a recovery of over $12 per ton, the owners were skeptical about the property, thought the good ore only temporary, and that it would attract buyers. They, therefore, placed the property under bond and lease, and although the lessees have been at work but a short time, they have uncovered a valuable deposit of ore, and I am reliably informed that the Erie promises to be a good investment.

The Erie has exceptionally good working conditions, and with a fair amount of judgment in the management, could make a handsome profit on ore that would barely pay expenses elsewhere. It is hardly necessary to add that I am not in any way interested in the Erie mine, except to wish it all success. The costs quoted were reached by milling a large quantity of low-grade ore and by adopting the most efficient methods of work. I would not attempt to duplicate them with the higher grade of ore now available, as the higher grade necessarily involves more care in the mining and handling.

S. H. BROCKUNIER.

Nevada City, California, May 20.

Special Correspondence

YUMA, ARIZONA

LA FORTUNA MINE RESUMES OPERATIONS.—FAMOUS OLD MINE SOLD TO KEEVER AND WOODWORTH.—ORE FOUND TO THE EAST.——NEW MILL TO BE BUILT.

Active mining operations have been resumed on the famous La Fortuna mine, situated about 23 miles southeast of Yuma. During the seven years beginning with 1895, this mine produced nearly $3,000,000 in gold and paid $1,180,000 in dividends to its owners, the late Charles D. Lane and associates. For a long period the average production was close to $50,000 per month, and as much as $90,000 worth of gold was extracted in a single month. La Fortuna was discovered in 1895 by three prospectors who were looking for placer gravel to be worked by the 'dry-washer' process. The story of the discovery and development of the property was told by F. J. Martin in the *Mining and Scientific Press* of July 6, 1912. The locators sold the property for $150,000 to Mr. Lane, who organized a company, of which he became president. In less than a year from the time the company took the property, the output more than paid for the mine and plant.

PART OF THE FORTUNA WORKINGS.

Some months ago Frank B. Keever and Todd S. Woodworth, of San Francisco, began an examination, through their field men, of La Fortuna, and the ground adjoining it on the west and east, and after full investigation secured an option on La Fortuna group, which contains seven patented claims. They also secured the ground adjoining La Fortuna on the west, known as the Phelan-Graham group, and the ground adjoining La Fortuna on the east, known as the Sommers-Gurski group. The Fortuna vein has been developed in the Phelan-Graham ground, with five shafts sunk on the ore. Several shafts on La Fortuna ground from which a considerable tonnage was extracted are within 100 ft. of the end-line of the Phelan-Graham group. Work was begun on this ground about the same time operations were started on La Fortuna, but on account of lack of water-supply has been only intermittently prosecuted. In order to eliminate the expense of a separate water-supply and of machinery for the Phelan-Graham property, the owners proposed a consolidation with La Fortuna, but no mutually satisfactory agreement could be reached. The Sommers-Gurski group has long been held because of its proximity to the proved ore zone in the Fortuna, and recent developments establish its importance to the consolidation.

From 1901 to 1904, heavy expenditures from the profits of La Fortuna were made in sinking a thousand feet below the 1000-ft. depth previously attained, with considerable lateral work. It was recognized that operating costs could be materially reduced by modernizing the plant; but at that time extensive mining enterprises in Alaska and other affairs of the principal owners demanded their attention, and operations were suspended before the lateral development had been far enough advanced to disclose the orebody at the greater depth. Successive events in the career of Mr. Lane, culminating in the attack of blindness which ended his activities, prevented him from carrying out his often-expressed desire to resume operations on La Fortuna, and with his death two years ago the property was practically abandoned until it was acquired by Keever and Woodworth.

During the interim there have been important developments in La Fortuna, disclosing not only that on the lower levels the lateral work was not continued far enough to the eastward to intercept the orebodies, but that if the upper levels had been carried farther eastward they would have opened productive ground. A new ore-shoot recently discovered there shows under development strong promise of proving an equal importance with the original ore-shoot, and it now appears that had they continued driving in the eastern part of the mine, they would have practically continued in ore of the same high average value as that extracted from the old workings.

At the present time Keever & Woodworth are rehabilitating the Fortuna main shaft and general workings, both at the surface and underground. They are obtaining estimates for modernizing the plant in order to reduce operating costs to the minimum, and for restoring the old pipeline. It is their plan to have the main La Fortuna group in full operation and the general exploration of the east and west ground well advanced within ninety days, and within the next five months the Fortuna 20-stamp mill should be dropping on a class of ore fully equal to that formerly milled, with a probable reduction of 30% in working costs. It is interesting to note that the $3,000,000 production of La Fortuna was made from ore of an average grade of $15.94 per ton, while the average value of the ore reduced during the last year of operations was $18.28 per ton, of which $16.15 was recovered by amalgamation.

NEW YORK

GIROUX CONSOLIDATION PROVIDES A NEW CONCERN FOR ELY.—CHINO AND RAY DIVIDENDS.—COPPER MARKET DULL.—MEXICAN LOAN.—MAY PIG IRON PRODUCTION.

Announcement of the merger of the Giroux, Butte & Ely, Coppermines, and Chainman Consolidated groups of properties at Ely, Nevada, forming the Consolidated Coppermines Co. with an authorized capital of $8,000,000 in shares of $5 each, was a feature of the copper market last week. The shares of the old companies are to be exchanged for stock in the merger at the rate of 2½ for 1 in the case of Giroux, 6¼ Butte & Ely for 1, 3⅛ Coppermines for 1, and 25 Chainman for 1. Stockholders who make the exchange have the privilege of subscribing at par for 7% convertible bonds, of which $3,000,000 will be issued, payable in four semi-annual installments. The consolidation will give the new company 160 claims, though the Chainman ore will be chiefly valuable for its excess iron and on account of its gold content. The Giroux has lately been mining about 1000 tons per day of ore said to contain 2% copper, which has been treated at the concentrator and smelter of the Nevada Consolidated. There have been repeated rumors that the Nevada Consolidated would eventually take over the Giroux, but the new arrangement effectually dismisses any such possibility. The Butte & Ely is already controlled by the Giroux, which some time ago took over 240,000 shares at $1 per share. The Coppermines Co. at one time had an authorized capital of $60,000,000, which was later reduced to $5,000,000. Little has been done to develop the property, which has good water rights and millsites. The Giroux has over $7,000,000 in shares issued and an indebtedness of $600,000. The merger, therefore, is a brave attempt to put on a working basis a number of properties from which great things were expected, but which did not come up to expectations. The Giroux has been producing a good deal of ore lately and in the other properties workable bodies have been developed. The directors of the new company will be as follows: Thomas F. Cole, Joseph B. Cotton, Isadore Hernsheim, William B. Joyce, Ralph C. Lupton, Mulford Martin, C. Lawrence Perkins, James Phillips, Jr., Charles F. Rand, W. Hinckle Smith, Erastus T. Tefft, and William W. Thompson.

Declaring of dividends by the Chino and Ray Consolidated Copper companies had little effect on the stock market, as both have been doing well for some time, and the early declaring of dividends has been expected. Chino declared a quarterly dividend of 75c. per share and Ray 37½c. per share, putting the stocks on a yearly basis of $3 and $1.50 per share respectively. The Nevada Consolidated and Utah Copper continue to pay regular quarterly dividends of 37½c. and 75c. respectively. The copper market has been quiet throughout the week, though exports continue large, the total from May 1 to May 28 reaching 34,479 tons, as compared with 29,533 tons for the same period last year. The home demand continued listless and the price tended to break to 15¾c. at the end of the week, when it developed that one of the largest producers had been selling electrolytic at this figure. These sales were mostly for nearby delivery, indicating that consumers had cut their May-June requirements a little too close. The signing of the treaty settling the Balkan trouble is generally taken as favorable to the copper market, since with resumption of normal conditions in Europe consumption should increase. The heavy exports perhaps indicate that this has been discounted to some extent by speculators, who have been stocking up with copper in expectation of an early settlement.

The foreign banks have concluded a loan of $25,000,000 for two years, bearing 6%, to Mexico for the National Railways. Of this, $10,000,000 was paid over to Speyer & Co. to take up the $10,000,000 of 4½% bonds which matured on June 1, and $13,000,000 will be set aside to take care of the cash loan which is due on November 15. The offering price of the bonds will doubtless be 97. This loan is less significant than it at first appears, since it is, in effect, the mere substitution of one obligation for another. Pig iron production in May was 2,813,336 tons, a record.

LONDON

NITROGEN PRODUCTS.—ELECTROLYTIC ALKALI.

The nitrogen industry has been brought prominently before the public recently by the issue of the prospectus of the Nitrogen Products & Carbide Co., in which 1,231,000 shares of £1 each are offered for subscription. As the whole issue has been underwritten, the success of the new issue is a foregone conclusion. The company has been formed with a capital of £2,000,000 to acquire the cyanamide works at Odde in Norway and at Alby in Sweden, the ammonium nitrate works at Vilvorde in Belgium, together with the rights outside Germany of the Ostwald catalytic process for making nitric acid from ammonia. In addition, the water rights at Dettifoss, Iceland, are acquired, as are also options on three water-powers in Norway. The possible electrical horse-power at Dettifoss is 400,000, and the combined capacity of the Norwegian water-powers under option is 600,000 electrical horse-power. Cyanamide is made by the absorption of calcium carbide of atmospheric nitrogen at a high temperature. It is in large demand as a fertilizer, and it is used also in the manufacture of sodium cyanide. When heated in the presence of water it gives off ammonia, which by the Ostwald process can be converted into nitric acid. The present works have a capacity of 40,000 tons of cyanamide per year, which is being increased to 88,000 tons. It is intended to proceed forthwith in the erection of new electrical works of 100,000 electrical horse-power, capable of producing 200,000 tons of cyanamide per year. The financial people backing this enterprise are strong, including Vickers Son & Maxim, and the Nobel Dynamite Company.

The appointment of a liquidator under order of the court for the Electrolytic Alkali Co. is an unfortunate incident in electro-chemistry. Twenty years ago the Hargreaves-Bird process for producing chlorine and soda from brine held out every promise of being a profitable venture. The products were of good quality and readily salable. The whole of the contents of the sodium chloride were recovered, as compared with only the soda by the Solvay ammonia-soda process and with the soda and half the chlorine in the Leblanc process, the greater recovery promising to counterbalance the extra cost of electrical dissociation. There are many practical difficulties in working the process, and unfortunately the soda products most readily made are the lowest priced. Then, again, the fact that all the chlorine is recovered is of no advantage, for chlorine and its compounds, such as bleaching powder, are not readily salable. In fact, bleach is a drug on the market, and the English market is flooded with excess German production. Attempts to make higher-priced products have been unavailing. At one time carbon tetrachloride was made, and it had a sale for 'dry shampoo.' Unfortunately, its poisonous qualities caused a few deaths at London hair-dressers, and its use was practically abandoned. In the drought of 1911 the supply of fresh water failed, and in 1912 the British coal strike stopped fuel supplies. The works are in Cheshire in the salt country, and brine can be raised on the spot for the cost of pumping. They are near the coal-fields, and near the soap and glass works. The failure of the process must be attributed largely to faulty domestic economy. For some years James Hargreaves, the inventor, continued to act as manager, and, being a man who was not imbued with the commercial idea, did not give due attention to costs. After his forcible ejectment, the new manager had to revise the methods, and the board was not able to raise sufficient additional capital to effect a thorough reorganization and extend the scale of operations. All this time the efficiency of rival and older established processes had been increasing, with the result that prices were being continually lowered. Thus a process that showed a large margin of profit 15 years ago found itself with a debit balance on its profit and loss account in 1912. The interest on debentures has been regularly paid to date, and the 7% preference shares are only two years behind; but the ordinary shareholders never got anything. While writing of this process it is necessary to compare the results of the other electrolytic process, the Castner-Kell-

ner, that has a works in the same district. That company had a long struggle for existence, and it was only by extensions of plant on a large scale that sufficient economy was effected to put the venture on a secure basis. Besides, the company produces metallic sodium which is sold to the Cassel Cyanide Co. Naturally, sodium at 8d. per pound is a more profitable material than soda crystals at 7 lb. for 3d. Also, the Castner-Kellner Co. had the advantage of a board of directors noted for chemical knowledge and business acumen. The owners of the Hargreaves-Bird patents would have done better to accept the original offer of the United Alkali Co. instead of trying to carry their own burden and wedge their way on the small scale among the powerful organizations of Lancashire and Cheshire.

JOPLIN, MISSOURI

AMERICAN ZINC, LEAD & SMELTING CO. REDUCES OUTPUT.—DEVELOPMENT NORTH OF CARL JUNCTION, MISSOURI.—ZINC AND LEAD NOTES.

As a result of lower prices, many sheet-ground properties where the ore is thin and of low grade have discontinued operations. Four of the five big mills of the American Zinc, Lead & Smelting Co., the largest operating company in the district, have been closed, meaning a curtailment in the district's production of about 800,000 lb. of zinc ore and 100,000 lb. of lead ore per week. The Underwriters Land Co. has also suspended operations in the North Webb City field, but is doing development work on an extensive scale in the newly developed West Joplin sheet-ore region, and in addition to the one large concentrating plant of 500 tons per day capacity now at work in this field, plans are being perfected for the construction of two additional plants of similar size on nearby leases which have been developed with prospect drills and shafts.

The ore in the West Joplin field carries about 3½% zinc sulphide, usually of good grade, and some lead. In the development on the west portion of the St. Louis-Joplin Lead & Zinc Co.'s land at Chitwood, the lead ore has been especially rich. One result of the lower prices is a general reduction in production throughout the district. Shipments are now below 6000 tons of zinc sulphide, compared with about 6600 tons a few months ago.

Shallow zinc and lead sulphides are being developed in a new camp four miles north of Carl Junction. Two concentrating plants of 300 tons per day capacity are now at work and a new prospect is being opened by Weaver, Oburg and associates, the ore being found in soft ground at a depth of 50 ft. The Rockford Mining Co. and the Weeks and Briggle Mining Co. are the only operating plants in this district. The nearest producing area is at Lehigh, five miles to the south. Lawton, Kansas, six miles west of the North Carl Junction field, is the scene of some new development of importance. The Neck City Mining Co. has acquired a lease from the Eastern Lead & Zinc Co., and is opening a mine that appears to be a milling property.

Hand jigs are employed to clean the ore at the Cactus mine on the Budd M. Robinson land, four miles northwest of Joplin. The average output is 30 tons of concentrate every two weeks over four jigs. Operations are conducted in a district that was mined many years ago, only the shallow ores being taken at that time. Mr. Robinson has sunk to a depth of 150 ft., penetrating a limestone stratum which was formerly thought to constitute the bedrock of that district. Good zinc sulphide was found beneath.

From sixth place in the rank of producing camps of the Missouri-Kansas-Oklahoma district in 1912, Miami, Oklahoma, has jumped to third place this year, being exceeded only by Webb City, Missouri, and Joplin. Last year Galena, Kansas; Duenweg, Missouri; and Alba, Missouri; all produced more than Miami, but the somewhat spectacular development of the New Oklahoma district has placed that field in a position of greater importance. Not only is Miami third in the combined values of zinc and lead ores, but it has ousted Joplin from the second position in the production of lead ore and now promises to have a tonnage of lead ore equal to Webb City, which for many years has been an easy leader, both in zinc and lead production. The development at Miami is being pushed to greater depths than heretofore, some operations being conducted at 250 ft. Two distinct runs of ore are present, the upper being slightly the richer, but the ore, yielding concentrates of extremely low grade and heavy in iron. The lower stratum is almost free from iron and the zinc sulphide contains nearly 60% metallic zinc. The lead also is of the best grade.

The Federal Lead Co., one of the large operating companies of the Flat River lead belt in eastern Missouri, has acquired the old Sunny Brook property in West Joplin and is operating the mill, which is one of the largest and most modern plants in the field. Operations were handicapped because of the extreme low grade of the ore, but the present company continues to make 'turn-ins.' It is reported the recovery is barely 2%. In a few instances some mines of the district are operating at a profit on even leaner dirt than this. At the Moler-Smith mine at Carl Junction, where an open pit is operated, everything being milled from the surface down, the recovery is a fraction over 1%, yet this mine has been a constant producer for many years.

TORONTO, CANADA

HOLLINGER REPORT.—KIRKLAND LAKE.—COBALT.

The regular four-weekly statement of the Hollinger sent out May 20, gives the profits from January 1 to April 22 as $549,894, and those for the last four weeks included as $179,941. In that period the mill ran 86% of the possible running time and treated 11,357 tons of ore of an average value of $19.61 per ton, making an approximate extraction of 95%. The surplus on April 22 was $541,696. The shareholders of the Dome Extension, which has been closed down since November 14, and has a debt of $12,481, have ratified a by-law to increase the capital from $2,000,000 to $3,000,000 to provide funds for reopening the mine. There are 70,000 tons of ore proved, valued at from $4.50 to $5 per ton. The power situation is again normal, the damage to the plants not proving so serious as was at first supposed. Kirkland Lake is at present the principal centre of attraction, further important discoveries in that area being reported. Considerable significance is attached to the fact that the ore has been found to contain tellurium, which is regarded as a guarantee of the value of the camp. The 5-stamp mill at the Foster is now in regular operation, treating 15 tons per day. At the Teck-Hughes, where considerable development has been done, two good veins, one of high grade, 4 to 5 in. wide, have been uncovered. The company is the first Kirkland Lake enterprise to offer stock to the public.

Cobalt excites but little interest in mining circles, the most noteworthy incident recently occurring being a discovery on the Lawson property of La Rose, where a wide ore-shoot has been opened at the 100-ft. level about 100 ft. west of No. 8 shaft. It contains 5 to 6 in. of 3000-oz. ore. The Beaver will enlarge its mill capacity from 100 to 125 tons per day, to dispose of large accumulations of milling ore. The attempt to dispose of a controlling interest in Peterson Lake has proved a failure, and at the annual meeting held May 26 the old board of directors was reëlected. The financial statement showed profits of $95,914. The shaft started in March has been sunk to 110 ft. It is intended to cross-cut the lake area to the south and pursue underground explorations near the Huronian-Keewatin contact. A new company entitled the North Star, capitalized at $1,000,000, has taken over the Belmont mine where a shaft is down for 65 ft. on three veins running in from the Drummond, and development is being vigorously pushed. The former King Edward, now the York Ontario, has shipped 20 tons of hand-picked ore to Denver. The Mann of Gowganda, now under option to an English syndicate, has struck an ore-shoot of high grade at the 150-ft. level. It has also been developed at the 90-ft. level.

KALGOORLIE, WESTERN AUSTRALIA

LABOR TROUBLE SETTLED.—SONS OF GWALIA AFFAIRS.—ORA BANDA MINES.—THE WATER SCHEME.—MARCH OUTPUT OF THE MINES.

After months of delay, and the passing of a new arbitration act, by the Labor Government, which included a compulsory conference clause, enabling the chairman of the Arbitration Court to summon a conference equally representative of both sides of a dispute, the wages question, so far as the Kalgoorlie mines are concerned, is settled for a further period of three years. At least, the six representatives of the labor unions, after repeated adjournments under the chairmanship of Justice Burnside, have come to terms with the six representatives of the Chamber of Mines, and these are expected to be duly confirmed by mass-meetings of the various unions to be held on April 13. The prolonged uncertainty has done a vast amount of injury to mining interests in the state, besides seriously affecting every class of enterprise connected with the mining industry.

The Sons of Gwalia, at Leonora, is once more in the throes of managerial changes. Jack MacDermott, now in charge of the Cam & Motor mine in Rhodesia, was retired at the end of November 1912, after having been in charge of the mine 76 months. When he took charge, in August 1906, the mine was in a hopeless condition, and, owing to the unfilled stopes, was the scene of many deaths and disablements. Mr. MacDermott was originally 'borrowed' from the Ivanhoe company for six months to straighten things out, and did it so well that, during his long reign, not a man was killed or injured by falls of rock. From the flotation of the company, in January 1898, to August 1906, when Mr. MacDermott took charge, 665,850 tons of ore was milled, yielding $8,979,800, or $13.48 per ton, and $1,965,800 was disbursed in dividends. From August 16, 1906, to November 30, 1912, under his management, 1,193,352 tons was treated yielding $9,439,200, or $7.91 per ton, and $2,173,400 paid in dividends. With a grade of ore $5.36 per ton lower, and working under far worse conditions of deeper mining and longer haulage, he paid $200,000 more in dividends in 76 months than his 12 predecessors in 103 months. Albert Wauchope took Mr. MacDermott's place in the beginning of December, but three months satisfied him, and he gave notice of resignation. Mr. Loring is now at the mine arranging for a successor.

Lionel Robinson, Clark & Co., the leading London brokers in the Western Australian department of the Stock Exchange, have taken a six months' option on the Slippery Gimlet, at Ora Banda, a mine working a parallel lode to the Victorious. This mine has produced from the oxidized zone above 150 ft., 27,485 tons, yielding $192,000 by amalgamation and $111,500 by cyaniding, equivalent to $11.04 per ton. The Slippery Gimlet was recently reported on by Alexander Montgomery, government mining engineer, who gave a highly favorable report. From the 285 to 150-ft. levels, Mr. Montgomery estimated the ore in sight as 60,000 tons, worth $11.04 per ton recoverable, or $682,500. Costs, including $1 for development, he puts at $6 per ton, or $360,000, leaving a net profit of $322,500. Mr. Montgomery estimates the cost of equipment at $200,000, including a new hoist and sulphide mill. The price fixed for the property is $125,000 cash, and $12,500 for the buildings, air-compressor, boilers, and steam hoist now at the mine. The property was put under option to Graham Price & Co., in 1907-8, for $40,000, and turned down. In 1909 it was bought from the prospectors, who also found the now famous Victorious, by Friedman & Johnson. Rutter Clarke & Co., sharebrokers of Adelaide, South Australia, were offered an option in 1910 at $125,000, but declined it. The Oroya Links company secured it in January 1911 at $125,000 but abandoned it after seven months' work. In August 1912 the mine was under option to the Gwalia South company for six months at $147,500, but was again refused. The various option holders have done a lot of work down to 285 ft., but, certainly, not enough to justify Mr. Montgomery's predictions regarding ore reserve. However, if the next level in the Victorious opens up rich sulphotelluride ore, as is generally anticipated, the reflected glory should easily float the Slippery Gimlet in London.

The Government has at last admitted the grave danger ahead of Kalgoorlie, should the daily flow of Mundaring water into the Mt. Charlotte reservoir be cut off for even 24 hours. The capacity of the reservoir is 2,000,000 gal., and the average daily consumption is 1,800,000 gal., so that the average daily balance is only 200,000 gal. It is rumored that on one or two occasions recently, the mines were almost notified that no water could be supplied. The Government has now announced that a new reservoir with a capacity of 10,000,000 gal. will be excavated immediately at the west end of Kalgoorlie in order to minimize the danger, as the pipe-line becomes weaker owing to increasing old age.

At last, investors in mines in London are taking notice of the poor policy of the labor party of this state, which allows the Goldfields Water-Supply Department to work at cross-purposes with the Mines Department. The former department refuses to supply water to mining companies who utilize salt water from the mines, and insist on the salt water being run to waste, although it costs money to pump, or haul, the water to the surface, and the mines must be kept unwatered to enable them to be worked in the deeper levels. The secretary of the Mountain Queen company wrote to John Scaddan, premier of this state, during his recent visit to London, that his company had contracted to get salt water from the neighboring Marvel Loch mine at 36c. per 1000 gal. Its manager had advised the company, however, that he must use Mundaring water at a cost of $1.68 per 1000 gal., the same price as charged at Kalgoorlie, 138 miles farther from the weir. The secretary pointed out in his letter that the mine was a low-grade property, and that $1.68 instead of 36c. for water meant an additional cost of 24c. per ton milled.

CANANEA, MEXICO

CANANEA CONSOLIDATED AGAIN PRODUCING.—STATE GOVERNMENT WORKING THE CINCO DE MAYO MINE.—MINING BEING RESUMED IN THE MOCTEZUMA DISTRICT.

The May output of the Cananea Consolidated Copper Co. will be a trifle less than 5,000,000 lb. gross of blister copper. This includes the copper from Miami concentrates, which are handled by the local smelter. Three furnaces and two converters have been in use most of the month. Recently a fourth furnace was placed in commission, as well as an additional converter. Both reverberatory furnaces have been in use all month. The concentrator of the company has one section in operation.

The Maria mine, adjoining the Chispas property of the Minas Pedrazzini company, near Arizpe, has been doing development work, and recently a rich find was made in the shaft. R. B. Phillips, the manager, reports the find to be of considerable extent. Del Pilar mine, near Santa Cruz, according to a report, has been sold to the Manhattan Development Co. for $88,000. The property is a copper claim of considerable merit, and shortly before the Madero revolution a deal was about to be closed for its sale for $500,000. Fred Bringesu has obtained possession of the old Guacomea mine, near the Cerro de Plata, west of Cumeral, and has begun development. Some rich gold ore has already been found. The Minneapolis Copper Co., after being idle for a few months, is again operating its mines and smelter near Cumpas. The smelter is producing eight or ten tons of matte per day, assaying 35 and 45% copper.

The state government, in revolt against the Huerta regime, has seized the mine of Col. Francisco Garcia, known as the Cinco de Mayo, near El Tigre, and is working it. A car shipment, which sold for $8000, has been made. A number of properties near Oputo, in the Moctezuma district, have resumed operations after being idle for some time. Among those now working are the following: La Agna Marga, Goodenough, San Ygnacio, La Caridad, La Maria, La Marageza, El Saffo, and Al Alico.

General Mining News

ARIZONA

Cochise County

The Commonwealth Extension shaft should be down 400 ft. about the end of July. An average of 6 ft. per 24 hours is being sunk. Leached and decomposed rock of no value was cut near the cellar of the shaft, and is still showing. Material has arrived for the sampling plant of the Old Dominion Mining & Smelting Co. Excavation work has been resumed for the new 500-ton concentrator. Fine-dust from the blast-furnaces is being sent to the Douglas plant. A 5000-cu. ft. air-compressor has been installed.

Bids are being advertised by the Copper Queen company for the erection of a new precipitation plant. The plant will supplant that now at the Czar shaft and will be considerably larger than that now in service. In the call for bids it is specified that about 5000 cu. yd. of grading will be required. Twelve wooden tanks will be constructed while about 35,000 ft. of timber will be utilized in the building of flumes, tracks, etc. The water from some of the shafts contains a good percentage of copper. Recently there was a general clean-up at Bisbee; about 12 tons of old scrap metal was collected, and this was purchased by the Copper Queen company at $8 per ton.

Gila County

(Special Correspondence.)—Judge Shute, at Globe, granted the New Keystone Copper Co. a temporary injunction compelling the Inspiration Consolidated Copper Co. to discontinue work in the main transportation drift from the Live Oak part of the latter company's property to the main east and west shafts in Webster gulch. The drift as originally planned will traverse the plaintiff's ground.

The ore on the 650-ft. level of the Iron Cap continues in richness and width as it was when first cut, and the same 2-ft. stringer of unusually rich copper and silver glance remains in the face of the drift. The Iron Cap is hampered by a shortage of cars, and could have shipped much more ore were it not for the present restraint imposed by the railroad's lack of rolling stock. The May shipments were all made after the 10th of the month, labor troubles at El Paso smelting plants having placed an embargo on the Copper Hill mines' shipments previous to that date.

Superior, May 27.

Rumors based on the purchase of 150,000 shares of the Inspiration company by the Amalgamated Copper Co., are current that a large smelter may be erected at Miami. It is probable that a railroad will be built between Florence and Superior, a distance of 30 miles.

Maricopa County

(Special Correspondence.)—The Max Delta Gold Mining Co., north of here, is installing a heavier compressor and sinking the main shaft deeper.

Phoenix, May 29.

Active operation on the property of the Sunflower Cinnabar Mining Co., in the Mazatzal range, northeast of Phoenix, is to be commenced at once. Capital has been furnished by New England people, and a 10-ton retort will be erected. Six claims, lying between two groups owned by the company, have been acquired, increasing the total holdings to 24 claims. These claims contain two veins. The one on which work will be started is said to be 30 ft. wide. There is an abundance of wood and water near the property.

Mohave County

The mill of the Frisco Gold Mines Co., at Union Pass, is in operation, after being overhauled and enlarged. It is stated that at 700 and 900 ft. depth, in the Gold Road mine, rich ore has been opened. On the 900-ft. level of the Tennessee, at Chloride, a vein 5 ft. wide has been opened for some distance. Shipments go to the Needles milling plant. The Boundary Cone mine is developing well.

The Arizona-Southwestern mine is in the Cedar district, in the Walpai mountains, 25 miles southeast of Yucca. Two shafts are down 300 and 203 ft., respectively, being connected on the 200-ft. level, they being 1538 ft. apart. Cross-cuts have opened silver-lead ore worth over $2,000,000. A concentrator of 200-ton capacity is being erected. Concentrate will be shipped to the Needles smelter.

Pima County

(Special Correspondence.)—One thousand tons of zinc ore per month is being produced by the Empire Zinc Co. The old workings show a great deal of carbonate of zinc, which, in the last 40 or 45 years, has not been considered worthy of notice by former operators. It is authoritatively stated that there is ore enough in sight to pay the full purchase price of all the claims.

San Xavier, May 29.

The Pioneer Smelting Co. has been reorganized by New York people. The proposed capital is 1,000,000 shares of $1 each. The smelter, which is at Sahuarita, will be improved, and will commence again about July 1.

Pinal County

The Kelvin-Sultana mine has been opened to a depth of 300 ft., exposing high-grade copper ore, which is being shipped to Douglas. The electric power-plant is in commission.

Yuma County

(Special Correspondence.)—Pat Emory, who is the owner of a number of rich placer claims in Laguna district, is in Los Angeles to purchase a large placer machine for use on his property.

Laguna, May 29.

CALIFORNIA

Amador County

The North Plymouth Mining & Milling Co. has been formed with a capital of 150,000 shares at par value of $1 each. The property, controlled under a 5-year working bond for $20,000, is situated 1.5 miles north of Plymouth. A shaft is to be sunk 300 ft. before cross-cutting. Water, fuel, and electric power are obtained in the vicinity. In the East belt, there is a fair amount of activity, and prospects are encouraging. On the 200 and 400-ft. levels of the Defender mine in the Volcano district, a shoot has been opened for 360 ft. showing good ore. A roller mill is being installed in the 10-stamp mill. Horn & Savella have driven an adit 800 ft. in the old Trecroft mine, known as the Moreland. Considerable good ore has been opened.

Calaveras County

(Special Correspondence.)—A new corporation, to be known as the Corral Flat Mining Co., of Mokelumne hill, has been formed for the purpose of working some of the gravel channels of this mining district. It has been capitalized at $300,000, divided into 300,000 shares at $1 each. The officers of the corporation are: W. H. Kearney, president and treasurer; J. L. Green, secretary; W. H. Kearney, J. L. Green, J. H. Reardon, A. F. Friedberger, and E. Johnson, directors. The Aetna King Gold Mining Co. proposes to unwater its shaft for the purpose of determining the extent of the alleged trespassing of the Utica Mining Company.

Angels Camp, May 27.

Modoc County

The Hess gold mine, near Canby, and 27 miles west of Alturas, has been sold by T. C. Hess, Sr., to Messrs. Jamison and Wylie, C. E. Crowder and J. L. Harvey.

Nevada County

In the North Fork mine, in the Alleghany district, two different companies are working the mine through the same tunnel. One company is opening the gravel deposit, and the other one is opening the quartz vein. The companies pool the expenses of the working, and as the ores are different in character no difficulty is found in keeping them separate.

Placer County

Development is being pushed along in the Jupiter mine on the Grass valley road, and two shifts are being worked with six men. The new machinery is working well and

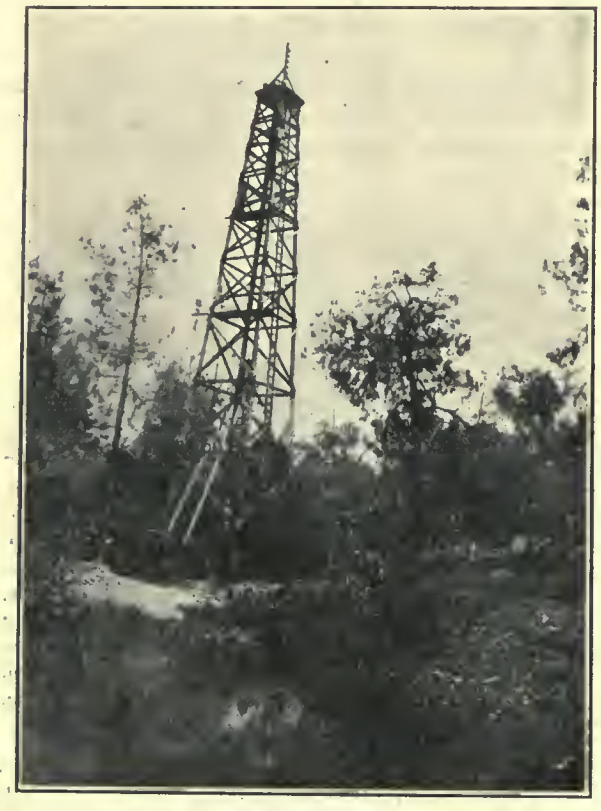
keeping the mine free of water. At the 200-ft. level, drifts are being driven in a northwesterly and southeasterly direction on the lode. The Orpheum Mining Co. is running its mill steadily, and is opening two adits on the old St. Lawrence mine. The Zanzibar Mining Co. is running its rotary mill at full capacity. The Bellevue mine has just been unwatered, and the Grass Ravine mine also. The Crandall mine is having considerable development done on it by its new owners, and an electric plant is being installed.

PLUMAS COUNTY

Machinery is on its way for the Develter claims on Wolf creek, a mile from Greenville.

SAN BERNARDINO COUNTY

On May 1 the new 100-ton mill of the Greenwater Copper Mines & Smelters Co., at Dale, was started. Since



PROSPECTING BY DRILLING AT THE PROPERTY OF THE WATERMAN GOLD MINING & MILLING CO., ANGELS CAMP.

1911, a shaft has been sunk to 1100 ft. depth, drifts driven on the vein every 100 ft. opening 3.5 to 8 ft. of ore with an average of $14 per ton. Ore reserves are estimated at 40,000 tons. John Kirchen is manager.

SIERRA COUNTY

The Tightner Mining Co. intends to erect a concentrate-treatment plant near its stamp-mill. This will save the expense of shipping this product to San Francisco. The company recently acquired the timber lands and sawmill of Frank L. Cole on Kanaka creek. Development of the mine toward the Red Star ground is being vigorously prosecuted. The Monarch mine, near Sierra City, is being examined by an engineer.

TRINITY COUNTY

About 30 men are employed by the Stanislaus River Mining Co. near O'Byrne's ferry. The adit is in 1700 ft. and is being driven to prospect a gravel channel. The Globe Consolidated Mines Co. has 130 men at work, and a large tonnage of ore has been opened. The main adit is 1700 ft. long, cutting the vein at 600 ft. below the summit of the mountain. Machinery for the 20-stamp mill and cyanide plant is being erected, and will be ready in August. Wallace MacGregor is superintendent.

TUOLUMNE COUNTY

(Special Correspondence.)—A consignment of 33 tons of steel rails was received at the Jumper mine this week. The work of repairing and straightening the main shaft has begun. The Jumper is credited with having produced some of the richest ore mined on the Mother Lode. The Rose Spring Mining Co., operating near Tuolumne, has purchased a 3-stamp mill from the Jardine Machinery Co., which it will install on its property. M. H., J. C., and A. J. Diepenbroh, W. F. Gormley, and E. C. Kavanaugh, of Sacramento, who are interested in the Mangante and other mines near Jamestown, visited the properties during the past week, and it is stated that they propose beginning extensive development shortly. The unwatering of the Experimental mine, near Columbia, is about accomplished, and after making some repairs to the shaft, work will begin in the bottom levels. The sinking of a new shaft at the Josephine mine, near Chinese, is in progress, and driving will begin when a depth of 200 ft. has been attained. Some rich ore has just been uncovered in the Chilano mine, situated east of Jamestown, and operated by H. Cavill.

Sonora, May 24.

(Special Correspondence.)—A new adit, to be 1200 ft. long, will shortly be started at the Hazel Dell mine, recently bonded to J. M. Rich and associates. It will develop the Evans vein, which, near the surface, was worked with success some years ago. The old 500-ft. adit is being repaired. From the face a winze will be sunk, and from the latter drifts will be driven. The Tuolumne River Mining Co., which has been operating in the bed of the Tuolumne river, near Jacksonville, during the summers of the last few years, has just begun this season's work.

Sonora, May 31.

COLORADO

THE SAN JUAN

In a cross-cut in the Guadaloupe mine, below Ironton, 4 ft. of iron ore averaging 8% copper and 40 oz. silver has been cut. During the first quarter of 1913, the Camp Bird company covered 483 ft. in development, and broken ore in stopes amounted to 6597 tons. On No. 5 level, the east 'heading' was advanced 67 ft., 30 ft. being in good grade ore. No. 3. cross-cut opened 40 ft. of ore, 4 ft. wide, worth $20 per ton. The main cross-cut on No. 6 level was advanced 52 ft. Three feet of $25 ore was exposed. Receipts from bullion and concentrate were $193,745, and working expenses $98,941. The Santa Gertrudis in Mexico made a profit of $172,290 for the Camp Bird company, so the quarter's profit was $271,231.

IDAHO

SHOSHONE COUNTY

Development on an extensive scale of eight claims at Saltese, in the Montana part of the Coeur d'Alenes, is planned by the Switchback Mining & Smelting Co., recently incorporated under the laws of Washington, with a capitalization of $1,000,000. Spokane men are at the head of the company, H. H. Guth and E. E. Guth, of that city, being president and secretary-treasurer, respectively. H. H. Guth, William Burke of Saltese, J. R. McDonald of Wallace, C. R. Rudesill and Valentine Abodie of Sandpoint, Idaho, compose the board of directors. The general office has been established in the Hutton building, in Spokane. During road formation in the district, a vein was cut which was opened to a width of 30 ft., carrying lead, silver, and copper. Development is being done by an adit which will cut the vein at a depth of 400 ft. The treasurer's report of the Highland-Surprise Con. Mining Co. has been published. The receipts of the Surprise mine, prior to the consolidation, were $22,795, and the disbursements $20,221. In the receipts are included $19,782 from 423 tons of zinc and 235 tons of lead concentrate. The Surprise mill was run about three months last summer and was finally closed on account of impassable roads. The report shows about 400 ft. of development to have been done at a cost of $4389. The property had a cash balance on hand at the time of the directors' meeting in April of $4050. As soon as the water along Pine creek subsides, active work at the property is expected to be resumed.

MICHIGAN

Gogebic County

The Oliver Iron Mining Co., Duluth, Minnesota, will install additional electrical apparatus in its mines at Ironwood, consisting of a 300-hp. motor, six 5-kva., and six 10-kva. transformers, and switchboard material. The apparatus has been ordered from the General Electric Company.

MISSOURI

During 1912, 2,723,403 tons of 'chats,' or mine talling, produced from the Flat river and Joplin lead and zinc districts, was used for commercial and railroad purposes. The mining companies sell the 'chats' for $1 per car, or less than 10c. per ton.

MONTANA

Fergus County

(Special Correspondence.)—Extensive improvements are being made at the Barnes-King mill at Kendall, and the leaching capacity of the plant will be doubled. The ores from the Santiago mine are slower in leaching, so more tank room is needed to treat the same amount of ore, amounting to 300 tons per day, which was treated by the Barnes-King company in its early days. A large force of men is now employed, and soon a number more men will be employed. The orebody blocked out in the Santiago is a large one, and the outlook for the Barnes-King is bright.

Kendall, May 31.

Lincoln County

(Special Correspondence.)—The machinery for the 5-stamp mill and concentrator to be erected by the Kalispell-Lincoln Gold Mining Co., in the West Fisher district, is expected to arrive at Libby within a short time. There is now a 3-stamp mill on the property, but it is the intention to operate on a large scale, the smaller mill having proved the value of the property last summer. S. F. Ralston, of Kallspell, one of the owners, will move to Libby and will be the company's manager. The ore contains gold and some silver, and the average is stated to be about $100 per ton. A concentrator is to be installed in the mill.

Libby, May 22.

(Special Correspondence.)—John J. Hibbard and P. S. Rose have taken a lease on five mining claims on the headwaters of Libby creek, owned by H. Peterson, P. E. Bergstrom, and Thomas Bogard of this place. Under the terms of the lease they will erect a stamp-mill on the property, and development work will be started within 30 days. The property has heretofore been opened by a shaft 140 ft. deep, and by 800 ft. of adits. The vein is from 2 to 3 ft. wide and is valuable mainly for gold. Many rich assays have been obtained from the property in the past, and the average value of the ore is said to be high. The lease runs for three years, with an option to buy the property during that time for $15,000. The owners are to be paid a royalty of 20 per cent.

Libby, May 22.

Park County

The claims, machinery, and other property of the Montana Gold Mining Co., of Jardine, have been sold to Chicago people for $65,000. This property was shut down several years ago, but will be reopened at once.

Silverbow County

(Special Correspondence.)—The Anaconda Copper Mining Co. has commenced the construction of a 5000-ton ore-bin, the largest in the district, at the Belmont mine. The bin is being erected on ground of the Butte, Anaconda & Pacific Railroad Co., and close to the tracks. The Belmont is down to a depth of 2200 ft. and is connected with the underground workings of the Anaconda mine. Through the shaft of the Belmont an immense amount of ore can be brought to the surface, and after the new bin is completed it will be kept well supplied with ore.

Butte, May 31.

NEVADA

Churchill County

During April the Nevada Hills Mining Co. treated 2218 tons of ore, yielding $38,089, with a profit of $14,236. At the end of the month, $50,000 was owing the bank. The net resources were $43,000. The new water-supply is giving satisfaction, and the mill is treating 140 tons per day. A station has been cut on the 800-ft. level of the mine, and cross-cutting is under way.

Esmeralda County

After an 11 days' trial, the Pittsburg Silver Peak Co., of Blair, was ordered to pay Walter Ward $13,000 damages. An appeal may be taken. The Goldfield Oro surface equipment is now complete. The Merger shaft is down 1750 ft. and will be sunk to 1800 ft. The Bonnie Claire mill of the Jumbo Extension company is ready to receive ore again.

Humboldt County

Within the past few days a number of Salt Lake people have made arrangements to take over the property of the Dutch Flat Gold Mining Co., at Dutch Flat in the Paradise mining district. The property is 18 miles north of Golconda. Arrangements are being made to have all the machinery on the ground and in operation within the next 60 days. A washer has already been installed. This property is one of the old placers of Nevada, and has not been worked for 20 years. In 1894, about $75,000 was recovered, water being obtained from the Little Humboldt river, six miles away. Estimates by T. W. Galigher show that 20 of the 200 acres held by the company contain 375,000 cu. yd., averaging 31c. per yard. Costs will be 20c. per yard. The gravel is 15 ft. deep. A 4 by 16-ft. rotary screen, fed by a drag-scraper, and a 5 by 20-ft. sluice-box, with an elevator for the tailing, will handle 400 yd. per 10-hr. day. The Ruby Mining Co. has done 4000 ft. of work in its quicksilver property in El Dorado canyon, 8 miles from Valley. A reduction plant is now nearly completed.

Lyon County

The directors of the New Yerington Copper Co. have issued a statement giving reasons for No. 1 assessment recently called. This is caused by extensive development and equipment. On the 400-ft. level, the east drift is now 425 ft. from the shaft. The ground is soft and the last 40 ft. required regular drift sets in order to keep the drift open. The vein matter carries considerable pyrite and occasional chalcopyrite. The latter copper-bearing mineral, together with the softening of the vein, leads the management to think that ore should be encountered at almost any time. In the Marsal adit, a stope floor has been laid out eastward for 45 ft. on the vein, showing 10 to 60 in. of 3% copper ore.

Mineral County

Mining at Rawhide is fairly active. The Nevada New Mines Co. is working to a depth of 500 ft., and a good deal of ore has been opened. The mill treats 30 tons of $25 ore per day. This plant consists of a crusher, 10 stamps, tube-mill, agitators, and Oliver filter.

Nye County

A merger of the Montana-Tonopah, North Star, and Midway companies is to be made, with C. E. Knox as president. The new concern will have a capital of 3,000,000 $1 shares. The Belmont company has declared a dividend of 25c. per share, amounting to $375,000, making a total of $4,718,000 to date. The mill is treating about 530 tons per day. In the western workings of the Extension mine, at 950 ft. depth, the cross-cut, which has been driven through the rhyolite, entered an ore-bearing trachyte formation dipping south. In other parts of the Tonopah district this formation carries the best orebodies, but was not expected in the Extension mine. During the week ended May 31, the mines at Tonopah produced 12,257 tons of ore worth $264,970. At Manhattan, the Big Four new hoist and head-frame has been installed. The hoist is a double-drum, driven by a 100-hp. electric motor, and is capable of hoisting from a depth of 1700 feet.

UTAH

Juab County

A cave-in took place in the No. 3 workings of the Iron Blossom during the past week. Fortunately, it occurred at a time when there was no one in the mine, and the damage will not be heavy. The part of the mine in which the cave-in occurred contains a large amount of ore, but but the bulk of it is of a milling grade.

Salt Lake County

The Ohio Copper Mining Co. has issued a statement under date of May 20 to the effect that operations during the first quarter of the year were unsatisfactory on account of breaking the dam which retains the tailing dump, in February. During the month of April, however, the report states that 690,000 lb. of copper was recovered from 71,275 dry tons of ore which averaged 1.045% copper. This tonnage was handled at a total cost of mining, milling, and transportation of 82c. per ton. The directors further say that the company is now making substantial profits, estimated to be in excess of $20,000 per month. Development on the All's Well vein is encouraging. On May 1, 1912, ore reserves totaled 3,185,000 tons.

During the month of May, the railways operating at Bingham moved 674,464 tons of ore, while the total will be close to 800,000 tons by all companies. The payroll of the 'camp,' including the mills of the Utah Copper Co., is between $500,000 and $600,000. In April, 21 steam-shovels were operated by this company. To insure a water-supply which will be more than adequate for any possible requirements, a contract has been made with the Utah Metal Co. This company has practically completed a tunnel through which it can furnish a supply of water superior to that now being used, and at less cost. Since May 1 also, almost the entire power requirements of the Utah Copper Co. have been taken from the Utah Power & Light Co., so that it is now proposed to close down the steam plant within a short time. Some rather significant results have recently been obtained in the re-treatment of the low-grade concentrate by a flotation process based on that in operation at the Butte & Superior company. In case further experiments prove satisfactory, the management believes that by means of this process it will be possible to effect a saving of from $250,000 to $500,000 per year in smelting charges.

Summit County

Engineers in the employ of the Silver King Consolidated Mining Co. have entered the workings of the Silver King Coalition Mines Co. at Park City with the view to ascertaining whether the Coalition company has pursued development work in the Consolidated territory. Permission to make these surveys was granted in an order issued by Judge John A. Marshall of the United States court for the district of Utah. The surveys of the Coalition workings will be conducted by Frank Anderson and L. G. Brittain, surveyors for the Silver King Consolidated. They will report direct to the court.

Tooele County

The International smelter has four lead and four copper furnaces in full blast, handling about 2000 tons per day. Ore is being received at a good rate, and the addition of another furnace is probable.

WASHINGTON

Ferry County

A party of 30 people from Chicago and New York arrived at Republic on May 24 and has been looking over the mines and mills. They expressed themselves as being entirely satisfied with their investment there. It is proposed to enlarge the mill of the Harper Consolidated mines to 1000-ton capacity. This may be completed during the present year and power will be brought from Bonnington falls, British Columbia.

Stevens County

The United Copper Mining Co., operating a mine near Chewelah, will resume dividend payments in June. Up to November 1912, $60,000 has been paid.

CANADA

Ontario

During the week ended May 24, 11 mines shipped 467 tons of ore, and three shipped 229,767 oz. silver. The strike vote was rejected by the Cobalt branch of the Western Federation of Miners, as it failed of two-thirds majority. The Silver Cliff mill, which has been idle for about 18 months, was started again on May 26. It is treating about 60 tons per day.

Yukon

Four of the Yukon Gold Co.'s dredges on Bonanza had started for the season on May 9. The Canadian-Klondyke Co.'s No. 2 dredge is at work, while No. 3 is about to start. Placer claims have been staked within the limits of the Boyle concession. The commissioner, Mr. Black, said the following in part in reference to this action: "The staking of placer claims within the boundaries of that concession is not a departure. There are applications on file, dating as early as 1903, for claims on Bear and Lindow and other tributaries of the Klondike river. Up to the present time, none of these applications has been granted, and none of the applicants have taken the cases to court."

KOREA

(Special Correspondence.)—During March, 240 stamps of the Oriental Consolidated Mining Co. worked 26.5 days, crushing 26,657 tons of ore. The East Candlestick 10-stamp mill was shut down during the month, being short of firewood. Including the store profit of $27,303 for the period April 1, 1912, to March 31, 1913, the gross receipts were $173,314. Operating costs, including $304 for improvements, were $80,711, leaving a net profit of $92,602.

New York, May 26.

MEXICO

Chihuahua

Owing to the revolution and the interference with railway traffic, the San Toy Mining Co. has only shipped 400 tons of ore between January 1 and April 14. Since then, shipments were made to the Chihuahua smelter, and 1080 tons were sent in April, while the present tonnage is 50 per day. Net smelter returns from this ore was $90,556. The mine has been operated without interruption, and prospects are good. No. 6 dividend of 1% has been paid.

Sonora

Labor troubles are over at the Moctezuma Copper Co.'s property, at Nacozari, and the mine is in operation again.

The graphite mines in this state are 20 miles from the town of La Colorada, and produce a large quantity of this mineral.

NICARAGUA

The Bonanza mine, in the Piz Piz district, has been

INDIANS POLING A PITPAN ON PIZ PIZ RIVER, NICARAGUA.

sold to American and English capitalists. The Mars mine is also said to be included in the group. The Bonanza has been under option previously to a number of well known concerns, but without result. Difficulties as to title to ore and the dip is said to have interfered with its sale.

Schools and Societies

THE UNIVERSITY OF IDAHO, at Moscow, will hold its annual commencement on June 11. Fifty-four seniors will receive degrees.

The annual autumn meeting of the INSTITUTE OF METALS will this year, under the presidency of A. K. Huntington, for the first time since the Institute's formation in 1908, be held in Europe. It will take place in connection with the Ghent International Exhibition, the dates fixed being August 28, 29, and 30. Among many important papers to be communicated will be the report of the Corrosion Committee.

C. F. Willis, professor of geology and mining at the UNIVERSITY OF ARIZONA will make an extended investigation of mining conditions throughout the state. The whole summer will be devoted to the work. Pima, Santa Cruz, and Cochise counties will be examined first, then Greenlee and Graham counties to the north, going as far west as Kingman, Mohave county. Mr. Willis will be accompanied by Merle Cochran, honor man at the university.

The eighth general meeting of the twenty-second session of the INSTITUTION OF MINING AND METALLURGY was held at the rooms of the Geological Society, London, on Thursday, May 22. The following papers were discussed: 'An Early Example of Blast-Roasting,' by H. Vassiliadi; 'Grading Analyses by Elutriation,' by H. Stadler; 'The Determination of Water in Coal,' by P. Litherland Teed; 'Notes on Sinking Operations at the Springs Mines, Transvaal,' by B. D. Bushell.

The junior class of the MISSOURI SCHOOL OF MINES will spend three weeks in Colorado, beginning June 4. This is a required part of the curriculum. The class will visit Colorado Springs, Colorado City, Pueblo, the Cripple Creek district, Leadville, Breckenridge, Valdoro, Montezuma, Waldorf, Silver Plume, Georgetown, and Idaho Springs. The class will be accompanied by G. H. Cox, H. T. Mann, and C. R. Forbes. The sophomore class will do field work in mine surveying at Edwardsville, Illinois, during the first two weeks in June. This work will be in charge of C. R. Forbes and E. S. McCandliss.

THE UNIVERSITY OF VIRGINIA, at Charlottesville, has issued a bulletin on the Department of Engineering. There are 36 members of the engineering faculty, instruction including mathematics, analytical and industrial chemistry, geology, civil engineering, physics, mechanical engineering, and electrical engineering. Students for the various courses must be over 16 years of age. Buildings include the mechanical laboratory, power-house, laboratory of general chemistry, laboratory of analytical chemistry, geological museum, and physical laboratory. Examinations are held at the end of each term. Upon completion of the four years' course as defined, degrees are awarded to students who prepare an acceptable graduating thesis. The average annual expense for students is from $380 to $430.

THE SCHOOL OF MINES AND METALLURGY of the University of Missouri held its annual commencement exercises on May 30 at Rolla. The forty-second annual catalogue recently issued shows that there are 23 members of the faculty, with 8 student assistants. The school includes the Rolla building, containing the library, laboratories, offices, and geological collections; the Chemical hall used for chemistry; the Mining building and power-plant, with instrument room and laboratories, engine-room and mining laboratory; Mechanical hall, with lecture-room, wood and metal-working rooms; Norwood hall, containing lecture and drawing-rooms; the Ore-dressing building, providing quarters for metallurgy and ore dressing; Parker hall, for administrative purposes; and carpenter-shop for general repair work of the school. Applicants for admission, not having diplomas from approved schools, must pass an examination. Average annual expenses of a student are about $300.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. H. BALL has gone to Europe.

C. H. MUNRO is in San Francisco.

CLIFFORD DENNIS has gone to Alaska.

THEO. E. DICKEL has been at Winnipeg.

E. B. KIMBALL has returned from Mexico.

ETIENNE RITTER was in New York last week.

S. F. SHAW has returned to Charcas, Mexico.

ROSS B. HOFFMAN left for Alaska last Saturday.

L. S. AUSTIN left New York for British Guiana, May 31.

F. H. PROBERT has returned to Los Angeles from Arizona.

EDWIN C. ECKEL has returned to Washington from a trip north.

A. N. WINCHELL will do geological work in Oregon this summer.

F. M. SYLVESTER has gone to Granby Bay on a tour of inspection.

JOSEPH L. DANZIGER is in Virginia on professional business.

S. C. ELLS was in San Francisco last week and has gone to Alberta.

M. H. KURYLA has left Mexico temporarily on account of having typhoid fever.

M. K. ROGERS came up from Mexico this week and has gone to Calaveras county.

C. W. PURINGTON is examining placer ground in the Olekma district of Siberia.

A. E. CANFIELD has succeeded B. N. LEHMAN as manager for the Yankee Consolidated.

VICTOR C. ALDERSON has retired from the presidency of the Colorado School of Mines.

COREY C. BRAYTON sailed for the season at Nome from Seattle on the *Victoria* on May 24.

E. M. WILKINSON has returned from Central America after an absence of three months.

U. S. GRANT will head one of the geological parties of the newly created Oregon Bureau of Mines this summer.

HOWLAND BANCROFT is visiting Washington, New York, and Boston. He will return the latter part of the month.

J. AGNEW has been appointed general superintendent and W. KENT, smelter superintendent for the Canadian Copper Company.

H. W. MESERVE has been elected president of the Alabama company, which took over the Alabama Con. Coal & Iron Company.

ALEXANDER MCLEOD is at Orangedale, Nova Scotia, where he is developing silica and magnesite deposits for British capitalists.

RUSH T. SILL, of Sill & Sill, has returned to Los Angeles from the Chloride district, Arizona, where he has been examining mines.

F. H. MORLEY was married to Mrs. DAVIS at Bournemouth, England, on May 5, and has gone to Colorado Springs, Colorado.

C. H. CLAPP, recently connected with the Geological Survey of Canada has been appointed professor of mining engineering in the University of Arizona.

D'ARCY WEATHERBE has retired from the firm of Bainbridge, Seymour & Co. and will continue his consulting practice at No. 62 London Wall, London, England.

N. C. GROVER has been appointed chief hydrographer for the United States Geological Survey, succeeding M. O. LEIGHTON, who joins the staff of J. G. White & Company.

GEORGE E. FARISH has resigned his position as general manager for the Mother Lode Sheep Creek Mining Co., of Sheep Creek, British Columbia, and, after an examination in Colorado, will return to New York about June 15.

New York Metal Market Review

Copper held up well during the greater part of May, but near the end was not regarded as overstrong. Lead was devoid of big business, and its price was stationary during most of the month. Spelter was dull and declined steadily. Antimony was weak and without demand. On only two days was there any heavy buying of tin, and throughout May it sold at below import cost. Aluminum is easier at lower prices than prevailed early in the month.

COPPER

The Waterbury average for April was 15.75c. The first week of May witnessed a drop in electrolytic of from 15.50c. cash New York to 15.37½c. cash New York, following a gloomy turn of affairs in the Balkans, which lasted only a couple of days. Then conditions became less threatening and the market started upward, reaching 15.62½c. cash New York, on May 7. With the rise, foreign buyers entered the market and bought in fairly good volume, and domestic consumers bought to a lesser extent. The movement did not last long, but it left the market firm. Lake was little affected in the decline referred to, because of its scarcity and the threatened strike trouble in the Michigan copper district. At the end of the first week Lake was held nominally at 16c. cash. The statement of the Copper Producers' Association for April, which appeared May 8 and showed a reduction in stocks of well over 28,000,000 lb. and also that deliveries to Europe had been exceptionally heavy, brought about a better feeling and some buying on May 9 and 10, and on the latter day electrolytic was advanced to 15.75c. cash New York. The buying, however, was not heavy, as consumers were well supplied previously. Lake continued scarce for early delivery, though future metal was not difficult to secure at 16c. cash. Re-sale copper practically disappeared in this movement. Toward the middle of the month foreign speculation caused uneasiness and some weakness, though the large agencies adhered to their price of 15.75c. cash New York for electrolytic. Re-sale lots again became a factor, however, and offerings were made at around 15.60c. cash New York. There was little change in the Lake situation, as producers were practically sold out for early delivery. The closing days of the month saw little activity and no real resumption of buying is looked for until about June 10, when the Producers' figures for May will be known. Exports up to and including May 29 were 34,479 tons. Consumers, while admitting a falling off in new business, declare that they are busy with orders booked and that their customers are insistent upon quick deliveries. The whole situation indicates that stocks on merchant shelves are low. At the same time, the market is not regarded as overstrong. Near the close of the month, producers were sticking to their prices of 16c. for Lake and 15.75c. cash New York for electrolytic, but outside lots were selling considerably lower. Electrolytic could be had for 15.55 to 15.65c. cash New York. Lake was nominal at 15.65 to 15.75c. New York.

LEAD

Prices of lead, though of varying strength, were uniform at 4.35c. New York and 4.20c. St. Louis, after the American Smelting & Refining Co. announced these quotations May 5, the figures being a decline from 4.50c. New York and 4.35c. St. Louis. The only reason advanced for the reduction was that demand had fallen off under the higher quotations. From May 8 to 14 there was better inquiry for carload lots, but large demand was scarce, the action of the large interest in reducing its prices evidently causing consumers to await further events. In the last half of the month big business was lacking and the tone became easier in the East. In St. Louis a few sales were reported at 4.22½c. Stocks were said to be rather light everywhere, and deliveries were running below those of the same period a year ago.

SPELTER

Dullness prevailed throughout May, and with the lack of business there were repeated declines. Opening at about 5.50c. New York, and 5.35c. St. Louis, the metal dropped by stages until at the end of the month it was selling at 5.35 to 5.40c. New York, and 5.20 to 5.25c. St. Louis. While some of the sellers complained of the lower prices, others said that the metal was only getting back to normal figures, as lead and spelter had been too far apart. New business was absent to a great extent during the month, but deliveries against old contracts continued good. In one week, that ending May 28, spelter declined from £25 to £23 per ton in London. The dull demand was the only cause for the decline, according to cable advices.

ANTIMONY

There is no story in the market for antimony in May. All that can be said is that dullness prevailed from first to last and that prices were constantly below the import cost. They ranged about 8.25c. for Hallett's, 8.75c. for Cookson's, and 7.50 to 7.62½c. for Chinese and Hungarian grades. Antimony, more than any of the metals, is adversely affected by fears of tariff reduction, and for weeks there has been more pressure to sell than inclination to buy.

TIN

Deliveries into consumption in April amounted to 3450 tons, leaving in stock and landing 2422 tons, with which to begin the month of May. The April deliveries were about 2000 tons under those of the preceding month. Like copper, tin suffered in the early days of May from the bad outlook in the Balkan states, but at the end of the first week there was a recovery and 50.05c. was paid May 6, and 50.30c. May 8. With the higher prices came better buying, which started with the taking up of cheap lots. It was felt at this time that the metal, which had been selling as much as 1c. below the import cost, would get back to a more desirable basis, but hopes were disappointed. The lack of demand and the desire of the dealers to get all the business there was stirring were the causes of the failure. The cost of import May 14 was a little over 50c. On May 20 there was a flurry of activity, and between 200 and 250 tons of spot and nearby were sold at around 47.87½c. At this time speculators in London were unloading, and prices everywhere declined and confidence was injured. Meanwhile, however, domestic consumers were well supplied. Only spasmodic buying occurred in the last days of the month and the market generally was quiet, but on May 29, just before the holiday, between 300 and 400 tons were traded in at prices down to 47c., the deliveries specified being mostly for July and August. The auction sale of Banca tin in Amsterdam, Holland, May 28, went at 135⅝ florins, equivalent to about 49.45c. c.i.f. New York. It had been expected that high prices at this sale would bolster up all markets, but on receipt of the news London declined, and on that day quotations in New York were 48.75c. Arrivals up to and including May 29 were 3022 tons, and there were afloat on that day 1490 tons. The highest price of May was 50.30c., May 8, and the lowest 47c., May 29. Deliveries in May were 3350 tons. In stock and landing, May 31, were 2094 tons.

ALUMINUM

The feature of the month was the heavy deliveries of American aluminum, which led to re-sales and lower prices. Foreign aluminum withstood the declining tendency thus brought about for a time, then it dropped. The prices in the early part of the month were 26.37½ to 26.26½c. for both domestic and foreign. Then came the unsettling influence, said to be caused by proposed tariff changes, and prices declined to 25.25 and 25.50c. for domestic, and 25.75 to 26.25c. for foreign, on May 20. Demand became quiet. May 26, prices were equalized again, 25 to 25.50c. being asked for domestic and foreign alike for prompt shipment, but this subsequently changed, and on May 27 quotations were 25.25 to 25.70c. for domestic and 25.50 to 26c. for foreign. Considerable interest was shown in the proposed amendment to the Underwood tariff bill to put the metal on the free list, instead of imposing a 25% *ad valorem* duty. At the end of May the market was fairly steady, but quiet, and the pressure to sell had almost disappeared.

The Metal Markets

LOCAL METAL PRICES

San Francisco is net a primary market for the common metals except quicksiiver. The prices quoted below therefore represent sales of small lots and are not such as an ore-producer could expect to realize. Ore contracts usually call for settlement on the basis of Eastern prices, less freight and treatment charges. The prices quoted are in cents per pound, except in the case of quicksiiver, which is quoted in dollars per flask of 75 pounds.

San Francisco, June 5.

Antimony	12—12½c	Quicksiiver (flask)	$41
Electrolytic Copper	16½—16¾c	Tin	52—53¼c
Pig Lead	4.60—5.55c	Speiter	8—8¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES

(By wire from New York.)

NEW YORK, June 4.—Copper prices are weak, being depressed by second-hand offerings and sellers refusing to lower asking price for new deliveries. Lead remains unchanged. Speiter is weak, with smaller demand and eager competition for such business as is done.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
May 29	60.00	April 23	59.77
" 30 Holiday		" 30	60.56
" 31	60.00	May 7	60.98
June 1 Sunday		" 14	60.25
" 2	60.00	" 21	60.66
" 3	59.87	" 28	60.08
" 4	60.12	June 4	59.99

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	61.32	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	67.87	Sept.	62.95	....
Apr.	59.20	59.26	Oct.	63.16	....
May	60.88	60.21	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
May 29	4.33	April 23	4.39
" 30 Holiday		" 30	4.50
" 31	4.33	May 7	4.40
June 1 Sunday		" 14	4.33
" 2	4.33	" 21	4.33
" 3	4.33	" 28	4.33
" 4	4.33	June 4	4.33

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	4.34	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as speiter, atandard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
May 29	5.18	April 23	5.42
" 30 Holiday		" 30	5.36
" 31	5.13	May 7	5.31
June 1 Sunday		" 14	5.28
" 2	5.10	" 21	5.28
" 3	5.08	" 28	5.19
" 4	5.08	June 4	5.11

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	5.23	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

JOPLIN ORE MARKET

(Special Correspondence, Joplin.)—The demand for zinc ore weakened toward the close of May and prices were correspondingly low, the best price reported paid being $44, basis of 60% metallic zinc, meaning a settlement of $47 for a few lots running high in metallic content. Low-grade ores and ores heavy in iron were in better demand than the higher grades, and sold for as high as $46, basis, although the settlements, because of the penalties assessed, were much lower than this figure, ranging down in some instances to $33. Speiter is weaker than it has been in months, East St. Louis quotations being reported at $5.15 per hundred. For the corresponding week of 1912 the basis price of zinc sulphides was from $56 to $58, with the choicer lots bringing a settlement of $61. Speiter was then quoted at $7, the highest figure in many years.

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
May 29	15.35	April 23	15.44
" 30 Holiday		" 30	15.26
" 31	15.30	May 7	15.30
June 1 Sunday		" 14	15.54
" 2	15.15	" 21	15.50
" 3	15.05	" 28	15.43
" 4	15.05	June 4	15.18

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	15.42	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merten's figures of foreign surplus.

		U. S.	European.
July	1912	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720
April	"	104,269,270	106,565,760
May	"	75,549,108	102,654,720

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
May	1912	126,737,836	72,702,237	69,485,945
June	"	122,315,240	66,146,229	61,449,650
July	"	137,161,920	71,093,120	60,121,600
August	"	145,628,521	78,722,418	70,485,150
September	"	140,089,819	63,460,810	60,264,796
October	"	145,405,453	84,104,734	47,621,342
November	"	134,695,440	69,369,795	55,906,550
December	"	143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February	"	130,948,881	59,676,402	72,168,623
March	"	136,251,849	76,585,471	77,699,306
April	"	135,333,402	78,158,837	85,894,727

QUICKSILVER

The primary market for quicksiiver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
May 8	40	May 22	40
" 15	40	" 29	41
		June 5	41

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	40.25	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	49.10	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, June 4.
Associated Oil 6s	98
E. I. du Pont 4½s	88½
Natomas Con. 6s	88¾
Unlisted.	
Associated Oil 1st ref.	80
General Petroleum 6s	69¼

Unlisted.	Closing prices, June 4.
Natomas Dev. 6s	100
Pacific Port. Cement 6s	99
Riverside Cement 6s	77
Standard Cement 6s	91⅝
Santa Cruz Cement 6s	84
So. Cal. Cement	78

STOCKS.

Listed.	Closing prices, June 4.
Associated Oil	39¾
Amalgamated Oil	81¾
E. I. du Pont Powder pfd	88
Pacific Coast Borax, pfd	100½
do com	80
Pacific Crude Oil	35c
Sterling O. & D.	1.00
Union Oil of Cal	80
West Coast Oil, pfd	70

Unlisted.	Closing prices, June 4.
Mascot Copper	1¼
Noble Electric Steel	9
Natomas Consolidated	9¼
Pacific Coast Borax, old	206
Pacific Portland Cement	59
Riverside Cement	45
Standard Cement	17
Standard Oil of Cal.	187
Santa Cruz Cement	45

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 5.

Atlanta	$ .15	Mizpah Extension	$ .40
Belmont	6.20	Montana-Tonopah	1.27
Big Four	.50	Nevada Hills	.89
Buckhorn	1.30	North Star	.60
Con. Virginia	.07	Opbir	.14
Florence	.37	Pittsburg Silver Peak	.49
Goldfield Con.	1.80	Round Mountain	.40
Halifax	1.20	Sierra Nevada	.05
Jim Butler	.67	Tonopah Extension	2.10
Jumbo Extension	.22	Tonopah Merger	.63
MacNamara	.16	Tonopah of Nevada	6.00
Manhattan Consolidated	.07	Union	.09
Mexican	.61	West End	1.02
Midway	.37	Yellow Jacket	.20

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	June 5. Bid	Ask
Adventure	$ 1⅜	1⅝
Allouez	30⅜	30½
Calumet & Arizona	62	62½
Calumet & Hecla	430	432
Centennial	11	12
Copper Range	40	40½
East Butte	10	10¼
Franklin	4¾	5¼
Granby	57½	58
Greene Cananea	5⅞	6
Hancock	16¾	17½
Isle-Royale	19	19½
Mass Copper	3	3¼

	June 5. Bid	Ask
Mohawk	$ 46½	47
North Butte	25¼	25½
Old Dominion	45½	46
Osceola	81½	—
Quincy	59	60
Shannon	7⅛	7⅜
Superior & Boston	2⅜	2½
Tamarack	23½	24
U. S. Smelting	36½	37
Utah Con.	7⅜	7⅞
Victoria	90c	1
Winona	1	1⅛
Wolverine	46¼	46½

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

June 5.

	Bid.	Ask.
Alaska G. M.	10⅝	10¾
Braden Cop. 6s.	130	140
B. C. Copper	2¼	2½
Davis-Daly	2	2¼
Dolores	2	4
El Rayo	1	2
Ely Con.	6	7
First Nat.	1⅞	2
Giroux	1⅜	1¾
Greene-Can.	6⅛	6¼
Hollinger	16⅛	16½
Iron Blossom	135	140
Kerr Lake	3	3¼
La Rose	2¼	2½
Mason Valley	5½	6

	Bid.	Ask.
McKinley-Dar.	1⅛	1¾
Miami 6s	168	173
Mines Co. Am.	2⅝	2⅞
Nipissing	8½	8⅝
Ohio Copper	1⅛	1¾
San Toy	19	20
Sioux Con.	2	4
S. W. Miami	5	7
So. Utah	¼	⅜
S. O. Calif.	172	174
Trl Bullion	⅛	¼
Tuolumne	2⅛	2¼
United Copper	⅜	¾
Wettlaufer	9	11
Yukon Gold	2⅜	2¾

Dividends

The Old Dominion Copper Co. has declared its regular quarterly dividend of $1.25 per share.

The Yukon Gold Co. has declared the usual quarterly dividend of 1.5%, payable June 30 to stock of record June 19.

The Copper Range Consolidated Co. has declared a quarterly dividend of 75c. per share, payable on July 1. The total since 1905 is $35.75 per share.

On June 4, 1913, the Bunker Hill & Sullivan Mining & Concentrating Co. paid dividend No. 189, of $65,400. This makes the total amount of dividends paid $14,304,150.

The Guggenheim Exploration Co. has declared a quarterly dividend of 3%. This is an increase of ½% over the previous payment and places the stock on a 12% annual basis, against 10% heretofore.

The Position of Silver

Samuel Montagu & Co. note that the stock of silver at Bombay rose in value to £1,000,000 the first week of May. The stock at Shanghai has increased from £4,700,000 to £4,850,000. The offtake at Bombay has fallen from 190 to 130 bars per day. A shipment of £50,000 in silver has been made from San Francisco to Hong Kong.

Commenting on figures compiled by the *Boston Financial News* for the period from 1905 to 1911, inclusive, showing that the world's production had aggregated 1,379,277,046 fine ounces, against which was to be set off the amount used in the arts, etc., amounting, according to United States Mint estimates, to 708,133,300 oz., leaving 671,143,746 oz. available for coinage purposes, the London firm says: "The natural inference from these figures is that the proportion for purposes of coinage is rather restricted, but it should be remembered that, notwithstanding the apparently limited amount available, the Indian speculative group had, during the latter part of the period in question, acquired a stock now considered to be in the neighborhood of three or four million sterling. Should there arise pressure for coinage, there is no doubt that this sum would be available at a price, and, moreover, that any pronounced rise in the level of prices would tap supplies from lower grade ores, and new supplies of silver in the way of silver coin which had become worth more for their intrinsic than for their nominal value."

Current Prices for Chemicals

(Corrected monthly by Braun-Knecht-Heimann Co.)

Prices quoted are for ordinary quantities in packages as specified. For round lots lower prices may be expected, while in smaller quantities advanced prices are ordinarily charged. Prices named are subject to fluctuation. Other conditions govern Mexican and foreign business.

	Min.	Max.
Acid, sulphuric, com'l, 66°, drums, ℔ 100 lb.	$0.75	$1.00
Acid, sulphuric, com'l, 66°, carboy, ℔ 100 lb.	1.00	1.50
Acid, sulphuric, C. P., 9-lb. bottle, bbl., ℔ lb.	0.13	0.18
Acid, sulphuric, C. P., bulk, carboy, ℔ lb.	0.09½	0.12
Acid, muriatic, com'l, carboy, ℔ 100 lb.	1.60	3.00
Acid, muriatic, C. P., 6-lb. bottle, bbl., ℔ lb.	0.15	0.20
Acid, muriatic, C. P., bulk, carboy, ℔ lb.	0.10½	0.15
Acid, nitric, com'l, carboy, ℔ 100 lb.	6.00	6.50
Acid, nitric, C. P., 7-lb. bottle, bbl., ℔ lb.	0.16	0.22
Acid, nitric, C. P., bulk, carboy, ℔ lb.*	0.12½	0.15
Argols, ground, bbl., ℔ lb.	0.10	0.20
Borax, cryst. and conc., bags, ℔ 100 lb.	3.00	4.35
Borax, powdered, bbl., ℔ 100 lb.	3.38	4.60
Borax glass, gd. 80 mesh, cases, tin lined, ℔ 100 lb.	10.50	13.50
Bone ash, 60 to 80 mesh, bbl., ℔ 100 lb.	5.60	6.50
Bromine, 1-lb. bottle, ℔ lb.	0.55	0.65
Candles, adamantine, 14 oz., 40 sets, ℔ case.	4.60	4.80
Candles, adamantine, 14 oz., 60 sets, ℔ case.	5.25	5.45
Candles, Stearic, 14 oz., 40 sets, ℔ case.	5.00	5.20
Candles, Stearic, 14 oz., 60 sets, ℔ case.	5.70	5.90
Clay, domestic fire, sack, ℔ 100 lb.	1.50	2.00
Cyanide, 98 to 100%, 100-lb. case, ℔ lb.	0.20½	0.24½
Cyanide, 98 to 100%, 200-lb. case, ℔ lb.	0.20	0.24
Cyanide, 129%, 100-lb. case, ℔ lb.	0.27½	0.28½
Cyanide, 129%, 200-lb. case, ℔ lb.	0.26½	0.27½
Lead acetate, brown, broken casks, ℔ 100 lb.	9.50	10.50
Lead acetate, white, broken casks, ℔ 100 lb.	10.50	10.75
Lead acetate, white, crystals, ℔ 100 lb.	12.50	13.25
Lead, C. P., test., gran., ℔ 100 lb.	13.00	15.00
Lead, C. P., sheet, ℔ 100 lb.	15.00	18.00
Litharge, C. P., silver free, ℔ 100 lb.	11.50	13.60
Litharge, com'l, ℔ 100 lb.	8.00	9.60
Manganese ox., blk., dom. in bags, ℔ ton	20.00	25.00
Manganese ox., blk., Caucasian, in casks, ℔ ton (85% MnO_2—¾% Fe)	36.00	47.60
Nitre, double ref'd, small cryst., bbl., ℔ 100 lb.	7.00	8.00
Nitre, double ref'd, granular, bbl., ℔ 100 lb.	6.50	7.50
Nitre, double ref'd, powdered, bbl., ℔ 100 lb.	7.25	8.00
Potassium bicarbonate, cryst., ℔ 100 lb.	12.00	15.00
Potassium carbonate, calcined, ℔ 100 lb.	7.50	9.00
Potassium permanganate, drum, ℔ lb.	0.10¾	0.13
Silica, powdered, bags, ℔ lb.	0.03	0.05
Soda, carbonate (ash), bbl., ℔ 100 lb.	1.50	1.75
Soda, bicarbonate, bbl., ℔ 100 lb.	2.25	2.75
Soda, caustic, ground, 98%, bbl., ℔ 100 lb.	3.15	3.60
Soda, caustic, solid, 98%, drums, ℔ 100 lb.	2.65	2.85
Zinc shavings, 850 fine, bbl., ℔ 100 lb.	10.55	12.00
Zinc sheet, No. 9—18 by 84, drum, ℔ 100 lb.	8.75	10.00

*Extra charge for packing nitric acid for shipment to conform to regulations.

Current Prices for Ores and Minerals

(Corrected monthly by Atkins, Kroll & Co.)

The prices are approximate, subject to fluctuation, and to variation according to quantity, quality, and delivery required. They are quoted, except as noted, f.o.b. San Francisco. Buying prices marked *.

	Min.	Max.
Antimony ore, 50%, ₱ ton	*$22.00	$25.00
Arsenic, white, refined, ₱ lb	0.04	0.04½
Arsenic, red, refined, ₱ lb	0.08	0.08½
Asbestos, according to length and quality of fibre ₱ ton	100.00	350.00
Asbestos, lower grades, ₱ ton	5.00	50.00
Asphaltum, refined, ₱ ton	10.00	20.00
Barium carbonate, precipitated, ₱ ton	42.50	45.00
Barium chloride, commercial, ₱ ton	42.50	45.00
Barium sulphate (barytes), prepared, ₱ ton	20.00	30.00
Bismuth ore, 10% upward, ₱ ton	*75.00	upward
Chrome ore, according to quality, ₱ ton	10.00	12.50
China clay, English, levigated, ₱ ton	15.00	20.00
Cobalt metal, refined, f. o. b. London, ₱ lb	2.50	
Coke, foundry, ₱ 2240 lb	14.50	15.00
Diamonds:		
Ballas according to size and quality, ₱ carat	70.00	
Borts, according to size and quality, ₱ carat	2.00	15.00
Carbons, according to size and quality, ₱ carat	55.00	90.00
Feldspar, ₱ ton	5.00	25.00
Firebrick:		
Bauxite, ₱ M	175.00	
Magnesite, ₱ M	190.00	275.00
Silica, ₱ M	42.50	55.00
Flint pebbles for tube-mills, ₱ 2240 lb	19.50	22.50
Fluorspar, ₱ ton	10.00	15.00
Fullers earth, according to quality, ₱ ton	20.00	30.00
Gilsonite, ₱ ton	35.00	40.00
Graphite:		
Amorphous, ₱ lb	0.01½	0.02½
Crystalline, ₱ lb	0.04	0.13
Gypsum, ₱ ton	7.50	10.00
Infusorial earth, ₱ ton	10.00	15.00
Magnesite, crude, ₱ ton	5.00	7.50
Magnesite, dead calcined, ₱ ton	20.00	25.00
Magnesite, brick (see firebrick).		
Manganese ore, oxide, crude, ₱ ton	10.00	25.00
Manganese, prepared, according to quality, ₱ ton	30.00	70.00
Mica, according to size and quality, ₱ lb	0.05	0.30
Molybdenite, 95% MoS_2, ₱ ton	400.00	450.00
Monazite sand (5% thoria), ₱ ton	150.00	200.00
Nickel metal, refined, ₱ lb	0.45	0.60
Ochre, extra strength, levigated, ₱ 100 lb	2.25	3.25
Platinum, native, crude, ₱ oz	30.00	45.00
Silex lining for tube-mills ₱ 2240 lb	32.50	35.00
Sulphur, crude, ₱ ton	20.00	25.00
Sulphur, powdered, ₱ ton	35.00	45.00
Sulphur, 80%, ₱ ton	16.50	18.50
Talc, prepared, according to quality, ₱ ton	20.00	50.00
Tin ore, 60%, ₱ ton	550.00	600.00
Tungsten ore, 65%	425.00	450.00
Uranium ore, 10% min.	25.00	per unit
Vanadium ore, 15% V_2O_5, ₱ ton	150.00	180.00
Wolframite (see tungsten ore).		
Zinc ore, 50% up, ₱ ton	*15.00	20.00

Recent Copper Production

Anaconda copper production for May was 25,600,000 pounds.

Utah Copper Co. April production amounted to 9,834,894 pounds.

Sulitjelma, Norway, produced in April 2,508,800 pounds of concentrate by the Elmore process.

The Ray Consolidated Copper Co., in April, produced 4,514,565 lb. of copper, compared with 4,420,000 lb. in March and 2,710,908 lb. in April a year ago.

Copper Production by States

The production of fine copper in the individual states has been compiled by B. S. Butler, of the United States Geological Survey, and is given below, the figures being in pounds:

	1911.	1912.
Alaska	22,314,889	31,926,209
Arizona	303,202,532	359,322,096
California	35,835,651	31,516,471
Colorado	9,791,861	7,963,520
Idaho	4,514,116	7,182,185
Maryland	23,555	53,043
Michigan	218,185,236	231,112,228
Missouri	640,411	440,725
Montana	271,814,491	308,770,826
Nevada	65,561,015	83,413,900
New Mexico	2,860,400	29,170,400
North Carolina	13,699	63,766
Oregon	125,943	311,860
Pennsylvania	661,621	248,378
Philippine Islands	9,612	.....
South Dakota	1,607	23,657
Tennessee	18,965,143	18,395,256
Texas	105	964
Utah	142,340,215	132,150,052
Virginia	.....	96,753
Washington	195,503	1,069,938
Wyoming	130,499	25,080
Undistributed	44,645	11,413
	1,097,232,749	1,243,268,720

ESTIMATED EARNINGS of the U. S. Steel Corporation for May are over $13,000,000, while the April figures were about $12,000,000. Earnings for the entire quarter are estimated in New York between $37,000,000 and $38,000,000.

Copper Production in 1912

The production of primary and secondary copper by the regular refining plants in 1911 and 1912, in pounds, is summarized as below by B. S. Butler of the United States Geological Survey.

	1911.		1912.	
Primary:	Domestic.	Foreign.	Domestic.	Foreign.
Electrolytic	823,507,764	332,604,223	[1]942,971,280	[1]331,964,091
Lake	218,185,236	.....	231,112,228	.....
Casting	22,977,534	.....	24,777,266	.....
Pig	36,600,269	.....	32,852,030	4,427,583
Total primary	1,101,270,803	332,604,223	[2]1,231,712,804	[2]336,391,674
	1,433,875,026		1,568,104,478	
Secondary:				
Electrolytic	19,093,622		23,932,166	
Casting	8,803,105		5,150,137	
Total secondary	27,896,727		29,082,303	
Total output	1,461,771,753		1,597,186,781	

[1]The difference in the total primary electrolytic copper as shown here and as already given out by the Copper Producers' Association appears to be due to the fact that through a misunderstanding some electrolytic copper derived from scrap was included in the Association's figures showing primary electrolytic copper. The figures for Lake copper include the Michigan copper that was electrolytically treated.

[2]The distribution of refined copper of domestic and foreign origin is only approximate, as an accurate separation at this stage of manufacture is not possible.

Company Reports

GOLDEN HORSE-SHOE ESTATES COMPANY, LTD.

This is an important company operating at Kalgoorlie, Western Australia, which has to the end of 1912 produced 2,712,103 tons of ore, yielding $41,960,200, and paid $14,500,000 in dividends. Mine developments have been watched with interest of late, owing to the sinking of the main shaft, and opening the lode near the boundary of the Great Boulder mine, from the Edwards and main shafts of the latter. This lode, in 1911, passed over the boundary into the Horse-Shoe property at a depth of 2630 ft. The main shaft is down to 2529 ft. and is to be sunk to 2780 ft. as quickly as possible. Stations were cut on the 2240 and 2360-ft. levels. No. 2 shaft was sunk to 1552 ft., and sinking is being continued. No. 2 lode produced 121,875 tons of ore during the year, and on the 1200-ft. level payable ore was opened for 1000 ft. south of the main shaft. No. 3 lode produced 156,890 tons of ore. On the 2240-ft. level it was cut 68 ft. from the main shaft, where the value was $7 per ton over 10 ft. A fault affected this lode on the 2360-ft. level, while at 2480 ft. it was worth $5 over 5 ft. This lode has always assayed lower in the main shaft section than when driving north and south. No. 4 lode was opened by 243 ft. of driving and 133 ft. of winzes, and produced 2042 tons of $19.90 ore. On the 2630-ft. level the lode, where first cut, assayed $25 over 7 ft., and 100 ft. south, $100 over 6 ft. To enable ore to be mined before the shaft is completed, a winze has been sunk from 2480 to 2630 ft., and the winze from 2630 to 2780 ft. is now being sunk. The year's results were as follows:

Development work, feet	9,768
To date, feet	127,619
Ore reserves, tons	714,141
Average value per ton	$8
Ore milled in 150-stamp mill, tons	280,868
Sand treatment, by percolation, tons	103,856
Slime treatment by filter-presses, tons	153,456
Concentrate treatment by roasting and cyaniding, tons	23,556
Residue re-treatment, tons	43,393
Revenue from bullion and slag	$1,800,000
Profit	49,000
Carried forward, including amount brought forward from 1911	160,000

GREENE CONSOLIDATED

The Greene Consolidated Copper Co. has issued its report for the year that ended December 31, 1912. The combined income account of the Greene Consolidated Copper Co. and the Cananea Consolidated Copper Co. for the years 1911 and 1912 was as follows:

	1911.	1912.
Total revenue	$6,045,834	$7,746,840
Operating exp., taxes, interest, etc.	4,738,703	5,313,393
Net earnings	1,307,131	2,433,447
Improvements	280,180	152,648
Net profit	1,026,951	2,280,799

The combined balance sheet as at December 31, 1912, shows assets as follows: Real estate, mines, plant, etc., $9,816,404; deferred assets, $41,640; accounts receivable, $4,227,182; notes receivable, $26,403; supplies and merchandise on hand, $1,564,371; inventory of copper in process, $293,116; cash, $125,057; total, $16,094,174. Liabilities: Capital stock, $10,000,000; accounts payable, $2,141,001; reserves, $176,852; profit and loss surplus, $3,776,320; total, $16,094,174.

L. D. Ricketts, general manager, says: "The drop in the yield per ton is largely accounted for by the high price of copper, which justifies us in mining a lower grade of ore. During the year there was 72,403 ft. of development done, of which 1392 ft. was shafts, 13,293 ft. was raises and winzes, and the balance drifts. Development, on the whole, showed satisfactory results, especially with regard to the tonnage of smelting ore developed. The amount of new concentrating ore opened during the year has not equaled the tonnage mined." The cost of mining is given as $2.93 per ton, compared with $2.46 in 1911.

BUENA TIERRA MINING COMPANY, LTD.

This company was registered in February 1912 to acquire from the Exploration Company of England & Mexico, Ltd. a silver-lead property of 89 acres in the Santa Eulalia district, Chihuahua, Mexico. The first annual report covers 11 months in 1912; and that of the general manager, Arthur C. Brinker, contains the following information: The Santa Eulalia district is included in a large area of well marked bedded limestone, lying nearly horizontal, with a dip of 10° to the south. In a large part it is covered by flows of andesite and rhyolite. Orebodies occur in irregular form; and those of the Buena Tierra are all oxidized, the sulphide zone being not yet reached.

During the year, development in the eastern and western sections of the mine covered 4806 and 2248 ft., respectively. Ore reserves in the different 'fissures' are as follows: Eastern, 195,500 tons; Catarina, 45,600; Ojuela, 5800; Santo, Domingo, 10,500; Chorro, 26,250; Chihuahua, 12,500; and San Lazaro, 5000 tons, a total of 301,150 tons. This ore will average 8.65 oz. silver per ton, and 15.1% lead. The Eastern orebody has developed into a large shoot above No. 1 level. The central portion is 85 ft. wide. The eastern portion extends 100 ft. southeast in the form of a 'manta' (blanket or covering). It is 50 ft. wide here. The western section is 100 ft. long by 100 ft. wide. The Catarina fissures have shown continuous ore from the eastern to the north boundary. A 'manta' or layer has been opened for a height of 75 ft. and length of 260 ft. The Santa Domingo fissures are yielding good lead carbonate ore. The Chorro fissures have been opened by a stope 45 by 80 ft., of low-grade ore. Full details of the geology of this district, and the mine development will be given in another issue of this journal. Operations during 1912 resulted as follows:

Ore shipped to Chihuahua smelter, tons	30,085
Lead content, per cent	15.10
Silver content, ounces per ton	8.65
Net return from smelter	$256,015
Costs per ton:	
Mining	$1.33
Development	1.08
Sorting and transport	0.86
General	0.54
Taxes	0.11
Total cost	$3.92
Profit	$145,888
Dividend	80,000

MIAMI COPPER COMPANY

This company operates a large mine and concentrating plant in Gila county, Arizona. The report is for the year ended December 31, 1912. The report of the general manager, B. Britton Gottsberger, contains the following: Work in the mine has been carried forward with the view of mining with the shrinkage-stope method, as soon as the irregular top layer of the ore, next to the capping, can be removed, by timbering methods, and a timber mat formed. This work, while expensive, has been nearly completed in the northwest portion of the orebody, containing approximately 2,000,000 tons, and active mining by the shrinkage-stope method will begin in April 1913, resulting in lower mining costs.

Development work for the year consisted in the completion of the 420-ft. extraction level, and the sub-levels and raises in the Northwest orebody; in extending this level into the Captain orebody, and starting several haulage drifts in it; also raising from this level to the bottom of the Captain shaft. The Captain or No. 1 shaft will be extended full size to the 420-ft. extraction level and will be used to help in the development of the Captain ore-

body, which contains approximately 4,000,000 tons of ore. This will be mined directly by the shrinkage-stope method without the use of a timber mat. Considerable full-sized driving was done on the 570-ft. level to prepare it as a main-extraction level. A station was cut at the 720-ft. level of No. 4 shaft, but as it will be several years before the ore tributary to this level is needed, the work of driving the cross-cut has not yet been started. During the year development covered 54.929 feet.

During the year 21 churn-drill holes were put down from the surface to an average depth of 612 ft., or a total of 12,865 ft.; and in addition to this, one hole was put down 269 ft. from the bottom of No. 1 shaft. Part of these drill-holes found high-grade ore, and part of them demonstrated the existence of a belt of 1.2% copper material 500 ft. in width, lying to the north of the Northwest orebody. While this material is not classed as ore, its copper, together with its pyrite content, may some day make it of value. In order to determine the extent and continuation of the ore below the 570-ft. level, nine vertical diamond-drill holes with a total length of 1957 ft. were put down below that level, all of them being in good sulphide ore, averaging 2.5% copper for varying depths. The deepest point at which ore was found was 265 ft. below the 570-ft. level, or 115 ft. below the 720-ft. level, the deepest extraction level as yet laid out at No. 4 shaft. The ore is evidently pitching to the east, and diamond-drill holes have been projected to cut it on its continuation in that direction. Underground development drifts have proved the Northwest orebody, and the area of the main orebody on the 570-ft. level. On January 1, 1913, the ore reserves were estimated to amount to 20,800,000 tons, and further development above outlined will undoubtedly add to this. While the ore developed by the diamond-drill holes below the 570-ft. level is taken at 2.40% copper, the Captain orebody is of somewhat lower grade, and an average of the above reserve is about 2.48% copper.

The sixth and last section of the mill was started about the end of February, and the average section treated 489 tons of ore per day. The ore is hard, and the rigid rolls used for intermediate crushing were partly replaced by a heavy spring roll, and the Chilean mills by Hardinge pebble-mills. These changes will decrease the crushing costs. Experiments made on No. 6 section, treating 475 to 500 tons per day, showed that the so-called roughing process was no improvement. The 're-treatment' process, which consists of finer grinding of the coarsest sands, from the sand-floor reject and middling, followed by classification and table treatment, is still in operation. It shows an increased recovery of 1.5 lb. of copper per ton of ore treated over the other sections. Results of the year's operations were as follows:

Ore treated, tons	1,040,744
Concentrate produced, tons	46,683
Copper in concentrate, pounds	34,560,665
Copper produced, pounds	32,832,609
Recovery in mill, per cent	69.39
Value of metals produced	$5,385,501
Profit	2,094,805
Dividends paid	1,100,112

ALASKA GOLD MINES COMPANY

The first annual report of this company, which is engaged in reopening the mines of the Alaska Perseverance group near Juneau, was issued under date of May 6. The president, Charles Hayden, announces that the Alaska Gold Mines Co. now owns $3,184,000 worth of the $3,500,000 bonds issued, and $10,137,640 of the $12,000,000 stock. It has issued 175,833 fully paid shares of its own stock and subscription receipts for 517,295 additional shares. There remain 39,001 shares available for purchase of additional shares and bonds of the Alaska Gastineau, the owning company. From the receipts from sale of stock, $1,250,000 has been paid to the Alaska Gastineau company. Presumably, though not so stated, this, with the 175,833 fully paid shares issued, covers the purchase price of the bonds and underlying stock. In addition, $3,250,000 is to be realized from the remaining payments for stock, and this sum "will be *loaned*, in accordance with the original plan, to the Alaska Gastineau M. Co. for development and equipment purposes." This statement clears the mystery as to how the money realized from sale of the Alaska Gold Mines Co. was to find its way into the treasury of the company spending it.

The report of D. C. Jackling, vice-president in charge of operations, presents a cheerful picture of the work under way, though publicity has been so complete that there is little that is new. Construction of the new 6000-ton mill is to be begun this summer, and active mining and milling operations should be under way before the close of 1914. The whole project is attracting much attention because of the scale of operations and the low grade of the ore, which is estimated to be worth $1.50 per ton.

Book Reviews

WINDING ENGINES AND WINDING APPLIANCES. By George McCulloch and T. Campbell Futers. Pp. 452. Ill., index. Longmans, Green & Co., London. Price $6.

The hoisting engine is one of the most important pieces of machinery about a mine, and is often the most uneconomical and least efficient portion of the whole equipment. While it must be granted that there are many causes which tend to make it impossible to operate a hoisting machine with the same efficiency as many other kinds of machinery, it, however, is possible by a careful and intelligent study of the duty and particular requirements of the various cases occurring in practice, to at least select that type of machine which is best adapted to the case under consideration, and will give the maximum economy and efficiency. It is the purpose of this book to treat the subject of hoisting engines as a whole, and with as simple mathematics as possible, to direct the attention to the problems of design upon which their economy depends. The choice of system and comparison of the designs which are to be had, is a most important subject, which is discussed in detail. Among the systems and designs covered by this volume are the duplex-cylinder, non-condensing engine with cylindrical drum, and also the conical type drum with the same engines, non-condensing compound engines, high-speed engines with cylindro-conical drums, and other types. The principal results of investigations conducted with the various types of hoists are tabulated and presented in a manner which shows at a glance the variations that are to be expected in the operation of different kinds of winding engines. Part II is devoted to the winding problems that arise in the working of deep orebodies where the ore has to be hoisted from depths of from 3000 to 6000 feet. The advantages and disadvantages of the different systems used in this class of work are pointed out. The principal systems discussed under this head are the single-lift system, tandem system, and the two-stage system. The various considerations which enter into the choice of a hoisting machine for deep mines are explained in full, and the problems and calculations involved in deep hoisting are illustrated by examples. The relation between economy of first cost and economy of working are important, and the conditions are given which are to be considered in the selection of a particular type of hoist to meet the operating conditions. While there is but little or no difference in the calculations for hoists used in metalliferous and coal mines, the hoisting problem is simplified in coal-mining, as the hoisting is done from but one depth, and the selection of a hoist will depend largely upon the tonnage to be handled. The problems as to rope, cylinder areas, horse-power, speed, and drum diameters are taken up and the methods given for arriving at the proper conclusions regarding these factors. The subject of the application of electricity to hoisting is an important one. In modern practice, where available, electricity is becoming more generally used for hoisting purposes and a number of systems have been developed.

There are three general systems of hoisting by electricity: first, where the current is taken directly from the generator or power-supply to the motor of the hoist; second, where the current is not taken directly to the motor, but to a motor-generator, or what is commonly called a fly-wheel set or the Ilgner system; third, a system which is a combination of the first two, by which the power mains are connected directly to the winding motor and also through transformers to a rotary converter. This system is known as the Westinghouse converter-equalizer system. The application of the various systems of hoisting, which come under these three general heads, forms an important part of the work, and the information and data contained in these pages are of particular interest and value.

The design of steam-engine details is given considerable attention. The subject of valve-gear is important, as it involves the economic use of steam and is one that is given little or no consideration by most writers on hoists. Cylinders, governors, main throttle-valves, cross-heads, pistons, and other parts are discussed as to their proper design and construction. The design of drums, brakes, and clutches is also an important subject, and is treated in a thorough manner. While there are so many devices designed with a view of preventing, or at least of minimizing, the consequences of the driver neglecting to shut off the steam at the proper point, that to describe them all would require a separate volume, this work does consider the more important safety devices under the heads of automatic engine-stops, slowing-down gear, and overwinding gear. The Karlik tachograph is also described, with illustrations. This recording instrument for registering and controlling the work of the hoisting engine forms a valuable adjunct to the hoisting equipment. The work closes with a discussion of the details of the accessories of winding gear, including ropes; safety gear for cages and skips; cages, and methods of decking in coal mines; cage guides, head-gears, and other details.

STEAM BOILERS. By E. M. Shealy. McGraw-Hill Book Co., New York. Pp. 350, index. For sale by the *Mining and Scientific Press*. Price $2.50.

This book is one of the engineering education series prepared in the extension division of the University of Wisconsin, at which Mr. Shealy is assistant professor of steam engineering. It is especially adapted for use in connection with correspondence instruction and for firemen and others who may be in charge of boiler-rooms. The subject is treated from the standpoint of operation rather than design. Various types of boilers and their characteristics are described at length. Formulæ for boiler calculations are given, as well as a discussion of heat and its effect, properties of steam, and evaporation. The discussion of fuel is somewhat disappointing from a Western standpoint by reason of the limited space given to petroleum as compared to that given to coal. Chapters on the inspection, care, and testing of boilers are especially interesting to the elementary student, and are quite as important as the fundamental principles of design and operation. The book is excellently adapted to the purpose for which it was written.

ELECTRIC FURNACES IN THE IRON AND STEEL INDUSTRY. By W. Rodenhauser and I. Schoenawa. Pp. 404. John Wiley & Sons, New York. For sale by the *Mining and Scientific Press*. Price $3.50.

The cheap electric power available throughout the greater portion of the Pacific coast states makes this book of special interest to engineers and manufacturers in this region. The experiments at Heroult have been watched with great interest, and the authors have given an admirable analysis of the results that have been obtained thus far. Characteristics of all known types of electric furnace embraced under the general title are given with a description of their design and operation, including both American and European practice and development. The electric furnace possesses one prime advantage over others, in that it permits close regulation of temperature, a vital factor in the manufacture of steel, especially in the higher grades. Cheap current is essential to large operations, however, and the authors, in due appreciation of the importance of this fact, have dwelt exhaustively upon the economic side of the question. Tabulations of operating costs with current at various prices have been carefully prepared and constitute one of the most interesting features of the book. The electrical, metallurgical, and chemical phases of the subject are discussed with the thoroughness of the European engineer. It is believed that ultimately the electric furnace will replace the old-time crucible for the manufacture of high-grade steel. Results achieved in the manufacture of rails would indicate that this is also a field in which conditions are favorable to electricity. As a whole, this book is exceptionally comprehensive and will well repay careful study, especially by engineers on the Pacific coast.

ELEMENTS OF WESTERN WATER LAW. By A. E. Chandler. Technical Publishing Co., San Francisco. Pp. 150, index. For sale by the *Mining and Scientific Press*. Price $2.

The attention that is being paid to the water question by the federal Government, as well as by the various state governments, makes the publication of Mr. Chandler's work especially pertinent at this time. As the question of water rights is a matter of law rather than engineering, the text is necessarily confined to the laws of the various states embraced within what is known as the West, and also includes the interpretation of these laws as exemplified by the various decisions of the courts. Mr. Chandler is especially able in expounding the stilted legal text, and his wide experience as a teacher has enabled him to clear away much of the fog that ordinarily clouds the mind of the layman when trying to translate legal phraseology into understandable English. Engineers especially will appreciate the book, as there are few, if any of them, actively engaged in the practice of their profession who do not deal occasionally with water rights.

Recent Publications

GEOLOGY AND UNDERGROUND WATERS OF THE WICHITA REGION, NORTH-CENTRAL TEXAS. By C. H. Gordon. Water-Supply Paper 317. P. 88. Ill., map, index.

UNIVERSAL EXPOSITION, 1915. Rules and regulations for intending participants. P. 16. Panama-Pacific Exposition Co., San Francisco, 1913. This pamphlet should be secured by all exhibitors, who will find information regarding the management of this exhibition.

THE DEVONIAN AND MISSISSSIPPIAN FORMATION OF NORTHEASTERN OHIO. By Charles S. Prosser. Geological Survey of Ohio publication No. 15. P. 574. Ill., index. Columbus, 1912. This investigation has been under way since 1901, and the formations in Cuyahoga and Summit counties are described, and those toward Pennsylvania on the east.

THIRD BIENNIAL REPORT OF THE DEPARTMENT OF ENGINEERING OF THE STATE OF CALIFORNIA. December 1910 to November 1912, inclusive. P. 263. Ill., maps, charts, index. Sacramento, California, 1912. This state department controls the engineering requirements of all state institutions, river problems, surveys, water-power, roads and highways, dams, the San Francisco harbor front, and other similar works needing constant supervision.

PETROLEUM IN SOUTHERN CALIFORNIA. Issued by the California State Mining Bureau. F. McN. Hamilton, State Mineralogist. Compiled by Paul W. Prutzman. P. 430. Ill., maps, index. Sacramento, California, 1913. California is the greatest oil-producing state of the United States, the output in 1912 being approximately 88,000,000 bbl., from the southern counties. This report has been in preparation for some time, and adds to the existing literature on the subject. It contains a description of the state of California geology, oil developments, methods of oil analysis, and detailed accounts of the various districts, their producers, analyses of oils, production, and details of wells. Some of the material is good.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

THE mica industry of India employs 14,000 men, methods being of a primitive character.

JOPLIN MINES in 1912 produced 47% of the total domestic production from zinc ores.

WATER-SUPPLY of Rio de Janeiro, Brazil, is to be improved, and it is estimated that the new engineering scheme will take five years, involving an expenditure of $60,000,000.

LEAD AND ZINC ORES to a total of 15,963,000 tons were mined in the Central States in 1912, and from them concentrates valued at $30,572,713 were obtained. The average value of the crude ore was $1.92.

GASOLINE PRODUCTION from natural gas in the Santa Maria field, California, is about 4500 gal. per day, and the total made in the state from this source is probably 11,000 gal. per day. This quantity will be largely augmented when the new plants under construction are in operation.

FLUORSPAR was mined in the United States in 1912 to the amount of 117,282 short tons, according to E. F. Burchard of the U. S. Geological Survey. The output in 1911 was 93,563 tons. The Illinois-Kentucky district supplied 114,410 tons, worth $756,653. Imports amounted to 26,176 tons, valued at $2.74 per ton. The average domestic price for all grades was $6.60.

SOUTHWESTERN MISSOURI lead-zinc deposits occur in 'sheet ground,' replacing the upper part of the Grand Falls chert, and in 'soft ground,' irregular runs in the limestone. The sheet-ground mines in 1912, according to J. P. Dunlap, yielded 5,465,100 tons of crude ore. The soft-ground mines treated 3,856,045 tons. The percentage of concentrates in sheet ground and soft ground, respectively, were 2.62 and 4.21.

ASBESTOS is the most important fire-proofing material known. Its fibrous structure adapts it to a wide range of applications—from woven fabrics, such as theatre curtains and articles of clothing, to asbestos shingles, stucco, plaster, asbestos 'wood,' and various other forms of building material that render structures thoroughly fire-proof. Its lightness, strength, durability, and insulating properties against heat and electricity give it special advantages for use in constructing cars and electric motor subways.

THE Treadwell companies on Douglas island, Alaska, have equipped the properties with three Draeger 1907 oxygen helmets, and a corps has been drilled in their use by the territorial mine inspector. Training in first aid to the injured has been taken up by some of the miners, and the management has offered the services of a physician if the men will keep up the work. At a number of the other lode mines a start has been made in mine-rescue and first-aid work, and it is hoped that some organization of first-aid training will be accomplished in the placer-mining districts during the winter of 1912-13.

BORNITE, which has long been supposed to be one of the characteristic products of secondary enrichment, in reality proves to be primary in the majority of its occurrences, and its rather common occurrence in an enriched zone is found to be mainly as residual masses which are undergoing alteration. It is formed at about the same period of solidification as primary chalcopyrite and primary chalcocite, with which it is most commonly associated. Accordingly, it usually develops in irregular-shaped masses, frequently intergrown with these other sulphides, existing either by themselves or filling interstitial spaces between grains of gangue or pyrite, and other ore minerals like sphalerite.

PUZZOLAN CEMENT was manufactured during 1912 at three plants in the United States—at North Birmingham, Alabama; Struthers, Ohio; and Sharon, Pennsylvania—and 'Collos' cement at Buffalo, New York, according to the U. S. Geological Survey. The output of puzzolan and 'Collos' cements in 1912 was 91,867 bbl., valued at $77,363, compared with 93,230 bbl., valued at $77,786 in 1911. The average price per barrel of these slag cements in 1911 and 1912 was 83.4c. In 1912 the average price of slag cement was, perhaps for the first time, 2.1c. higher than that of portland cement. One reason is that a considerable quantity of this product is of a light color and is considered to be non-staining.

GARNETS are generally classed as precious stones, and a fine gem garnet may be worth from $5 to $25 per carat, according to variety and size, but it is not necessarily true that the owner of a garnet mine is a millionaire because his mine produces garnets by the ton. In fact, the bulk of the garnets produced are measured by the ton, but those of inferior quality are used for abrasive purposes. In 1912 the production of abrasive garnet, according to the U. S. Geological Survey, amounted to 4182 short tons, valued at $137,800, so that the average price for a ton of garnets was not quite $33, or considerably less than double the price of a ton of hay.

IN EUROPEAN tunnel driving, the 'shallow-hole' system has been used in such works as the Arlberg, Simplon, and Loetschberg tunnels. In this, holes are only drilled about 40 in., and are of large diameter, compared with the American system, where a hole by the time it is down 10, 12, or 14 ft., is just a little larger than the diameter of the steel. The result of this is, that the explosive is put at the bottom in a section of hole of small diameter, which is the reverse of what is wanted in order to produce the most effective results. It is much better to drill a large number of shallow holes of large diameter, and use a great deal of powder, than to put in a small number of deep holes and try to save powder. The European system simply peppers the head with holes.

PRODUCER-GAS POWER-PLANTS in the United States are ably discussed by R. H. Fernald, in Bulletin 55 of the Bureau of Mines. As far as could be gathered, there were at the end of March 1912 over 900 plants, ranging in size from 15 to say 5000 hp. capacity. The following were using fuel as mentioned: anthracite coal, 610 plants with 89,470 hp.; bituminous, 77 with 86,615 hp.; lignite, 32 with 10,230 hp.; wood, one with 500 hp.; and oil, two with 325 hp. New York state leads with 77 installations, Pennsylvania with 67, New Jersey with 53, Wisconsin with 48, Illinois with 40, and California with 3. Blast-furnace and coke-oven gas-power plants are closely allied to producer-gas plants, and it is interesting to note that the total capacity is 339,280 hp., against 187,140 hp. of the latter producer type. The total cost of operating a 100-hp. producer plant at one mill was 1.58c. per kilowatt-hour.

FORMULAS for temperature conversion tables are put in convenient form by Herbert Haas in the *Transactions* of the A. I. M. E. Remembering the thermometer scales of Fahrenheit (F.), Celsius (C.), and Réaumur (R.), and their derivation and relation:

$$n°\text{F.} = {}^4/_9\,(n° - 32)\ \text{R.} = {}^5/_9\,(n° - 32)\ \text{C.}$$
$$n°\text{C.} = ({}^9/_5\,n° + 32)\ \text{F.} = {}^4/_5\,n°\text{R.}$$
$$n°\text{R.} = ({}^9/_4\,n° + 32)\ \text{F.} = {}^5/_4\,n°\text{C.}$$

As the freezing point of water is at 32°F., corresponding to 0°C. and 0°R., 32 must be deducted from the Fahrenheit degrees when these are converted into C. or R. degrees. Likewise, to C. or R. degrees converted into F. degrees, 32 must be added. The fractions ${}^4/_9$ and ${}^5/_9$ and their reciprocals are obtained thus:

$$212°\text{F.} - 32°\text{F.} = 180;\ \frac{180}{100} = {}^9/_5\ \text{and}\ \frac{100}{180} = {}^5/_9.$$

The Mine Telephone

Not only is a telephone system an actual necessity in the efficient operation of a mine, but it is also of invaluable use in emergencies and accidents. In fact, it is safe to say that the telephone is the mine operator's greatest help in his fight to reduce the loss of life, that ever present factor in mining operations. This does not mean that a telephone system will necessarily prevent accidents; but it does provide a means for instantly summoning help. In case of fire, the telephone furnishes a means for warning all the men in the mine and directing their escape, while often in cases of explosion, some of the instruments, if they have been made properly, can still be used for warning and directing. In fact, the United States Bureau of Mines, in its second annual report, in dwelling upon the need of refuge chambers, states: "Even if nothing more than several mine-rooms or chambers were utilized, these could have tight-fitting doors in duplicate, and a protected telephone."

The modern mine telephone, as made by the Western

Electric Co., is built to fulfill the requirement of a 'protected telephone.' All apparatus is enclosed in a substantial cast iron case, heavily japanned inside and outside, and equipped with two doors. This combination makes the set fire-proof, rust-proof, and moisture-proof when closed. The iron case is also curved at the top so that water or any other foreign matter falling upon it will easily slip off. The line wires may be brought in either at the top or bottom of the case. When brought in at the top, the wires run in through a curved inlet which works as a drip loop to prevent water from getting into the set. The outer door protects the transmitter mouth-piece, receiver, and generator crank, the only parts visible when this door is opened, while the second or inner door protects all the apparatus within the case. Electrically, the set is the same as an ordinary magneto instrument containing practically the same apparatus. Here, however, the resemblance ceases, as the mechanical features are entirely different. Besides being encased in a cast iron box, every piece of apparatus is individually and thoroughly treated to protect it against the inroads of moisture, corrosive mine water, and gases. The generator springs are covered with asphaltum paint. The generator terminals are mounted on a hard rubber block, and after connections are made they are covered with a water-proof compound. Switch-hook springs and ringer terminals are covered with asphaltum paint and compound, respectively. The induction coil is mounted in a hardwood case, the parts of which are boiled in linseed oil before they are put together. These boxes are not glued, but are fastened by means of brass screws, while the spaces between the sides and the induction coil are filled with water-proof compound.

To prevent battery troubles, the cardboard cartons are thoroughly impregnated with waterproofing compound to prevent the absorption of moisture which would otherwise short-circuit adjacent shells. To safeguard the batteries still further and prevent them from coming into contact, circular holes, each large enough for one cell, are provided in the wooden block under the batteries. All wiring is done with Habirshaw red rubber core cable, fastened with insulating tape, and treated with asphaltum paint. Every exposed iron part is triple electro-galvanized.

Commercial Paragraphs

The Meese & Gottfried Co., well known along the Coast as the largest manufacturers in the West of transmission, elevating, conveying, and screening machinery, having outgrown its present main offices, has taken a ten years' lease for $78,000 for the four-story steel and brick building, corner Mission and Annie streets, San Francisco. A force of experts are now hard at work equipping what it is claimed will be the finest offices for a concern of this kind in the West, if not perhaps in the country. The firm will occupy the whole building and expects to take possession about June 15. On the ground floor will be up-to-date salesrooms and the executive offices. The second floor will be arranged to care for the estimating department, the engineering department, drafting-room, advertising department, blueprint and photographic rooms. The balance of the building and large basement are to be used for the storing of certain standard goods—such, for instance, as wood and steel pulleys, bearings, hangers, shafting, chain and link belting, etc., which will supplement the stock carried at the factory to expedite local deliveries. The new building marks but another step in the aggressive policy of this wide-awake concern and will place it within easy reach of all the machinery interests, the big hotels, banks, and offices of manufacturing, engineering, and mining men.

The Abbé Engineering Co., of 220 Broadway, New York City, manufacturers of pulverizing and grinding machinery, vacuum pumps, and pressure blowers, announces that owing to increasing business it has been necessary to open an additional testing laboratory for the grinding, mixing, and crushing of samples submitted by prospective customers. The Abbé Engineering Co. has maintained a testing laboratory for the past ten years, but this new laboratory has been more thoroughly equipped and the machines are more advantageously arranged. The new addition occupies the entire ground floor of the building at Huron and West streets, Brooklyn, New York. The laboratory is equipped with pebble-mills of various sizes, 'Max' mills, cutters, crushers, 'Excelsior' mills, vacuum pumps, and pressure blowers. The above company also invites prospective customers to take advantage of the offer to make tests on samples and secure the benefit of a practical demonstration, combined with the knowledge of its engineers, gained through many years of experience and who are in a position to make suggestions for special requirements. The Abbé Engineering Co. also intends to install an up-to-date bolting reel, on which the different meshes of Swiss silk bolting cloth sold by the company may be used for bolting samples. The primary object of this laboratory is, of course, to obtain a more thorough and practical knowledge of the particular material to be tested for customers, so that recommendations for machines are based on facts and not on guess-work. Besides this laboratory, the company also has hundreds of samples with records of tests, so that in a good many cases it is not necessary to test a sample for the prospective buyer. In addition to the foregoing, the Abbé Engineering Co. has elaborate display-rooms at its offices, where there are on exhibition about twenty machines of different sizes and styles, including a tube-mill equipped with the Abbé patented 'Ideal' spiral feed and discharge, this machine being operated by motor.

Catalogues Received

Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog L, 'Brownhoist Locomotive Cranes.' 32 pages. Illustrated. 6 by 9 inches.

Edgar Allen American Manganese Steel Co., Chicago. Bulletin No. 56, 'Gyratory and Jaw Crusher Wearing Parts.' 28 pages. Illustrated. 6 by 9 inches.

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EDITORIAL STAFF:

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EDITORIAL

CHERRIES, as well as gold bricks, may be carried by parcel post. We are indebted to Mr. Harold Rae Moss for a demonstration of this fact. Now when Barnum & Bailey send us 'eomps' we shall feel we have arrived at the inner circle of editorship.

WESTERN mining men do not always appreciate the extent and variety of the mineral production of the eastern states. We print this week the first of a series of short artieles by Mr. Thomas L. Watson, the aeeomplished state geologist of Virginia. They afford eonvineing proof that the pioneer eommonwealth is as ready to resume giving the nation mines as presidents.

BOILING EGGS on a mountain top has long been known to involve difficulties, but just how the smaller amount of oxygen per eubie foot of air was to complieate smelting was not altogether realized until the Cerro de Pasco company began its pioneer work. Fortunately that eoncern has been backed by knowledge and persistence as well as money. As a result intricate technical problems of wide interest have been and are being solved by its staff. We print this week the first account of the sueeessful applieation to the Cerro ores of the Dwight & Lloyd proeess of sintering. It is significant that a 25 per cent sulphur charge is handled and even this may not be the maximum. As always there is room on the mountain top—for the right men.

EXPORTS and imports throughout the world have been made the basis of elaborate study by the Bureau of Foreign and Domestie Commeree, disclosing the interesting fact that the imports of all the countries in the world aggregated in value $18,868,880,000 in 1911, as compared with exports valued at $16.848,908,000. The discrepaney doubtless represents imports from uneivilized countries, where no reeords of exports are kept. It is interesting also to learn that the United States furnishes 13.8 per eent of the total exports and only 9.2 per cent of the total imports. It must not be hastily eoncluded from this that the finaneial position of the United States is necessarily the same as that of a farmer who sells produce greatly exeeeding in value the amount of his purchases, thus aeeumulating wealth. The farmer may have a heavy mortgage on his farm; similarly, nearly all countries whieh produee much raw material must pay interest or dividends upon European capital. Foreign investments in the United States are large, and the faet that the United States sells to Europe much more than it buys would not prevent our being in debt to Europe.

XENOPHON wrote a chronicle of Cyrus the Younger's attempt to dethrone his brother Artaxerxes, King of Persia, in the 'Anabasis,' known to all school boys; DeQuincey has written of the anabasis of Napoleon; the 'Spectator' told of General W. T. Sherman's great anabasis; and many other warriors have written their names on the pages of history by the accomplishment of a forced march. Still others in modern times and on peaceful missions have overcome nature's obstacles and surmounted difficulties as great, but are forgotten save in isolated cases where an account of their experience strayed into print. The journal of one anabasis to the interior of Peru we are glad to place on record in the current issue. This story of Mr. Pierre Bonery's experiences in the Peruvian interior, besides being an interesting personal record of the hardships and vicissitudes of travel in out of the way places in the tropics, is of special interest in its delineation of the character of the Peruvian Indian, the habits and customs of the people, and the general atmosphere which surrounds an expedition of this nature. This expedition, with its attendant perplexities, is typical of pioneer mining work in Latin America and illustrative of what is to be expected by one who blazes the trail for the mining industry to the outskirts of civilization. However, through the haze of adversities, can be seen the snow-capped mountains rising from the plains of luxuriant tropical vegetation, the singing of the birds mingles with the shouts of the *arrieros*. The work of overcoming nature's obstacles in the accomplishment of one's purpose, though marked by trials and vexations that make life seem burdensome at the time, fades into the background. In a general retrospect, the picture is not made up entirely of sombre tints. Without journeys of this kind, the mining industry would still be in its infancy, and while every expedition does not result in the finding of a bonanza, the pioneer work done by the prospector and examining engineer is equally important from the standpoint of broadening the scope of the industry, whether it results in the discovery of a pay-streak or determination of its absence. In a succeeding issue we will have the pleasure of presenting to our readers an account of the placer deposits of the Peruvian interior by Mr. Bonery. For the present, we commend his account to those who all too light heartedly look upon an examination in any foreign country as a picnic.

Potash Production Assured

Announcement was made on Thursday of the incorporation, under the laws of Delaware, of the American Trona Company, which is to own the saline deposits of Searles lake in California and to operate works for refining and marketing the various salts in that great playa. The new concern is to control and manufacture for the California Trona Company, and is capitalized for $12,500,000, of which $5,000,000 is to be represented by preferred 7 per cent stock, protected by a sinking fund and redeemable after July 1, 1916, at 110. While the California Trona Company, after various vicissitudes, has fallen under the control of the Foreign Mines Development Company, itself affiliated with the Consolidated Gold Fields of South Africa Limited, the new capital going into the enterprise is American. It is proposed to immediately expend $3,000,000 in the building of a railway from Searles to the lake, and a plant which is to have a capacity equal to 2,000,000 gallons of brine per day. This announcement is of large importance, as it marks the completion of important preliminary work and the beginning of a serious effort to compete with Germany in the production of potash, for it is the potash content of the brine that lends greatest interest to the new enterprise.

Searles lake, or Borax lake, as it is variously called, was discovered years ago and was for many years an important source of borax. Indeed, the experimental work of the new company has been conducted in the old borax works which were abandoned, so far as operation is concerned, when the colemanite mines of Death Valley were opened. The California Trona Company was organized to produce soda ash from the deposit, and, borrowing $50,000 from the Foreign Mines Development Company, the control eventually came through receivership and other legal complications tedious to relate, into the hands of the latter concern. In the meantime the deposit had been carefully studied by Smith Emery & Company, and its extent and quality had been determined. Incidentally, the presence of potash had been learned, but this was not made generally public until announced by the Geological Survey on the basis of preliminary samples taken by Mr. H. S. Gale and Mr. E. E. Free, the latter then of the United States Department of Agriculture. It will be recalled that we had occasion to criticize the form of the announcement made at that time. We are glad to be able to add that, despite the sensational features of statement issued, the estimates then made as to quantity and quality have been found within the true limits, the latter having been determined by the long and painstaking investigations involving drilling of nearly 100 wells and study of 500 or more samples by Mr. John W. Hornsey, who has also devised the process of treatment that will be used.

In brief, there is an ample supply of brine containing approximately 4.36 per cent of potassium chloride; 2.93, borax; 4.92, soda ash; 15.84, salt; and 6.72, sodium sulphate. This is equivalent to a trifle under 35 per cent of solids, and the percentage of brine in the body of the lake has been determined by measurement to vary between 40 and 45. The lake is fed by a strong underground flow of water, and the brine is constantly condensed by evaporation. The new works will draw from the lake the equivalent of 0.1 inch per day, while natural evaporation varies from 0.25 to 0.50 inch. For practical purposes, the supply of brine is ample. The plan of treatment involves first throwing out the soda as bicarbonate by using carbon dioxide under pressure in closed cylinders. Beyond that the process is one of fractional evaporation in horizontal rotary furnaces of simple type and large capacity. The process has been worked out with

great care, but as a further safeguard against mistakes, a first unit equal in capacity to one per cent of the final plant is to be erected and placed in operation before the main plant is built. The daily output of the latter will be: borax, 225 tons; soda ash, 508; salt, 1507; sulphate of soda, 593; potassium chloride, 489. For revenue, the Company will necessarily depend mainly upon the potash, soda ash, and borax. A part of the salt may be marketed, and in time uses for the sodium sulphate may be found, but for the present these may be neglected. It is stated that the policy of the Company will be to disturb existing industries as little as may be, and to be "manufacturers for manufacturers." However this may be in theory, profound changes are inevitable. We have seen Mr. Hornsey's report and estimates. The cost will be low; so low that the new Company can easily undersell any important competitor. The soda ash is mainly to be marketed abroad, and especial efforts are to be made to capture the Oriental markets. The potash will be marketed as a chloride, at least for the present, and will go to the Eastern or Southern states. Judging by imports, there is ample room for sale of all that will be produced without provoking the sharp antagonism of the German producers of other potassium salts. The limiting factor as regards output is the borax. While there are no exact and complete figures covering the borax industry, the output of borate of lime amounted in 1911 to 53,300 tons. The new concern will be prepared to manufacture about 90,000 tons of borax, and the cost is a matter of bookkeeping. A lower price would increase consumption of borax in the dyeing industries, and possibly in other directions, and it is manifestly to the advantage of the Trona company to stimulate the use of the salt in every way possible.

In a later issue we shall print a technical description of the process of manufacture that has been devised, and also will discuss the bearing of this project on the general matter of public ownership of potash lands. It will be recalled that when the potash lands were withdrawn, it was carefully explained that the withdrawal order was not intended to affect lands that had been located in good faith and upon which the required assessment had been done. At present the title of the Trona company rests on locations, but application for patent is to be made in due course. The large amount of money that has been spent on the preliminary investigation of the deposits would seem to preclude any successful attempt to attack the good faith of the applicants. While the matter of title involves many complicated questions, some of which have not been definitely settled, the projectors of the new concern are acting on legal advice and have no fear as to results. It is to be remembered that potash production is necessarily a rich man's game, and many thousands of dollars have already been spent. The sensational accounts printed last year of armed conflict over locations were mainly based upon imagination, and the 'poor locator' has little foundation in fact. While there are outstanding difficulties, equities are usually safe in American courts.

The Coppermines Merger

The merging of the Giroux, Butte & Ely, Chainman, and Coppermines properties, in the Ely district, Nevada, announced in our news columns last week, is a matter of moment. The board of directors is made up of the representatives of strong financial interests that have heretofore operated independently, while the president of the new company, Mr. Charles F. Rand, has engaged in the mining of iron ores in Cuba with conspicuous success. The Coppermines interests are represented on the board of directors by Messrs. W. B. Thompson, James Phillips, Jr., and W. Hinckle Smith, while Messrs. Thomas F. Cole, Isadore Hernsheim, William B. Joyce, C. Lawrence Perkins, and Erastus T. Tefft represent the Giroux, Mr. Joseph B. Cotton representing the Butte & Ely. The Coppermines property consists of 33 claims which were acquired in 1907 from the Ely Mines Company. According to a report by Mr. Henry Krumb, there has been developed 1,900,000 tons of 1.29 per cent copper ore, underlying an area of about five acres. Since nearly 60 acres of the property is underlain by the porphyry in which ore occurs, the new management is hopeful of developing larger orebodies with further work. Not the least of its assets are the water rights on Steptoe creek, of which the Coppermines owns 7/9 and the Giroux 2/9. The Giroux is a well known property which awakened great expectations, but has so far proved disappointing, as the orebodies in the porphyry were neither large enough nor rich enough for profitable mining with steam-shovels, and the hoped-for deep-seated rich orebodies along the limestone contact zone, while offering much encouragement, show no great extent, so far as disclosed in the development work already done. The Butte & Ely is a comparatively small property, one-half of which is owned by the Giroux, in which disseminated ores occur in the porphyry. Through an agreement with the Nevada Consolidated, which adjoins them, these orebodies have already been stripped and are ready for steam-shovel mining. The Chainman is one of the oldest mining properties in the district, having been first opened in 1869, and has been worked for gold, occurring in large bodies of iron oxide, which were of rather low grade even at the surface and proved refractory in depth. In their former situation these four properties offered little hope of profit, but consolidated under one management and more thoroughly explored they may prove to contain reserves of ore sufficiently large and rich to yield a good operating profit. It is announced that the efforts of the new company will be concentrated upon exploration work and the development of ore reserves of ample magnitude before incurring capital expenditure for new plant. The general management will be in the hands of Mr. Edwin F. Gray, who has had long experience in the district. The gentlemen who have already invested considerable sums in these properties deserve much credit for their faith and persistence under adverse conditions, and it is to be hoped that the final outcome may reward their perseverance.

AREQUIPA, A CHARMING CITY OF SOUTHERN PERU.

A Journey to the Interior of Peru

By Pierre Bouery

Having been told that there were in Peru vast plains or pampas remarkable for their gold deposits, and unworked as yet on account of the lack of capital and knowledge of mining, I decided to take a pleasure trip and investigate the placers of that country. Information was secured, and, as a result, a syndicate was organized, and my friend, D. M. Riordan, who was as much if not more in need of rest than myself, decided to join me and share the chances of the expedition.

One week was spent in New York purchasing goods, and money was going fast, because we had been informed that we would have to be prepared for peculiar climatic conditions and also to meet such high officials that the blue shirt of the Western miner would have to be replaced by the high collar and evening clothes. Finally everything was packed, labeled, brought to the steamer, checked, and lowered into the hold, and we were ready for the start. After six days of pitching, rolling, and grumbling, we landed at Colon, happy at the thought of our escape from the steamer, and a few hours later, in the midst of lightning and rain, we were at Panama.

Our troubles commenced when it came to transferring our baggage to the *Guatemala*, which was to take us south. After exhausting my vocabulary of Castilian, unbroken English, and old French in an attempt to have my baggage accompany me, the only satisfaction I could get was that "it will surely follow on the next steamer." So in the afternoon, regardless of my protest, the *Guatemala*, proud of her human cargo, left the anchorage at Balboa and graciously steered south.

Our first stop was at Paita, where we landed to stretch our legs and see the aborigines. As our friend McElmell introduced me to the population as 'General Smith of the United States Army,' we had all the deference and salutes due to such a high rank, and had it not been for our hasty departure, I believe that a pro-American demonstration would have taken place. In three days more, after leaving Paita, the promised land was in front of us—Callao, the chief port of Peru, and, eight miles farther, Lima, the capital and city of Pizarro. One week was enough in Lima: not only for our business, but to persuade us that a few cents per cubic yard would have to be added to the gold contents of the gravel in the interior to make Lima attractive. During our stay all our credentials were delivered, and I am glad to say that we found some very nice people, courteous and polite, who looked upon us as potential distributers of future wealth. Finally, one week after landing at Callao, Mr. Riordan and I were ready to explore the goldfield of Nosiniseato. After three stops at Tambomoda, Piseo, and Chala, we landed on the third day at Mollendo, our seaport destination. Leaving Mollendo, we arrived at Arequipa the same afternoon, and found high officials of the railroad waiting for us. We introduced ourselves, thanked them for the compliment which they had paid us, and went to the hotel on a car running through some of the semi-fragrant principal streets of the city.

The scenery from Arequipa to Juliaca is as monotonous as between Arequipa and Mollendo, with the exception of the crossing of Crucero Alto at an altitude of over 14,000 feet. The precious vicuna is said to inhabit the barren mountains of this region, but we did not see any. The next day we took the train at Juliaca for Sicuani and noticed very little change in the scenery, stopping a few moments at Tirapata, which is the headquarters of all mining enterprises in the Sandia district. From Tirapata to Sicuani it is the same slow, tedious train, and in the evening I was glad to find myself at our destination. It takes nearly another day to go from Sicuani to Cuzco; the scenery is a little better, with the high snow covered peaks in the distance and herds of cattle, sheep, and llamas pasturing on the pampas. Delays had been so numerous since leaving Panama that Mr. Riordan could not accompany me further. To my great sorrow, he had to leave in order to reach Panama in time for the meeting of the American Institute of Mining Engineers. I bade him good-bye and went back to finish my preparations and be ready to start when my cargo arrived. I had plenty of time to visit Cuzco, its churches, convents, and surroundings.

I left Cuzco on the morning train with, in my opinion, enough money to pay the workingmen and carriers, and arrived at Urcos. Here I saw the subprefect, whom I had invited to dinner at the Hotel Urcos, to thank him for the letter which he had

JULIACA, WHERE THE ROAD TURNS SOUTH TO BOLIVIA.

given me to the governor of Marcopata. The next day, Astete, my *arriero*, arrived and we busied ourselves with preparing the loads for transport. After weighing our cargo we found there was 150 arroba (one arroba is 46 lb.), for the transport of which we paid at the rate of one sol (50c.) per arroba. In addition to this, saddle animals and three mules for our personal effects were obtained, together with a *muchacho*, which brought our expenses to 212 soles. It was decided to leave at 6 o'clock the following morning, but on account of unavoidable delays we left at 8:30, with 27 mules, 1 *arriero*, and 7 helpers. During the first part of the day's journey we climbed from 10,300 to over 14,000 ft. altitude and were at the summit of Acopia. From there we had a full view of the valley of Ureos and on the east we could see the high Cordilleras with two huge peaks, Allangate and Callangate, rising to a height of over 20,000 ft. and covered with perpetual snow. After a few moments stop for lunch, we followed the ups and downs of the hills and crossing many small streams which only during the rainy season flow to the main river, the Paucartambo. At 5:30 we were on a flat about 5 kilometres from Palso, the first *finca*. It was impossible for me to force the *arrieros* to go further, so they spent the night at that place. Vanoni and I, followed by two mules and two men, went ahead in order to reach Palea, where we arrived at 6:30 after a long and hard day's ride, especially so because it was the first day of the trip. The owner of the *finca* put at our disposal his room, which was as dirty as one can imagine, and after opening a box of sardines and preparing the coffee we unpacked our cots and went to bed. The night was long and cold and we were glad to start again at 7 o'clock in the morning, after eating some bacon and drinking a cup of coffee. However, we decided to wait for the pack-train, which, according to our *arriero*, would arrive at 9 o'clock. Neither at 9 nor at 10 was anything seen of it, so we decided to leave. We climbed the hills slowly and walked our horses on the pampas cut here and there by small gulches. At 12 o'clock Lauramarca was in sight, and further on the valley of Paucartambo. In the afternoon a hailstorm covered the pampa, but we were safe at the famous *finca*, Lauramarca, an ancient convent of the Jesuits.

In the morning we were on the road again early, as we wanted to set an example for the men and also to sleep on the other side of the Cordilleras that night. The trail is long and monotonous, with nothing living in sight but a few llamas, sheep, and alpacas. There are two or three little gulches to cross before reaching the point where the trail branches to Huali-Huale on the north and Perayani on the south, and as I was ahead of the pack-train, I stopped there and awaited its arrival. This was very fortunate, because the *arrieros* wanted to follow the south trail and also to sleep before crossing the Cordilleras, while I wished to take the north trail. I lost my temper and threatened to report the affair to the prefect in order to make them decide to take the north trail, which followed the zigzags of the Rio Paucartambo, toward the terrible Cordilleras. The trail is wide and at little expense could be easily made a good one. We left the Rio Paucartambo at the village of Huali-Huale and turning to the east we arrived in less than half an hour at the lake of Huali-Huale, where the climb of the Cordilleras begins. The climb was very steep and very hard for the animals. It takes about an hour and a half to reach the summit, and once there, at an altitude of 14,600 ft. above sea-level, one may look over the country and appreciate the magnitude and beauty of the snow-covered peaks. About half way down, our *arrieros*, who were ahead, stopped and began to unload the animals. We tried to persuade them that the *tambo* (stopping place) was near, but it was no use to insist, the animals were unloaded and the men began eating their popped corn. The nights at an altitude of 13,150 ft. are cold, and there being no way to build a fire, we did our best to keep warm by comforting ourselves with the thought that we would be able to sleep at Marcapata.

As only four leagues more remained to reach that place, we did not wait for the pack-train, and at 8:30 in the morning we were on the road. The trail follows the windings of the Rio Marcapata, so with little trouble we arrived at the village of Huayllayoc. On our way down we found the ruins of several old forts of the Inca type. I learned that they were built to resist the attacks of the savages, who came from the mountains, and often burned the villages and killed the inhabitants.

At Marcapata we were 10,500 ft. above sea-level and probably 1000 ft. higher than the river of the same name, which flows at the foot of the hill. The town has 400 or 500 inhabitants, and is unhealthy, dirty, and always in the clouds. It is just above the junction of the Arasa and Marcapata rivers, from which point both take the name of Marcapata. It is an excellent spot to protect against the attacks of the savages. The length of the road

TITICACA, A SEAT OF INCA CIVILIZATION.

from Ureos can be estimated as follows: Urcos to Palca, 40 kilometres; Palca to Lauramarca, 10; Lauramarca to Tambo, 40; Tambo to Marcapata, 20. The altitude of the trail varies from 10,000 to 15,000 ft., all below the line of perpetual snow, which is about 17,000 feet.

The following day I was on the road again, and the fact that I was ahead and far from my disgusting carriers and laborers, was enough to brace me up and make me take interest in the surroundings. The poverty of the people is everywhere impressive. Here and there are a few small, low, adobe houses with a few feet of ground around them, half dirt and half boulders, in a pitiful state of cultivation. At Chari we were glad to find accommodations for the night in the house of the past governor. At 6:30 the food arrived, and after the boxes were opened, I prepared the dinner, which consisted of pea soup and bacon. As I cooked it myself, there was plenty, and we shared it with our host. Even without blankets the night was pleasant and we were up early and ready for the journey. At nine we passed through the village of Chili-Chili, which is the starting point of the trip to Sicuani. Eight or ten houses scattered here and there is all there is to the village. But what houses—some have a door and no windows, while others have windows but no door. As there is no level country near, the agricultural land is on the hillside and the narrow banks of the river. In the mountains, where the Indians live, there is little soil. From here the trail became more and more impassable; it was no longer a trail, but an aggregation of wild animal tracks. I have my own opinion about the savages now. No, they do not live in the pampas of the Amazon; they live here. This so-called trail looked more like a ladder than a trail, and several times we had to get off our horses, it being impossible to stay in the saddle.

While in Lima I heard of the Mourayaca, a nearly perpendicular cliff over 1000 ft. high, and thought that it was all exaggeration, but it certainly is not. There is a succession of steep zigzagging steps to the top under a regular jumble of interwoven vines. These steps are from 8 to 20 in. high and in worse condition now than they were during the time of the Spaniards. The view from the top was beautiful, and having made the descent we encamped. We set our beds under a roof, without walls, and mentally divided the space into two parts; one part for the beds and the other for the kitchen and our specialists, the foreman, cook, and boy. After dinner our boy prepared the beds with the air mattress and we were glad to slip in between the blankets with the hope that the night would be short and good to us.

The trail followed the day before was bad, but the one in front of us was worse. We crossed two small streams early in the morning, and at 10:30 came to the famous San Pedro bridge. To cross it we had to get off our animals, as it was far from being safe, having been made by the Indians, with crooked stringers held by vines. After crossing the bridge we left the trail which, according to reports, was built by a swindler, who, with the money received for the work, bought rifles and ammunition and started a revolution in Peru.

It takes nearly three hours to go from San Pedro to Cadena. The trail is a little better, but there are some break-neck places, and I was surprised to find myself alive on arrival there. The next morning I gave orders to build a bridge across the Rio Cadena; this was done, as far as the abutments were concerned, but the stringers were left for the next day, in fear that a storm during the night might take them away. It does not take very long to build a bridge in this country; two trees, a few timbers on the top, several hundred feet of vines, and it is complete.

Below are the approximate distances and altitudes of the different villages passed through. Marcapata to Chari (7400 ft.), 10 kilometres: Chari to Mourayaca (6050 ft.), 20; Mourayaca to San Pedro (3700 ft.), 12½; San Pedro to Cadena (2800 ft.), 15.

Judging from what I had seen up to this point, there was little hope for developing a mine, as there was always something against it. If it was not the mine, it was the weather. If it was not the weather, it was the road. Finally, discarding all these, there were the natives and the Peruvians. There is no discipline among the men, and Vanoni, my guide, was not able to impose any. If he had told me anything as to the character of the natives before beginning this trip, I would have asked for *gendarmes*, but he did not, and the consequence was that when we ought to have been at Huallumbe, our destination, we still had four days traveling to accomplish, even if everything went right. My foreman-interpreter was the only person upon whom I could depend; he was active, obedient, and a good worker, but he had no authority over the men. The boy was stupid, and the cook an idiotic mixture of *cocoa* and *pisco*. In addition to the labor, we had the ants to contend with. They carried off the food, and

CUZCO, THE ANCIENT CAPITAL OF PERU.

many times we were obliged to get up in the night to rescue the bacon and hang it in another place.

Because of delays, we were at Cadena one month later than anticipated, and as a result I started for the Nosiniseato placers on the date that I should have been coming back. Finally, however, we did start for the mines, and one kilometre from town we crossed the Rio Arasa on a cable. The crossing was made in a cage without sides, which is used for both men and cargo. It took three hours to get all the crew across, and then, following a supposed-to-be trail, we jogged along. At 3 o'clock we were on the banks of the Basiri, after crossing the Chuncapunto, which had swollen the night before and taken away the bridge built by the laborers we had sent ahead for that purpose. They are so stupid they did not think to replace it, so we crossed the stream on foot, with water above our belts. Camp was made on the Basiri, and a good bath completed the day's work. Five of my *kepires* were bitten by vampires during their sleep, and their faces showed traces of blood; but that was their business.

To detail the progress of the march is labor lost; it was the same, even worse, than the day before. Vanoni thought my advice was superfluous and did not send men ahead to cut the trail, so we were obliged to do so ourselves, which delayed us again. Vanoni swore and yelled at the men, telling them how in all his life he never met such a collection of idiots. I said nothing; my sacrifice had been made, and I felt like a bull going to the slaughter, with the idea, however, to use all that was left of my energy to avert catastrophe. At 1 o'clock we were at Repartition, which is the junction of two supposed trails, one going to Noseiniseato, and the other to Huallumbe. As Vanoni had decided that the prospecting should be done on the Huallumbe, as the richest claims were there, we took the trail to the right.

The following day we continued to invade the wilderness; we tried several times to reach the banks of the Arasa, but were unable, as there was too much clearing necessary. Finally we came to the river, but as its course had recently changed, we had to wait until a short trail was cut. By making our way through, we came upon a small stream with perpendicular banks of hard cemented gravel, and after the laborers had made a ladder we crossed to the other side.

The next day was to be the last, as they said we would reach our destination, the Rio Huallumbe, in the afternoon. After the excitement of the preceding morning we started to climb the last hill. The ascent was easy; we were 1650 ft. above sea-level, and the divide between the Arasa and the Huallumbe was only 2150 ft., so a few minutes later we were running down to the Huallumbe, the promised land. Vanoni said that the mouth of the river was 5 kilometres below, and as I had to pick out a place for the camp, I though that half way down would be the best place, as we could prospect above and below camp from this point. Alas, the farther we went the less I saw any possibility for a mine, and so asked Vanoni where the gravel was. Here, there, and everywhere I saw boulders and sand, but of what a miner calls gravel, there was none. Vanoni assured me that gravel was on the banks under the brush, but I reserved opinion.

As this was to be our camping place for some time, I gave orders in the morning to finish the kitchen and dining-room, and also to clear the brush 25 ft. farther back in order to keep the insects and animals away from our tents. At this time I had a chance to test the skill of the workmen, and soon came to the conclusion that my negroes of the West Coast of Africa were far superior. As it was too late when we had finished to start prospecting, we killed as many fish as we could use by throwing dynamite into the stream. I decided to start the work in the morning, but was satisfied from what I had seen that I could foretell the result.

The crew was divided into gangs, one to work with me, and the other to cut prospecting trails above and below the camp through the forest. Vanoni, who saw that I knew something about hydraulic mining, became more communicative and told me that after his first visit to the property, he knew that some one had been tricked into buying the mine, because the gold claimed as coming from this property really came from the Sandia district and not from this. While we were talking of these things, we heard a strange rumbling in the river like the rolling of boulders, the falling of trees in the forest, or the breaking of a dam. As it was dark, we could not see anything, so I took the lantern and going to the river saw the water rise three feet in less time than it takes to write it.

After five days spent in prospecting here, we started for another locality, where prospecting was to be done in the cemented gravel. It was a good thing I had had a trail made, because the river was high, and if we had been obliged to walk in it, it

would have been exceedingly difficult. The ground was prospected, and no gold was found; so I left the Huallumbe for good, without any hope of returning.

Starting Home

After a last meal on the watershed of the Huallumbe, we started climbing the divide, walking all the way in the creek with water about half way to our knees, and reached the top after two and a half hours of difficult ascent. When we had rested a few minutes we proceeded to the Arasa. There I waited nearly an hour for the loiterers, but as they did not come I went on without them. Since we were here the last time, the river had changed its bed, and we had to make our way through the rocks and pot-holes as best we could, not having time to cut a new trail through the forest. Forty-two times that day we crossed the Arasa, with water sometimes to our waists. Progress was hindered by the boulders, and the march was tiresome. Turning to the right, we plunged again into the forest and followed a trail which we had cut on the way down. The sun was by this time getting low, so after picking out a camping ground far enough above the Arasa to be safe from flood, we camped.

Two days later we crossed the Infernillo, one of the tributaries of the Arasa, with water to our belts, and one hour later we were on the banks of the Chuncapunto. There we had to stop, as the current was too swift to cross and it was necessary to build a bridge. Vanoni and I found a tall tree, which he cut down while I looked for a ford. About 300 yards above, there was a place where the water was quiet, so I waded in and found the water up to my shoulders, but there being little current at this point, I crossed to the other side. We soon had the tree in place, and shortly afterward the bridge was completed. When everyone was across we hurried toward Cadena, which was four kilometres away. At the cable bridge, as luck would have it, the cage was on the other side, and we had to wait until our gunman came up and shot, as a signal to the people in Cadena to come to our rescue. The signal was heard, and a boat was sent out, and we crossed. The last man was scarcely on the other side when the well known noise of a sudden flood came to our ears, and five minutes later there was four feet more water in the river. At Cadena we were welcome and went to our old quarters, where we drank a cup of hot coffee with rum and changed our clothes.

How the Natives Work

In talking about mines, a friend explained to me the manner in which they were worked in this country. He contracted for a few laborers, paid them in advance, and then awaited their good will to come to work. Sometimes they came, but other times they did not, and the money in such cases was lost. There was no way to get it back except by going to Marcapata or Cuzco and making a complaint to the governor or the prefect, thereby losing more time and money, which does not pay; for if the man does come back he will make his escape a few days later. To work with such men, it is necessary to bring in all the food as I did, and show them every morning just what to do. In placer mining, hunt for a place along the river where it seems advisable to place a sluice-box, and bring the material on the men's backs to it. Each man makes from 70 to 90 trips a day, carrying 25 lb. of dirt each trip. It takes four men to make a gang, two to dig and carry the dirt, and two at the sluice-box to keep the ground in motion with their hands and prevent it from packing down in the bottom. In the evening the clean-up is made, and from an ounce to an ounce and a half of gold is recovered from the six or eight cubic yards of gravel treated. These people do not know what mining is. If our miners from California would go down to that country and were able to take in tools and supplies, they could easily make from $3000 to $5000 per year.

I inquired what was to be found along the Colorado river, and was told that there was gold everywhere, but very fine. I saw some of this gold later, and could see that it could not be saved in quantities to make it pay. The plains of the Colorado are wider than those of the Nosiniseato and are covered with a bed of sandy alluvium in which very fine gold occurs. The streams are all traveled in canoes, and if the journey by stream is long, the real distance traveled by land is very short, as the rivers meander so much.

The Last of the Journey

By this time I was getting tired of hearing false stories of placers, quartz mines, nuggets, and the like, so said a good-bye to Huallumbe and Cadena, and started again on the road to Marcapata. The tears did not wet my face. We went ahead, leaving the pack-train to follow, and when we arrived at the bridge over the San Pedro, found that it was being repaired. Here I had an opportunity to see the natives work; it was simply disgusting. I asked their foreman how much they were paid, and he answered, "Nothing," which I said was too much. We tried to make time by going by way of Tio, Chari, and Chili-Chili to Marcapata, which we reached without incident. The day here was spent in settling accounts with the men and the Governor; everybody was paid and very much surprised that I robbed nobody. At 1 o'clock I said good-bye to Marcapata, and at 5 I was again at Huali-Huale, facing the Cordilleras with my seven mules, two Indians, one *alcade*, and the cook.

The trip was without excitement of any kind, and after a hailstorm at Huali-Huale, we continued as far as Lauramarca, where we arrived at 5:30. There we found our old quarters, and the major domo offered us supper consisting of frozen potatoes (*chuno*) and mutton tripe. I stopped at Palca to get the *poncho* I ordered and paid for on my way down, but no such luck; they took the money and kept the goods. It was cold traveling along the backbone of the Apioca mountain, just before reaching Urcos, but the town was soon in sight, and in little over an hour we were at the hotel, and my 'pleasure trip' was over.

Geology at Santa Eulalia, Chihuahua

By Arthur C. Brinker

*The Santa Eulalia district is included in a large area of well marked bedded limestone, which lies nearly horizontal, with a dip of 10° to the south. In the greater part of the district it is covered with flows of andesite and rhyolite. Certain strata show abundant fossils, particularly in the upper portion of the Buena Tierra mine, and at a depth corresponding to the fourth, fifth, and sixth levels. These strata are, apparently, more favorable to ore deposition; and almost all of the known orebodies of the district occur within these horizons. The limestone beds are remarkably free from folds, but are much fractured, and somewhat faulted by numerous belts of fissures nearly vertical, which extend for long distances. The principal ore-bearing fissures have a northerly trend, varying from north 10° east to north 30° west. These are crossed by other belts of fissures, the direction of which is north 20° east to north 30° east. The ore-bearing solutions availed themselves of the fissures in the limestone as circulating channels, and spread out horizontally in the more favorable strata, especially where the ground was much fractured by the cross-fissures.

Ore in Fissures and Manta

There are found, within the area of the mine, six of the main northerly ore-bearing fissures, namely, the Eastern; the Catarina or Potosi fissure; the Santo Domingo and Ojuela fissures, closely related; the Chorro fissure; and the Chihuahua fissure. These are all continuations of fissures in the Potosi and Santo Domingo mines, on the south, on which large orebodies have been found. Ore is not found continuously along these fissures, but usually in large blocks or masses at the junction of fissures. Great lengths are sometimes found by connection on a northeast fissure, between one northerly fissure and another, giving a northeastern course to the orebody. This is shown in the portion of the orebody between the first and second levels, in sections C and D. The Eastern orebody, spreading from one fissure to another, takes a general northwestern course. The orebodies occur in very irregular form, some showing a bedded or *manta*† structure, alternating with strata of the limestone, the *manta* varying from 5 to 20 ft. in depth, and spreading out 20 to 100 ft. in width. In other places, they occur as thick channels or masses, 40 to 80 ft. in depth; others, in the form of chutes or chimneys, or *chorros*; while in other places they are narrow and bear some resemblance to fissure-veins.

The orebodies in the Buena Tierra mine are oxidized, and the sulphides have not been reached in the deeper workings. The oxidizing and leaching action has caused a peculiar shrinkage of the orebodies, leaving them open and somewhat accessible along the top of each *manta* or body of ore.

The Eastern orebody has developed into a large and strong shoot; covering, above the first level, half the area of section F. The central portion, in the cross-cut on the first level, shows a width of 85 ft.; a stope, at a height of 42 ft. above, shows an area of 80 ft. square, of good-grade ore.

The eastern portion of this orebody extends 100 ft. farther to the southeast, in the form of a *manta*, and has been worked very little during the year. This part shows a width of 50 ft. and a depth of 40 ft. at the north end. The western portion has yielded ore, during the year, from a stope 75 ft. above the level. This shows a length of 100 ft., and a width of 100 ft. This part makes connection with the north Catarina orebody in two places, showing continuous ore. The Catarina fissures have shown a continuous line of ore from the eastern boundary, in section D, to the north boundary line. The southern portion of section D has been stoped.

In sections E and F, a third *manta* or layer of the north Catarina orebody has been opened for a length of 260 ft., at a height of 75 ft. above the first level. This has been of better than the average grade, of 8.65 oz. silver and 15.1% lead. On the Zero level, in section E, the orebody is opening to fair size and good grade. This stope now has a length of 100 ft., a width of 30 ft., and a depth of 16 ft. The old 'Boca Mina' from the surface has been cleaned out, and opens an old roadway and stope along a northeast fissure. A new level will be opened, above the Zero level from these old workings, northward along the course of the Catarina fissure. On the second level, a stope in section D is opening in a promising manner, and of good grade. The drift or roadway north in section E is opening favorable-looking ground. On the Ojuela fissures, very little work has been done along or near the stopes above the first level.

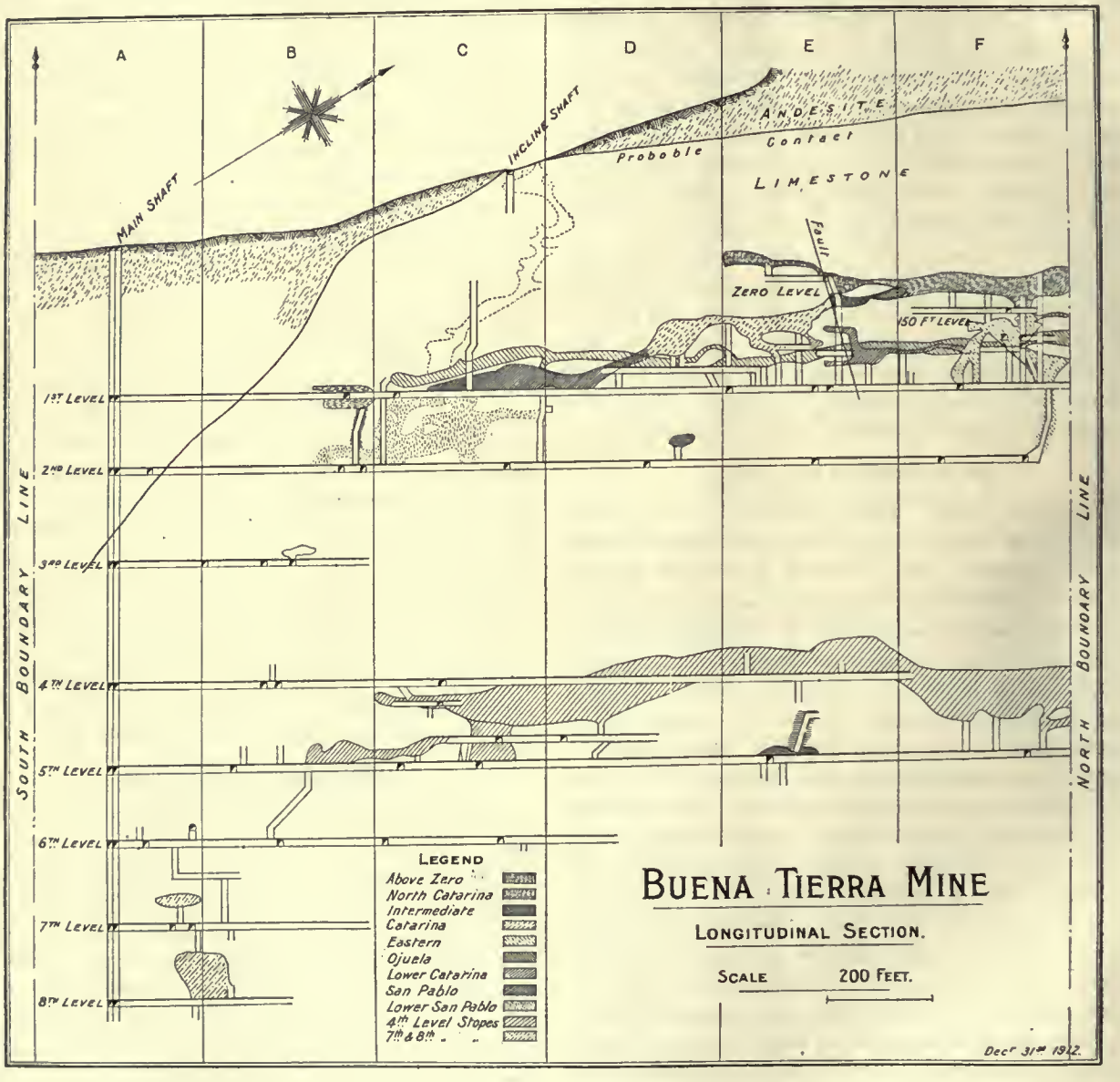
Extensions of Orebodies

In section D there is an extension on the east side, and in section F new ground to the west has been mined. On the Santo Domingo fissures, in section C the Cruz cave, above the first level, has been opened further in a northerly direction, and is yielding good-grade lead carbonate ore. This fissure has also been opened by a west cross-cut in section E, and a narrow streak of ore exposed. On the Chorro fissures the shoot in section B, lying above the first level and between the first and second levels, a stope has exposed ore 80 ft. in width and 45 ft. in length. This ore is low grade in lead and above the average in silver. This same fissure has been opened farther north by the western development. In section 3 C, a raise to an old shaft, has recently cut what is apparently an extension of this orebody. This connection makes it possible to develop this shoot, which is 200 ft. above the level at this point. In section E on the first level, a long cross-cut west has cut this fissure, and also a belt of northeast fissures. Drifts north and south have been driven, and though no ore has been found at this level, strong open channels and caves have been encountered. These, with

*Abstract from report of the Buena Tierra Mining Co. for 1912.

†*Manta* means blanket, covering, or layer.

the appearance of the limestone, indicate the probability of ore above. Development on these fissures will now be carried on in this part of the western area. The main cross-cut, in sections B and C, will be carried out into the country farther westward. Between the No. 2 and No. 4 levels is an intermediate block of ground, 415 ft. in depth, in which no development had been done. This ground is supposed to be physically of less favorable character. A new level has been started midway in this, and has cut the Chorro fissure in section 2 B. At this point a *manta* extension of the big *chorro* of the adjoining mine shows ore, and good possibilities. A drift on this level has been run north along the fissure for 160 ft., and has cut northeast fissures showing favorable indications.



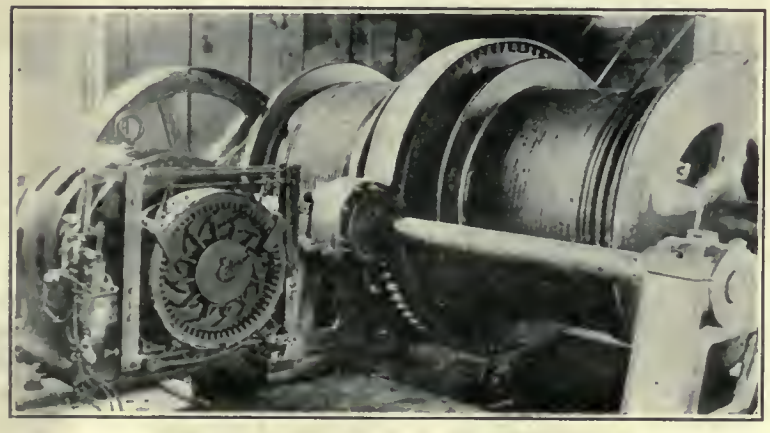
The lower levels are situated in a fossiliferous-limestone horizon, believed to offer the most favorable prospects in the district. The principal ore worked in this portion of the mine has been that between the fourth and fifth levels, lying on the Santo Domingo fissures; in sections C and D, on the Catarina fissures in sections E and F, which extends through the whole length of sections C, D, E, and F, varying from 20 ft. to 50 ft. in width, and from 30 ft. to 80 ft. in depth. On the Eastern fissures, in section E on the fourth level, a cross-cut east has been started to prospect 200 ft. of virgin ground east of the roadway, and to open up the eastern line of fissures in sections D, E, and F. On the Santo Domingo fissures, further work has been started on the extension northward of this fissure in sections E and F. A cross-cut at the south end of section E has opened up ore, and, farther northward, a winze is being sunk to the fifth level, which also shows ore. No work has been done on the fifth and sixth levels during the year, but the drift for a short distance in section E on the fifth level, and the drift in sections C and D on the sixth level, show indications of ore. On the Chorro fissure, the drift north on the fourth level on a branch of this fissure has been extended in a northwesterly direction to meet the main fissure. This has cut several northeast fissures with only slight indications of ore, but no development has been done on them. The Chihuahua fissures, which have proved productive in the mine of the Chihuahua Mining Co., to the south, had been developed slightly on the seventh and eighth levels by the original owners of this ground. The roadways have been improved, and the stope along the seventh level reopened, where ore shows from 3 to 6-ft. width in various places. This, and a *manta* a short distance above, have yielded a fair tonnage during the year.

Automatic Mine Hoisting

By G. B. Rosenblatt

The Mines Operating Co., of Salt Lake City, has a lease on a considerable amount of low-grade ore in the Ontario mine at Park City, Utah. It has developed a process for treating this low-grade ore profitably, but the financial success of the project depends not only upon the process for recovering the metal, but also upon economy being practised at every point in the handling of the ore. In order to get this ore from the mine to the mill, it is necessary to hoist it through a double-compartment shaft approximately 175 ft. deep. This shaft is used for ore hoisting only, another entry being provided for men and supplies. This shaft had installed on it a No. 604 double-drum, Lidgerwood, electric hoist, operated by double reduction gearing from a motor running at approximately 580 r.p.m.

To hoist ore with this equipment required the services of three men; a hoisting engineer, a top man, and a station tender. The cost of hoisting was a considerable portion of the total cost of handling the ore. In order to reduce this hoisting charge, it became desirable, if possible, to do away with the services of the hoisting engineer and top man, and allow one man to operate the entire outfit if this proved practicable. Also, the capacity of the hoist in tons of ore per hour had to be increased in order to supply the full capacity of the mill.



ELECTRIC HOIST USED IN AUTOMATIC WORK.

Accordingly, it was determined to increase the hoisting speed by the substitution of a larger higher-speed motor, leaving the gears intact, and to use skips in place of cages. The head-frame was changed, and the skips designed so as to permit of automatic dumping at the top, thus obviating the necessity of a top man. There still was required the services of a station tender to attend to the loading of the skips, and a hoisting engineer to operate the hoist. In order to cut down expenses, it was desirable to do away with the services of the hoisting engineer, and if possible allow the station tender to control the hoisting. A specially designed automatic electric hoist proved entirely too expensive to warrant its purchase.

The source of power was 440 volts, 3-phase, 60-cycle alternating current. The original variable-speed hoist motor was replaced with a higher-speed squirrel-cage motor, this motor being what is known as the Westinghouse 'type MS' elevator motor, which has high resistance and rings permitting it being thrown directly across the line at starting. A motor with a drooping speed characteristic was selected, and direct-geared to the jack shaft on the hoist. The hoist drums, which were originally loose on the main shaft, were keyed solidly to the shaft, and an electric solenoid brake provided on the motor shaft. This brake was designed so that it set when the current was cut off from the motor and was released when the motor was thrown upon the line. A similar reversing switch and circuit-breaker with no voltage trip were provided by the electrical manufacturers, and placed at the foot of the shaft accessible to the station tender.

The head-frame for the hoist was designed with a curved track at the end of the skip travel, so as to provide for automatic dumping of the skips. As the skip ran upon this curved track, the rope-pull on the hoist was increased, and as the hoist motor had a drooping speed characteristic, this tended to slow the motor down. Trips were provided at the limit of the skip travel, these trips being operated by a projection on the skip.

With this arrangement it has been entirely feasible to operate this hoist from the station at the bottom of the shaft, and semi-automatic operation has now been carried on successfully for six months. The station tender loads the skip, throws the handle of the reversing switch, closes the circuit-breaker, and the hoist motor starts up, accelerating the load evenly and without jar. When the skip reaches the top it runs out on the curved track for dumping, which automatically slows down the motor. When it reaches the limit of its travel, the trip described above is struck, which in turn trips the release on the circuit-breaker, opening the main circuit to the motor and brake, and the brake promptly sets, stopping the motor and holding the skip in the dumping position while the ore falls out into the chute.

As the hoist is always operated in balance, an empty skip is descending as the full skip is hoisted. As the full skip reaches the dumping position, the empty skip reaches the bottom of the shaft and settles into the loading position. This skip is then loaded, the handle of the reversing switch thrown over, and with the closing of the circuit-breaker another cycle of operation is started. To entirely disconnect the hoist from the line, the reversing switch is set in the neutral position.

The head-frames and skips were designed by G. W. Wood, of Salt Lake City. The electrical installation was designed and furnished by the Westinghouse Electric & Mfg. Co. The plant was erected under the supervision of Charles King, chief electrician of the Mines Operating Co., and has been in operation without a moment's trouble ever since it was started.

The Mineral Resources of Virginia—I

By Thomas Leonard Watson

The value of the mine production of gold, silver, copper, lead, and zinc in Virginia in 1912, according to H. D. McCaskey, of the United States Geological Survey, was $74,855, against $169,394 in 1911. There was sold or treated 5790 short tons of ore, yielding $218 in gold, 982 fine ounces of silver, 112,835 lb. of copper, 469,026 lb. of lead, and 497,235 lb. of zinc (figured as spelter), against $3064 in gold, 21 oz. of silver, 90,000 lb. of copper, 830,542 lb. of lead, and 2,064,818 lb. of zinc in 1911. The values, besides that of gold, in 1912 were as follows: silver, $604; copper, $18,618; lead, $21,106; and zinc, $34,309. All the gold yield was recovered from silicious ores in 1912, and all the silver from the refining of copper. The gold output was derived from small quartz-mine operations in Fauquier and Gooehland counties, the copper from pyrite mines in Louisa and Prince William counties, and the lead and zinc from Wythe county in southwestern Virginia.

Amount of Production

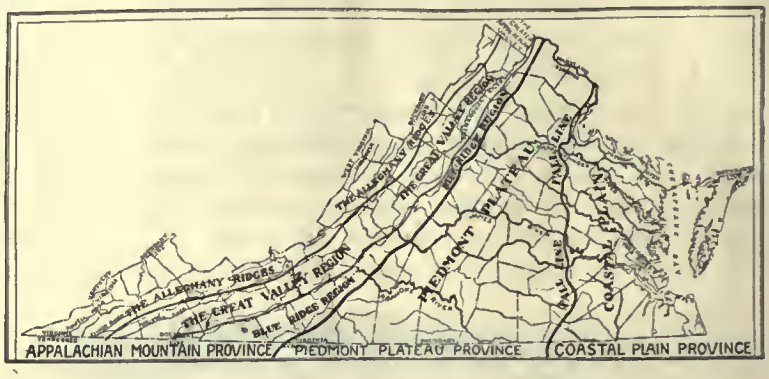
While the complete data on the mineral production of Virginia for the year 1912 are not as yet available, the following is an itemized account of the production of 1911 and its value:

Product.	Unit of measurement.	Quantity.	Value.
Clay products	.....	.....	$ 1,743,872
Coal	short tons	6,864,667	6,254,804
Coke	short tons	910,411	1,615,609
Copper	pounds	90,000	11,250
Gold (mines report)	fine ounces	148	3,064
Granite	.....	.....	420,611
Iron ores	long tons	610,871	1,146,188
Iron, pig	long tons	402,625	5,576,599
Lead	pounds	830,542	37,374
Lime	short tons	132,174	483,416
Limestone	.....	.....	369,872
Manganese ores	long tons	2,455	24,546
Millstones	.....	.....	17,635
Mineral waters	gallons	2,474,918	298,701
Pyrite	long tons	150,800	558,494
Sand and gravel	short tons	553,996	204,170
Sandstone	.....	.....	31,315
Silver	fine ounces	21	11
Slate	squares	40,040	188,808
Talc and soapstone	short tons	26,759	660,926
Zinc (spelter)	pounds	2,064,818	117,695
*Other products	.....	.....	1,188,526
Total			$20,953,486

*Includes asbestos, barytes, cement, feldspar, gypsum, infusorial earth, manganiferous ore, mica, mineral paints, and salt.

The statistics quoted were collected by the Virginia Geological Survey in coöperation with the United States Geological Survey. It is to be noted that the total number of operations is large and includes a variety of subjects. The aggregate output for the year is seen to be quite a large figure for a state which has never been given much consideration as a mineral producer. In 1909 the mineral output of the state was valued at $19,835,670, and in 1910 at $22,755.161.

Virginia is so situated as to be favored by a mild climate whereby actual mining and quarrying operations may be continued throughout the entire year.



PHYSIOGRAPHIC PROVINCES OF VIRGINIA.

The state is traversed by abundant lines of railway, which insure ample and ready transportation facilities. Its position being half way between the North and the South, all points are readily accessible to and within easy reach of the principal cities and markets of the East. Abundant streams afford an ample water-supply. Numerous opportunities for power development are available on the larger streams. Some of these have been developed, some are undergoing development, and others still remain to be developed.

Possessed of large supplies of unexcelled bituminous coal for steaming and coking purposes, of limestone for fluxing and other purposes, of timber for mining operations, and of comparatively cheap labor, Virginia easily becomes a most inviting field for development of mining industries. As shown in the table, the mining industry in Virginia aggregates a total annual value of over $20,000,000, and most of the materials now produced can be further developed. The undeveloped mineral resources of Virginia are believed to be large, and with their development there is promise of a greater increase in production.

Physiographic Regions of Virginia

Considered with reference to the surface features, Virginia is divided into three major provinces: (1) an eastern plain region, usually designated as the Coastal Plain; (2) a central or plateau region, designated as the Piedmont Plateau; and (3) a western or mountain region, designated as the Appalachian Mountains province. These three differ in the nature and origin of their surface features and in the age and kind of rocks. They are intimately related to the geologic structure, and so have an important bearing upon the mineral resources. The accompanying map shows the territory embraced by each.

The Coastal Plain province is the most easterly of the three larger physiographical provinces and comprises approximately one-fourth of the total area. It is characterized by broad, level-topped stretches of country of low relief. It gradually declines in slope from the Piedmont border to the Atlantic shore-line, with a probable average elevation but slightly more than 100 ft. above the tide. The deposits of the Coastal Plain consist chiefly of unconsolidated beds of sand, gravel, clay, and marl, which may be locally indurated by a cement either of iron oxide or carbonate of lime. These indurated beds in the vicinity of Acquia creek, and in places southward along the western margin, represent the oldest formation of the Coastal series and afford sandstone suitable for building purposes. Chesapeake bay, which crosses the Coastal Plain region, affords unparalleled transportation facilities, and its principal tributaries give access to vessels as far west as the Piedmont border.

The Piedmont Plateau province lies between the Coastal Plain and the Appalachian mountains and contains a greater variety of minerals than either of the two other provinces. The plateau surface has a general southwestward slope from an average altitude of 1000 ft. along the western margin to from 200 to 400 ft. on the east, where the plateau rocks pass beneath the Coastal Plain sediments. The rocks composing this region are the oldest in the state, and, excepting the areas of Triassic rocks, they are all crystalline. They comprise both sedimentary and igneous masses so greatly altered from metamorphism that many of them bear but slight resemblance to the original rocks. The Plateau region is made up of complex schists, gneisses, and granites, with, in places, areas of slate, quartzite, and limestone, intersected by intrusions of basic eruptive rock. The structural relations of the rocks of the plateau region are complex and have not been worked out in detail. They range from pre-Cambrian to late Ordovician in age.

The Appalachian Mountain province embraces the western portion of the state. Its eastern boundary, the southern slope of the Blue Ridge, forms in places an abrupt change from plateau to mountain conditions. The western limits of the province are artificially drawn in the western boundary of the state. The mineral resources occurring in the region west of the Blue Ridge bear an intimate relation to the structure of the rocks.

Variety of Mineral Products

There is probably no state in the Union, of the same area as Virginia, that can show a greater diversity in mineral resources. This is confirmed by the actual exploitation thus far made, and it might naturally be inferred, from its position with reference to disturbed and undisturbed areas. About forty mineral materials are now exploited, many of them on a large scale, which afford a basis of important commercial enterprises and give it prominence in a varied and extensive mining industry. The mineral products that have been mined and quarried in Virginia are: iron ores, manganese ores, gold, silver, copper, lead, zinc, tin, coal, clay, sand, gravel, stone (granite, marble, limestone, sandstone, and slate), abrasive materials (millstones and emery), silica (quartz, chert, and diatomaceous earth), mica, feldspar, asbestos, talc, soapstone, barytes, gypsum, salt, mineral paint (ocher), marl (greensand and calcareous), pyrite and pyrrhotite, arsenic (arsenopyrite), phosphate, graphite, rutile (titanium), monazite, mineral waters, and precious stones in considerable variety.

Without exception, the mineral products of Virginia can be developed still further with an increased production in future years. Some of these have been developed within recent years, and others still have not yet been exploited. The undeveloped mineral resources are vast and promise a greater increase in production in the future.

Iron Ores and Pig Iron

Mining of iron ore in Virginia in 1609 by the Jamestown colonists was the first iron ore mined in the United States. The building of the Germania (Rappahannock) furnace, about 1714, by Governor Spotswood, in Spotsylvania county, marked the first successful iron industry in the South. By 1781 a total of 10 furnaces had been built, seven of which were in Piedmont, Virginia, and three in the Appalachian region west of the Blue Ridge. The total number of blast-furnaces in Virginia at present is 26, all of which are west of the Blue Ridge.

The commercial deposits of iron ore in Virginia are confined to the Piedmont and Appalachian regions, and include three important types, namely, limonite (brown hematite), red hematite, and magnetite. In recent years, the iron ores of the Piedmont region have contributed only a minor part of the production of the ores, though small quantities of magnetite and limonite are produced annually from this region. The sulphides (pyrite and pyrrhotite) occur in many places, in the crystalline area, but they do not as yet form an important source of the metal, but are extensively mined for use in the manufacture of sulphuric acid.

Magnetite deposits, usually having the form of lenticular beds interlaminated with gneisses, schists, and in places limestones, have considerable distribution in the Piedmont region. The magnetite ore occurring at Pittsville, in Pittsylvania county, has been the most extensively mined in the Piedmont region.

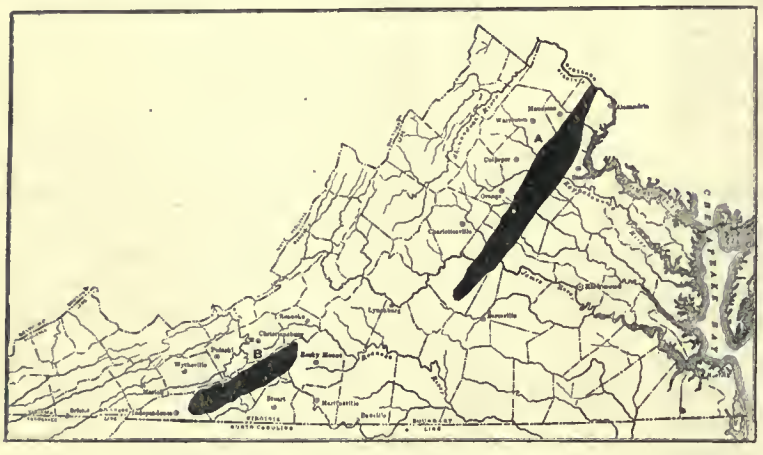
Brown (gossan) ore, resulting from the oxidation of pyrite and pyrrhotite above ground-water level, occurs capping the pyrite and pyrrhotite bodies in metamorphic crystalline schists in many counties of the crystalline area. The brown iron ores of the Appalachian region are commercially the most important ores at present in Virginia. The specular hematites of the Blue Ridge are second in importance, the Clinton fossil ores third, and the remaining types are of minor importance.

The annual production of iron ores in Virginia amounts to about 725,000 long tons, valued at approximately $1,500,000. Of this production, brown hematite constitutes about 90%, red hematite about 9.5%, and magnetite less than 1%. Deposits of magnetite are widely distributed through the crys-

talline area, which form important future reserves of iron ore.

Pyrite Deposits

Virginia has long held the position of first producer of pyrite (iron sulphide used in the manufacture of sulphuric acid) among the pyrite-producing states in the United States. Commercial deposits of pyrite occur in Louisa, Stafford, Spotsylvania, and Prince William counties. Mines are opened in each of these counties, but the production has been chiefly from Louisa and Prince William. The pyrite mines in these two counties are probably the largest and most extensively developed in the United States, and



PRINCIPAL PYRITE AND PYRRHOTITE AREAS.

the product from them constitutes nearly 50% of the total output of pyrite in the United States. Pyrrhotite, magnetic pyrite, used for the same purpose as pyrite, occurs in great abundance in Floyd, Carroll, and Grayson counties. This ore is mined near Monarat, in Carroll county, and treated at Pulaski for sulphuric acid. The annual production of pyrite and pyrrhotite in Virginia exceeds $400,000 in value.

Coal and Coke

The annual production of coal in Virginia amounts to about 6,500,000 short tons, valued at $6,250,000. The coking-coals of Virginia are confined to a few counties in the extreme southwest. The rapid development of the coking-coal fields during the last few years has given Virginia rank as one of the four principal coke-producing states. Prior to 1895, there were only two coke-making establishments in Virginia, with a production of less than 2000 tons per year. There are at present 19 coke-producing establishments, with a total number of ovens exceeding 5000. The annual coke production amounts to approximately 1,500,000 short tons, valued at about $3,700,000 at the coke ovens.

Western Australia in 1912

In the annual report of the Chamber of Mines, R. Hamilton, the president, stated that during 1912 the total quantity treated by all mines was 2,688,868 long tons, yielding 1,267,845 fine ounces of gold, of which Kalgoorlie produced 788,785 oz. Thirteen companies paid $3,900,000 in dividends. Compared with the agricultural, timber, and other products of the state, which produced $21,000,000 during the year, the value of gold output was $25,500,000, or $4,500,000 more than the former. On the whole, although there were labor troubles, there was no serious rupture. With fair treatment from all, Kalgoorlie will continue to support a large community for many years.

Helena Ore Deposits

The ore deposits near Helena, Montana, according to Adolph Knopf, of the U. S. Geological Survey, fall into two distinct groups in point of age. The older deposits, clearly related to the intrusion of the quartz monzonite, are mainly productive of silver-lead and gold-silver ores and have yielded three-fourths of the wealth of the district. These deposits are commonly situated near the 'granite' contact, either in the 'granite' or in the older andesitic rocks. They are replacement lodes carrying galena, sphalerite, pyrite, and arsenopyrite and are commonly associated with heavy black tourmaline. This mineral is associated with the tin lodes of Cornwall, England. The association of tourmaline with lead-silver ores has never been described before and is in fact most remarkable. Its presence, together with other evidence given in the report, shows that the ores must have been formed at very high temperatures and probably at a considerable depth below the surface. The younger deposits are closely associated with the latest flows and are essentially precious-metal deposits in fine-grained porcelain-like quartz and calcite. These veins were exceptionally rich at the surface, but are barren at below 1000 feet.

Western Australia Gold Output

The returns for Western Australia for March were $2,076,400, the principal producers being as follows:

Name.	Tonnage.	Value.	Profit.	Div.
Great Boulder	18,542	$240,200	$137,200	$328,100
Ivanhoe	20,285	187,600	70,000	.....
Bullfinch	5,178	77,680	57,500	.....
Kalgurli	10,870	107,300	45,700	.....
Victorious	9,600	68,800	35,200	.....
Sons of Gwalia	13,400	107,000	28,900	81,200
Yuanmi	10,500	89,400	24,300	.....
Golden Horse-Shoe	26,181	182,900	21,300	.....
Lake View & Star	18,481	106,000	18,000	.....
Perseverance	21,244	118,500	11,800	.....
Associated Northern	1,426	35,800	11,300	.....
Mararoa	2,670	23,800	8,800	.....
Oroya Links	11,920	61,200	7,400	.....
South Kalgurli Consols.	9,933	55,400	7,100	.....
Mountain Queen	3,703	26,000	6,800	.....
Great Fingall	6,016	49,600	5,000	.....
Golden Ridge	2,900	22,800	5,000	11,600
Ida H.	1,358	16,700	3,500	.....
Associated	11,010	62,300	3,400	.....
Kyarra	650	13,800	2,400	.....
Lake View Consols	9,045	8,000	2,000	.....
Marvel Loch	996	7,500	1,300	.....
Boulder No. 1	2,139	4,600	1,200	.....
Lady Miller	1,500	9,000	300	.....
Sand Queen	900	18,500	8,700	7,500

The Year at Cananea

By L. D. Ricketts

*During the calendar and fiscal year of 1912 there was done at the mines of the Cananea Consolidated Copper Co. 72,403 ft. of development work, of which 1392 ft. was in shafts, 13,293 ft. in raises and winzes, and the balance in drifts. The development for the year was satisfactory, and especially was this true in regard to the finding of smelting ores, of which a large tonnage was opened. The tonnage of concentrating ore developed during the year was not equal to the tonnage mined. Of all the properties, the most satisfactory work was in the Puertecitos and Capote mines. In addition to the tonnage which was mined by open-cut methods at the Puertecitos property, the development underground resulted in the opening of a number of orebodies which have proved to be both profitable and desirable for smelting purposes. The great increase in tonnage from this mine is due to the discovery of these bodies of sulphide ores, which carry a high percentage of lime.

Development at the Elisa mine has been satisfactory, and as a result the mine has more ore in sight at the present time than at any time in its history. At the Capote property the results have also been good. Ore has been cut on every level below the fifth, and on the tenth level a fair grade of smelting ore has been opened having a width of 100 ft. Driving is now being done on the strike of this orebody. A new 4-compartment shaft has been started, and at the end of the year had reached a depth of 495 ft. It is expected that this shaft will be completed to the tenth level and equipped by the first of August. This mine gives promise of being one of the largest producers and most profitable mines that the company owns.

Notable developments have been made in the Sierra de Cobre property during the year in addition to the continued development at depth of the orebodies which have been known to exist previously. At the Oversight mine the work has been disappointing; but little new ore has been discovered and the orebodies have been greatly depleted during the year. The Veta Grande mine was idle until August, when operations were resumed; since then the developments have been of the most encouraging nature. In the upper levels much more ore has been found than was expected, and it is of much better grade.

GENERAL VIEW AT CANANEA.

At the Kirk mine the developments have been encouraging, and the ore developed has been considerably in excess of that extracted and of better grade. The main shaft has been sunk an additional 100 ft., and during the coming year will be sunk 200 ft. farther, or to the 1000-ft. level.

At the Cobre Grande mine, the body of concentrating ore referred to in my last annual report has proved to be 15 ft. wide by 350 ft. long, and extends for 100 ft. above the level. Sufficient work has not yet been done to determine the depth to which it goes.

Owing to interruption of railroad service in northern Sonora and the generally unsettled condition of affairs, progress on the property of the Superior Bonanza Mining Co. was less than anticipated, and as a consequence this mine has not reached the producing stage. It was decided not to build the narrow gage railroad that was contemplated, running from the mine to a point near Imuris on the Sonora railroad, but instead to improve the wagon-road and

*From annual report as general manager.

operate motor trucks for the transportation of ore and material. All plans for the operation of this property are, however, held in abeyance pending a return to more settled conditions.

Cost of Mining

The cost of mining for the Cananea Consolidated Copper Co. for the year 1912 was $2.93 per ton, as against $2.46 for the previous year. This is partly accounted for by the increased amount of development. Another item tending to show an increase in the cost is that of general expense. Heretofore this item has been handled as a direct charge against the cost of copper, but for the year 1912 it has been charged direct to operating expenses. In July the pay of the Mexican miners was increased on account of the high price of copper, and this also tended to increase the cost of mining, but the main reason for the increased cost has been the unsettled and disturbed condition of the country and the decrease in efficiency of Mexican labor, due to the excitement, and the lack of power to preserve order by the authorities.

During the year the tonnage produced by the different mines aggregated 906,546 tons. For the production of this tonnage, the stoping cost was $1.391 per ton; development, $0.762 per ton; dead work and surface expense, including the general expense of $0.148, was $0.774; making the total cost of production per ton from all of the mines of the company $2.927. The cost of mining at the various properties of the company varied all the way from $1.468 at the Kirk 15 mine to $8.605 at the Henrietta property.

The Concentrators

During the year there were milled 690,956 wet tons of ore. Of this amount, 547,025 wet tons were produced from the mines of the Cananea Consolidated Copper Co., and 143,931 wet tons from the Cananea Duluth mine. The former had a ratio of concentration of 3.157 tons into 1, and the latter 4.877 tons into 1. The concentrators are in good condition and there was no notable expenditure for new equipment during the year. Section A was overhauled throughout, the old floors being replaced and all weak portions of the structure being strengthened by the use of concrete piers. Sixteen new concrete jigs were added, replacing a like number of worn-out wooden jigs. An 8-ft. Hardinge mill was placed in one section for experimental purposes, it being our belief that the use of the Hardinge mill will result in notable economy in crushing expense.

Owing to a change in our methods of accounting in the reduction division, it is difficult to give a table of costs comparable with former years. The total cost per dry ton of new copper-bearing material treated during the year was $2.85, as against $2.57 for the previous year. The cost for the year 1912 includes, however, an item of $0.087 per ton for general expense, and an item of $0.059 per ton for hauling concentrate to the smelter, neither of which have hitherto been charged direct to smelting operations. The reduction works treated 653,595 dry tons of new copper-bearing material at a cost of $2.848 per dry ton. The total charge to the reverberatory furnaces amounted to 145,970 dry tons, consisting of 62,147 tons of flue-dust, 52,541 tons of calcines, and 31,282 tons of Miami concentrates and flux. The two furnaces were operated a total of 675 furnace-days, the average charge per furnace-day being 223 tons. The total net cost of smelting a ton of charge in the reverberatory furnaces, including general expense, was $1.66, as against $1.65 for the previous year. During the year, three stands of the Great Falls type of upright converter, 12 ft. in diameter, were put into commission, and have been operating satisfactorily.

As it was late in the year when these converters went into commission, the full effect of the change to this type from the old barrel type of converter is not reflected in the costs for converting for the year. It is safe to say, however, that a great economy in operation will be effected by the adoption of the Great Falls converter. The smelter building was lengthened 58 ft., and the work of raising the roof of the building 20 ft., which was undertaken in an endeavor to improve the conditions under which the men work, was well under way at the close of the year. A new 60-ton Morgan crane was installed, as were also two blowing engines to provide additional blast for the converters, and one No. 10 blower for the blast-furnaces. It was decided to install two straight-line electrically-driven casting machines, each machine to have a chain of 39 molds, casting bars of about 260 lb. each, and with the exception of receiving the motors this installation was practically complete at the end of the year. With the completion of these installations there should be a decided improvement in our converting practice, and I can see no immediate need for additional equipment at the smelter or powerhouse.

Mining and Beneficiating

The copper costs for the past year were as follows, per pound of copper:

Gross costs, f.o.b. Cananea		$0.11452
Freight to New York, refining, marketing, etc.		0.01498
Total costs		$0.12950
Credit:		
Value of precious metals	$0.01741	
Miscellaneous revenues	0.00899	
Total credits		0.02640
Total cost, fine copper sold		$0.10310

The total cost of mining and beneficiating a ton of ore, including every cost until the refined copper has been sold, has been as follows:

Fiscal year.	Per ton.	Tons treated.
1909	$5.459	835,929
1910	5.765	792,856
1911	5.257	741,873
1912	5.925	895,406

During the year, labor conditions have not been as satisfactory as heretofore, owing to the general political unrest in Mexico. In the early part of the year, production was below normal.

Properties of Mines Company of America

By Charles Biesel

*The Mines Company of America is a holding corporation which now owns 98½% of the stock of the Dolores Mines Co., 98% of that of the El Rayo Mines Co., 100% of that of the Creston-Colorado, and 33⅓% of that of the La Dura Mill & Mining Co., of which the remaining two-thirds are at the same time owned by the Dolores and El Rayo companies. The properties are all situated in northern Mexico, as shown on the accompanying map.

Dolores Mines Company

The Dolores mines are in Chihuahua, west of Madera, a station on the Mexican Northwestern railway, about 250 miles southwest of El Paso, Texas, and 200 miles northwest of the city of Chihuahua. The mines are reached from Madera over a trail 45 miles long. To make the trip usually requires two days on mule back. Pack trains require from five to seven days.

The company owns 17 mining claims, all adjoining and comprising 250 acres. The main group contains, as far as developments to date have shown, two main ore-bearing veins. One vein is known as the Alma, the other as the San Francisco. The group covers 8000 ft. on the strike of the Alma vein, and 4000 ft. on that of the San Francisco vein. Besides these two partly developed veins, several others crop on the surface within the boundaries of the property. No underground development has been done. The company also owns three detached mineral claims, on which there are vein croppings, and a claim containing a lime deposit. The lime is being used in the cyanide treatment. Two detached mineral claims, the Esther and Bohemia, comprising 126 acres, are 1½ miles southeast and 3½ miles northwest of Dolores, respectively. The company owns in addition all surface rights to 12,500 acres, and holds, by lease from the Madera Company, Ltd., the timber rights to 3500 acres.

MAP SHOWING SITUATION OF THE PROPERTIES.

Dolores is equipped with steam-operated crushing, concentrating, and cyaniding plants; also steam-operated compressor, and hoisting plants, necessary mechanical shops, offices, warehouses, and dwellings. The company owns 200 small one-room houses, rented to native employees; a steam-driven pump, 2½ miles east of the mine, on the Tutuaca river, supplies the necessary water for steam, milling, and domestic purposes. During the past year electrical equipment has been installed to supplement the present expensive steam power. Based on 360 working days, the company, during the past year, employed 29 Americans and 449 natives at this property.

The veins are fissures in rhyolite dikes, have a general strike of north and south, and vary in dip from 55° West to perpendicular. The general country rock of the district is andesite. The ore is a hard quartz, containing about 1.75% of sulphides. These latter are iron, silver, and occasionally lead and zinc sulphides. The values in the ore are approximately 60% in silver and 40% in gold.

Orebodies and Their Developments

Frequent shortage of labor, as well as shortage of powder and other supplies, caused by the existing revolution, and consequent interruption of railway traffic, have interfered with a more aggressive policy of development. There were driven during 1912 the following development and exploration faces: drifts, 2403.5 ft.; cross-cuts, 985; raises, 1123.3; winzes, 31.5; a total of 4543.3 ft. The opening of two extensive stopes resulted from this work. The main level faces were driven ahead for only short distances. The work was mostly confined to prospecting the present developed area, with a view to finding parallel orebodies, or picking up lost veins. Several main development faces at the present time stand in pay-ore.

*From annual report as general manager for the company, for the year ended December 31, 1912.

So far four commercial orebodies in the Alma vein have been proved. They extend from above the upper workings to the lowest working of the mine, the 700-ft. level, with good ore showing under foot in the latter. Indications point to the existence of another Alma orebody north of the present orebodies. It is the intention to thoroughly prospect this part of the mine during the coming year. From the second-class dump there was milled 3730 tons, assaying $8.90 per ton. Several new stopes were started on the ore-filling system. In these stopes there is now stored 2710 tons of ore, assaying $14.80 per ton.

Ore Reserves

During the past few months the mine was thoroughly re-sampled. From the results obtained I estimate on January 1, 1913, the ore reserves, available for extraction, to be as follows:

	Tons.	Value. Per ton.	Value. Gross.
Ore in place	41,107	$18,35	$754,251
Ore broken	2,710	14.80	40,190
Over breaking	5,138	.....	.....
Total	48,955	$16.20	$794,441

Silver contents are based on a price of 60c. per ounce, gold contents on $20 per ounce. As a number of stopes are too narrow to work to advantage, an allowance for over breaking was made. The average vein width is 3½ ft. The wall rock broken down with the ore, as well as occasional mining of low-grade ore in the stopes, will reduce the value per ton to about 12½%. It would not be advisable to mine the high-grade block of ore around the main working shaft at the present time, as its extraction may cause trouble and expense in keeping the shaft timbers in alignment. A re-sampling of the second-class dump resulted in a value of $7 per ton; too low to be of commercial value at the present time.

Operations

Because of an invasion of the camp by the revolutionary forces in July, milling operations were suspended for two months. In the plant the ore is crushed in jaw crushers, is then fed through stamp batteries into Bryan mills, classified and concentrated. Tailings flow through de-waterers to sand plant, as well as through tube-mills to slime plant. During the past year the plant treated 46,778 tons of ore from the mine and second-class dump; 88% of the gross value of the ore was recovered, 26% by concentration and 62% by cyanide treatment. Operating costs were reduced from $13.67 per ton during 1911 to $12.38 per ton during 1912. In the latter figure are included the expense of repairing the plant during August and September shut-downs.

The following new construction was accomplished during the year: addition of two treatment tanks and one solution tank to sand plant; new 150-hp. steam-engine completed. A power-transmission line, on steel poles, 30 miles in length, was constructed between the large sawmill plant of the Madera Lumber Co. at Madera, and the mine. A transformer station at the mine was built and equipped for transforming the 33,000-volt transmitted current into a 440-volt working current. Two induction motors, 150 hp. each, were installed at the mill and cyanide plant. One induction motor of 150 hp. was installed for driving the air-compressor.

Future of Mine

At the present time five development faces stand in pay-ore. An aggressive policy of development has been laid out for the coming year. The fourth orebody on the 500-ft. level extends farther north than it did on the level above, with the present face of the 500-ft. level in 4 ft. of high-grade ore. The 600-ft. level, and possibly the 700-ft. level, should develop this orebody during the year.

Cross-cuts driven into both walls of the older workings are disclosing ore. It is too soon, however, to tell the extent of these possible orebodies. The mine today is in position to produce a daily output of 225 tons of profitable ore. From present indications, the ore reserves at the end of the coming year will be increased. Outside of the present developed zone of orebodies, covering only 2700 ft. on the Alma vein and 650 ft. on the San Francisco vein, the company owns 2700 ft. on the Alma toward the north and 2600 ft. toward the south. On the San Francisco vein the company owns 2950 ft. to the north and 400 ft. to the south of the present development faces. In the early days of the camp, high-grade ore was milled from surface underhand stopes on the Prieta claim, one-quarter mile north of the present Alma workings. It is the intention to explore these old workings. No sinking in the present workings will be necessary for some time. A short winze underfoot in the bottom of the 700-ft. level of the mine shows 4 ft. of good ore in the bottom. The operating costs will be reduced to below $10 per ton, and lower as soon as steady power from Madera is supplied. The Madera company has been delayed in providing electric power on account of the revolution, but expects to be able to deliver power on April 1, 1913.

Revolution

On July 20, 1912, a force of about 3000 revolutionists forced an entrance into Dolores, and took a large amount of supplies. The company's store suffered the most. The plant was not in any way injured. Subsequent exodus of the men caused frequent labor shortage. A claim for all losses sustained is being prepared to be presented to the Mexican government. On September 26 the company's bridge across the Aros river, between the mine and Madera, was destroyed by revolutionists, which interfered with the packing of supplies. For weeks at a time the town of Madera was without railway communication. These disturbed conditions have made it difficult and expensive to operate the property. Much credit is due the staff for sticking to their posts during these trying times. The departments are in charge of the following gentlemen: H. G. Brown, mine superintendent; P. S. Speyer, mill and cyanide superintendent; J. H. Oates, master mechanic; W. E. Ryan, mining engineer; H. G. Palsgrove, manager.

El Rayo Mines Co. of Chihuahua

The El Rayo mines are in Chihuahua, southwest

of Santa Barbara, the terminal of a branch line of the Mexican Central railway. The mines can be reached from Santa Barbara over a trail eight miles long. Supplies are hauled over a wagon-road, 14 miles long, from San Jose, a station on the Parral & Durango railway. The latter branches from the Santa Barbara line at Parral station.

The El Rayo Mines Co. owns 21 mining claims, all contiguous and comprising 766 acres. In addition, the company has a lease on about 12 square miles of timber land. This lease does not expire for 16 years. A large supply of cordwood is to be had from the land covered by the lease. The timber territory adjoins the mining property.

El Rayo is equipped with steam-operated crushing, concentrating, and cyaniding plants of a daily capacity of 160 tons, also a steam-operated compressor plant. There are also the necessary shops, offices, warehouses, and dwellings. Based on 360 working days, the company during the past year employed 15 Americans and 298 natives.

Production and Reserves

The veins are fissures in trachyte and have a general strike of north and south. Their dip is to the west, varying from 50° to perpendicular. The ore is a seamy quartz, containing approximately 4% sulphides, principally of iron, with traces of zinc and lead. Copper sulphides are found occasionally. The veins vary in width from 2 to 20 ft., and the metal content in the ore is approximately 68% gold and 32% silver.

There were driven during the year the following development and exploration faces: drifts, 5798 ft.; cross-cuts, 140 ft.; raises, 3247 ft.; winzes, 37 ft.; making a total of 9222 ft. Previous development and exploration amounted to 51,405 ft., bringing the total to 60,627 ft., or 11½ miles.

Work during the past year has been confined to the orebodies in the northern part of the property, namely: Comet, Adela, West Pettit, and Buena Vista. Two more large orebodies exist to the south of these, the El Rayo and the Descubridora. Each one of the orebodies consists of a number of irregularly shaped lenses. The latter vary in length from 150 to 750 ft. At times the lenses overlap; other times they join or are separated by short and lean zones.

From the Comet orebody there was mined during the year 20,689 tons of ore, assaying $11.53 per ton. The Adela yielded 14,448 tons assaying $17.61 per ton, and the Vista yielded 20,075 tons assaying $17.62 per ton. From the West Pettit orebody there was mined 788 tons of ore, assaying $24.78 per ton. No stoping was done on the El Rayo and Descubridora orebodies. All stopes are being worked on the waste-filling system. The filling from the upper stopes is used in filling the lower ones.

I estimated the ore in reserve on January 1, 1913, at 60,700 tons, averaging $15.37 per ton, with a gross value of $933,000. In this estimate no allowance has been made for ore reserves in the El Rayo and Descubridora orebodies.

There was treated 56,000 tons of ore during the year. From the storage-bin at the mine the ore is trammed to the storage-bin at the mill, then through Blake crusher to rolls, and from here to Huntington mills. Discharge from the latter goes to concentrators; tailing through tube-mills; classified sand to sand plant, and slime to slime plant. Eighty-six per cent of the gross value of the ore was recovered, 17% by concentration and 69% by cyaniding. The resulting concentrate and bullion are marketed at Monterey, Mexico.

Operating costs were kept down to the minimum record of the previous year, and the net profit per ton was increased.

Owing to delays in delivery of material, construction of the new cordwood tramway was only recently started. The constructing firm expects to have it in operation by April 1, 1913. A considerable saving will be effected through the use of this tramway.

A small foundry was completed, and a new storage water tank for boilers was installed, as well as a local telephone system; a large storage-bin was completed, situated at the mouth of the Pettit tunnel; a new drill-sharpening machine and an electrically driven triplex pump and ore-cars were added to the mine equipment.

The development work during the year has extended the limits of the known orebodies, and several development faces at present stand in ore. The north drift on the lower level is now being driven toward the Adela orebody and is expected to enter it in the near future. Aside from further extending the limits of the four northern orebodies, chances are favorable toward opening up a large tonnage in the El Rayo and Descubridora veins. Work in this part of the property will be started in the near future.

Fortunately, no suspension of operations was necessary because of the revolution. While at times conditions were extremely unsettled, the majority of the staff, under the guidance of James S. Colbath, remained loyal and kept the plant running. On December 17, 1912, Mr. Colbath was captured by 40 bandits, who demanded a ransom of ₱60,000 from him. After considerable parleying he succeeded in satisfying them by the payment of ₱1000, and was released. The departments were in charge of J. Scott Liutner, mine superintendent; J. R. Edwards, mill superintendent; G. Howard Sumner, cyanide superintendent; James H. Baker, master mechanic; Bennett R. Bates, in charge of the office.

Creston Colorada Company

The Creston Colorada property, more commonly known as the Prietas mines, is at La Colorada in the state of Sonora. The mines have been worked for about 100 years, and during the last 30 years they have been producing regularly. Estimates place the gross production of the camp at $110,000,000. The property comprises 15 mining claims, covering 362 acres, and contains a number of producing veins for a length of 7000 ft., between the east end of Las Prietas claim and the west end of the Colorada claim. The company also owns 7000 acres of surface ground.

Creston-Colorada, as the name implies, is a consolidation of two mines. The Creston or east end

is equipped with steam plant, hoists, compressors, crushing plant, shops, mine offices, etc., and the Colorada or west end is equipped with electrically operated hoisting and crushing plants. It is furnished with compressed air from the Creston plant. One centrally located cyanide plant of 350 tons daily capacity receives the Creston ore over an aerial tramway 3200 ft. long, and the Colorada ore over an 800-ft. incline tramway. The cyanide plant is steam operated and consists of wet-crushing plant, sand, and slime plants. A pumping plant on the Matape river supplies water for all purposes through a 5-in. pipe-line 18 miles long. The company, during the past year, employed 46 Americans and 336 natives.

Character of Ore

The larger orebodies occur principally in diorite, metamorphic rocks, and quartz-porphyry. The veins have a general strike of nearly east and west and dip north, from 55° to perpendicular. The east end ore is a heavily fractured quartz, stained by limonite and manganese. Sulphides appear only on the lower levels. The west end ore is a harder quartz. Sulphides of silver, iron, and zinc occur from the surface down. Streaks of high-grade shipping ore are discovered occasionally. The gold and silver contents in the ores are approximately: East end ore, 57% gold and 43% silver; West end ore, 54% gold and 46% silver; average as treated, 56.5% gold and 43.5% silver.

During the year the following development work was done: Drifts, 2817 ft.; cross-cuts, 1266 ft.; raises, 1300 ft.; winzes and shafts, 133 ft.; making a total of 5516 feet.

The new West shaft was finished and equipped in order to allow the mining of a block of ore situated around the upper 200 ft. of the Creston shaft. This block contains 118,000 tons. Recent developments, however, indicate that the immediate mining of this block of ore is not required. On the 600-ft. level of the Creston mine two new veins were prospected, the East and the New Cross veins. Both of these veins are yielding ore. This is encouraging, as these orebodies are east of the main fault of the Creston mine, in a territory that heretofore was non-productive. The Colorada mine developments have extended the limits of the known orebodies, both on dip and strike. The limits of the 'Glory Hole' have been extended, with two pay-veins showing in the west face.

The principal ore-producing veins in the Creston mine are known as the South vein, Perry vein, North vein, New vein, and East vein. These veins vary in width from 4 to 30 ft., and are all more or less parallel.

For a vertical distance of 100 ft. from the surface, east and west of the Creston shaft, the main veins are connected by numerous diagonal fissures and stringers. These carry sufficient gold and silver to apply here to advantage the glory-hole system of mining. The main glory-hole east of Creston shaft is now 400 ft. long by 300 ft. wide, and 100 ft. deep, with good chances of being lengthened. The glory-hole system, on a smaller scale, also is in use at the Colorada mine. There are two known veins in the latter mine, namely, the North vein and the South vein. The former is known as the Gustavo vein in the west part of the mine. From the Creston mine there was milled 169,600 tons of ore assaying $4.24 per ton. The Colorada mine supplied 30,100 tons to the mill of an average assay value of $8.28 per ton. The Colorada mine also produced 32 tons of shipping ore, assaying $360 per ton.

I estimated on January 1, 1913, the ore reserves, ready for extraction, to be as follows:

	Tons.	Assay per ton.	Gross value.
Creston mine	185,000	$5.18	$958,000
Colorada mine	22,000	7.64	168,000
Total	207,000	$5.44	$1,126,000

Silver contents are based on 60c. per ounce, and gold on $20 per ounce. With a production of 10,000 tons per month, the reserves will keep the mill going for 1¾ years.

Despite the threatened invasion of the camp by the revolutionary forces, the mine was operated continually during the year. The mine produced 199,700 tons of ore, of which the company's mill treated 122,600 tons, and the Grand Central plant, under lease to the company, 77,100 tons. The crushed ore, as it is delivered by the tramways, is fed through stamp-batteries into Huntington mills, classified, tube-milled, and distributed through spitzkastens to slime and sand plants.

Plant and Equipment

On November 1 the use of the Grand Central plant was discontinued. Since then, by reducing the mine's output, the ore is mined cleaner, and consequently of a better grade. This slightly increases the operating costs, but allows for greater profits.

The Colorada mine was equipped with new headworks. A 9 by 15 Blake crusher was installed. The new electric hoist is doing good work. A new incline tramway connects the headworks with the mill. At the Creston the headworks of the new 'West' shaft were completed. The steam hoist of the 'Wyman' shaft was moved to the 'West' shaft.

Re-sampling of the mine, both on surface and underground, is disclosing numerous pockets of pay-ore, especially in the east end of the Creston and in the Colorada mine. In the earlier days of the property, higher operating costs prevented the development and extraction of ore assaying less than $8 per ton. With present operating costs a number of these showings should prove profitable. The former policy of development has been changed to one of aggressiveness. Surface prospect shafts are being sunk on new ore showings, cross-cuts, drifts, and raises are being driven with encouraging results. Recent development indicates that the coming year will see a decided increase in the ore reserves as well as in the operating profits. The future for the property looks exceedingly bright.

The revolutionary forces, in August, threatened to invade the camp, and only by the efforts of a few of the cooler heads was an exodus of employees prevented. The Yaqui Indians were, and are still,

on the warpath, and on several occasions interfered with our wood camps, causing temporary shortage of fuel. A large supply of wood is now on hand. The departments have been in charge of W. C. Taylor, mine superintendent; E. F. Rowell, mill superintendent; C. E. Cleaveland, cyanide superintendent; R. R. Wheeler, master mechanic; and C. C. Rountree looked after the office and business interests.

La Dura Mill & Mining Company

The La Dura mines are situated on the Yaqui river, in the state of Sonora, near La Dura, a station on the Cananea, Yaqui River & Pacific railway. The mines are connected with the railway by aerial tramway and ferryboat across the Yaqui river. Parts of the La Dura mines have been worked by the Spaniards, and estimates place the gross production at $5,000,000. The property consists of four different mines, namely: California, Prieta, Gloria, and La Dura. The California and Prieta groups comprise four mining claims, containing 267 acres. The Gloria and La Dura groups comprise seven mining claims, containing 412 acres. The company also owns the surface rights to 16,250 acres.

The equipment consists of three units: the Prieta steam-operated compressor and hoisting plants; the Gloria steam-operated compressor, hoisting, milling, and generating plants; and shops, stores, administration buildings, and pumping plant. The latter supplies the Prieta plant with river water for the boilers. A transmission line from the Gloria plant furnishes the power to the pumping plant. The Prieta mine is operated through a 3-compartment vertical shaft 1040 ft. deep. The Gloria mine is operated partly through an incline shaft 1600 ft. long and partly through a vertical shaft. The incline shaft starts on a 45° slope and gradually flattens to 22°. The vertical shaft connects with the incline shaft workings at the 500 and 700-ft. levels. The company during the year, employed 8 Americans and 252 natives.

There are four main veins on the property, namely, the California, Prieta, Gloria, and La Dura veins. Since acquiring the property, the company has confined its operations to the Prieta and Gloria veins only. Considerable and profitable ore was mined by the former owners from both the California and La Dura veins. The Prieta and Gloria veins are from 6 in. to 4 ft. wide. The ore is a white quartz, carrying sulphides of silver, copper, lead, iron, and zinc. The veins occur in andesite, strike northwest-southeast, and dip at about 30° to the southwest. The ore occurs in terraces, formed by frequent faulting, both on the strike and dip of the veins. This faulting is especially frequent in the Prieta vein. In places the grade of the ore allows shipping direct to the smelter. Most of the ore, however, has to be hand sorted, and the lower grades have to be milled. The metal contents in the shipping grades are approximately: silver, 86%; copper, 9.5%; and lead, 4.5 per cent.

There was driven during the year the following development and exploration faces: Drifts, 3332 ft.; cross-cuts, 1455 ft.; raises, 1758 ft.; and winzes and shafts, 733 ft.; making a total of 7278 ft., or 1.2 ft. of development work for every ton of ore treated and shipped.

In the Prieta mine, three orebodies have been developed, namely, the 'South,' 'Middle,' and 'North' orebodies. Each of these consists of a series of terraces. On this account, no defined system of stoping can be applied. At times it is found advantageous to carry the ore in rawhide sacks on the backs of the natives to the nearest chutes. Several new terraces were found and developed during the year. The 'North' orebody was cut off by an extensive fault. It was picked up west of the fault plane and shows good ore on and below the 1040-ft. level.

Two extensive terraces of ore have been developed in the 'Middle' orebody.

Only limited development work was done on the 'South' orebody. Some high-grade ore in limited quantities was extracted. Further prospecting on this orebody will be done in the near future. The Prieta mine, during 1912, has produced 588 tons of hand-sorted ore of a gross value of $173.08 per ton. In the Gloria mine, two orebodies have been developed, namely, the 'Main' or 'South' orebody, and the 'Second' or 'North' orebody.

The lower or 900-ft. level has opened the 'Main' orebody for an additional distance of 200 ft. during the year. A winze on this orebody on the 900-ft. level discloses good ore underfoot. The 900-ft. level has passed out of the 'Main' orebody and should in the near future enter into the 'Second' or 'North' orebody.

Output and Ore Reserves

The ratio of production from Prieta and Gloria mines during the year is as follows:

Particulars.	Tons.	Gross value per ton.	Total.
Prieta hand sorted	588	$171.00	$100,469
Gloria hand sorted	746	98.74	73,660
Gloria concentrates	511	161.57	82,562
Total	1845	$140.00	$256,691

The mill treated 2897 tons of ore from the Gloria mine.

I estimated on January 1, 1913, the ore reserves in both mines to be as follows:

	Tons.	Gross value per ton.	Gross val.
Prieta	2246	$ 88.80	$215,832
Gloria	7040	48.35	367,737
Total	9286	$ 62.84	$583,569

In addition to these underground reserves, there are stored on the dumps second-class ore and middling amounting to 8939 tons, of a gross value of $175,000. In estimating the ore reserves, reasonable allowance has been made on orebodies ahead of the present developed faces. Silver contents are based on 60c. per ounce, copper contents on 13c. per pound, and lead contents on 2½c. per pound.

On January 15, 1912, operations were suspended on account of a strike of the employees for higher wages. The plant resumed operations February 18. Another shut-down of 15 days was caused by the invasion of the camp in August by the revolutionary forces. Numerous minor shut-downs were occasioned by frequent holidays and repairs necessary

to the second-hand machinery of the milling plant. During the year the total time lost on account of all stoppages was 135 days.

The Gloria mill has treated only ore from the Gloria mine proper. The ore is dumped from mine skips to storage-bin, fed to Blake crusher, into Dodge crusher, sized in trommels, jigged, tailings re-ground in rolls, and classified; sand to Wilfley, slime to Deister tables.

Additional concentrating machinery was installed. A new power line, 1¼ miles long, was constructed between the Gloria plant and the machine-shops and pumping plant. Motors and generator set were installed at the Gloria. The Gloria mine also was equipped with a new triplex motor-driven pump, placed on the 900-ft. level.

The extensive and profitable old workings of the mines have proved the persistence of both veins and orebodies. No matter how badly faulted the orebodies were, they were invariably picked up again on the opposite side of the faults. The lower levels both in Prieta and Gloria look well. Winzes sunk from both these levels show high-grade ore of more than average width. The showings in these winzes justify the deepening of both Prieta vertical and Gloria incline shafts. The veins in the lower levels appear strong, free, and well mineralized, and should continue to yield ore at further depth. Both the California and La Dura operations are said to have been profitable in the past, and further development work, I believe, will open profitable ore reserves in these two mines also. Satisfactory profits have been made during the past year, and I cannot see any reason why they should not continue and more than likely be increased in the future. The unsettled poltical conditions and the fact that the mines are located in the heart of the Yaqui Indian country, have made it difficult to carry on operations. The management and staff deserve credit for sticking to their posts. On November 1, H. G. Palsgrove, who was in charge of operations, was promoted to become manager at the Dolores mines, and Ben T. Wells, formerly engineer under Mr. Palsgrove, was appointed manager at La Dura.

Sintering Sulphide Ores at High Altitudes

By R. L. Lloyd

The results obtained by the Dwight & Lloyd sintering machines installed at the Cerro de Pasco smelter in Peru, at an altitude of 14,000 ft. above sea-level, have shown that sintering by this method at high altitudes is confronted by no more serious problems than are experienced in blast-furnace smelting at the same altitudes.

At such altitudes as 14,000 ft. there is always some difficulty in kindling a fire of any kind, and any burning material tends to go out if the conditions most favorable to combustion are not maintained. As was to be expected therefore, a sinter bed is not quite as readily ignited at Cerro de Pasco as at lower altitudes, but no serious difficulty was experienced in this regard; the ignition flame was simply made a little more intense, a condition readily attained with the crude-oil burner that was used. The ore charges treated were in all respects similar to the copper charges treated elsewhere, except that the sulphur content was higher than usual (25%). With such a sulphur tenor, considerable difficulty is generally experienced at lower altitudes, on account of the excess of the heat of combustion of the charge, but at an altitude of 14,000 ft. no difficulty at all was met. This was probably because of a tendency toward slower combustion, it being remembered that a cubic foot of air at 14,000 ft. contains only about 60% of the oxygen that a cubic foot of air contains at sea-level.

As is well known, sulphur is sometimes produced while sintering, and is carried through the fan with the gases as flowers of sulphur. At lower altitudes, if the exhaust gases are quite hot, the sulphur sometimes tends to collect in the fan, and if not cleaned out at regular intervals may take fire. No such difficulty was experienced at Cerro de Pasco, and although the sulphur appeared in the fan and was cleaned out at regular intervals, there never seemed to be any tendency to take fire, probably because of the low oxygen tenor of the atmosphere. No attempt was made at Cerro de Pasco to find the low sulphur limit for sintering, as the problem was to work the highest sulphur charges possible, and while it was proved that 25% was an entirely feasible charge at that place, it is not yet proved to be the maximum permissible.

The speed of sintering was rather surprising, and seemed to be almost if not quite equal to that at lower altitudes. This I take to be, partly at least, due to the large amount of sulphur driven off in the elemental state, as the ore contained much pyrite. It is hard to get an exact comparison of speed, however, as no such high sulphur charges are being worked elsewhere by this method. The power consumption per ton sintered was practically no greater than that used at ordinary altitudes, and the ordinary vacuum of 4 to 6 oz. per square inch was found to be entirely satisfactory.

Sintering by the Dwight & Lloyd system had been previously tried at Cerro de Pasco, in a plant erected in 1907 under an arrangement with the patentees, but designed independently. The plant was of the intermittent 'pan' type and proving unsatisfactory was eventually abandoned. The cause for this failure is entirely clear when the mechanical difficulties of properly placing a sinter bed on an apparatus of the pan type, and of re-establishing the best working conditions for every batch are realized. Such difficulties do not exist while practising the continuous system of sintering as is now satisfactorily employed at Cerro de Pasco and many other places. Steps have been taken to enlarge the existing plant at Cerro as rapidly as possible, so as not only to eliminate fine ore troubles, but also to get the great increase in smelting speed which invariably follows the addition of sintered material to the charge.

Joint Meeting of Institutes

A joint meeting of the Spokane local section of the American Institute of Mining Engineers with the Western branch of the Canadian Mining Institute, was held at Rossland, May 22, 23, and 24. The attendance included between 30 and 40 mining engineers, metallurgists, and geologists, nearly all of whom were members of one or other of the two institutes, and a number of local residents interested in mining. R. S. McCaffery, professor at the University of Idaho, Moscow, chairman of the Spokane local section of the American Institute of Mining Engineers, and L. K. Armstrong, editor of the *Northwest Mining News*, Spokane, secretary, were among those who went from Spokane. M. E. Purcell, superintendent of the Consolidated Mining & Smelting Co.'s Centre Star group of mines, Rossland, chairman, and E. Jacobs, of Victoria, secretary, were among the members of the Western branch of the Canadian Mining Institute.

Two evening sessions were held, and one day was devoted to visiting the Centre Star mines, and the Consolidated company's lead and copper smelter and electrolytic lead-refinery at Trail. Mr. Purcell showed the visitors through the mines, and R. H. Stewart and S. G. Blaylock, general and assistant general manager, together with the respective superintendents, received them at the reduction works.

Papers presented were as follows: 'Notes on Early History of Rossland Camp, with Brief Synopsis of Its Geology,' read from a provincial government bulletin; 'The Use of Oxygen Helmets in Mine Fires,' by E. P. Dudley, Kellogg, Idaho. This paper was read by R. S. McCaffery, and was based upon experience in connection with a mine fire that took place last fall in the Bunker Hill & Sullivan mine. 'Ore Sorting and Handling Arrangements at the Centre Star Mine, Rossland,' by M. E. Purcell. 'The Copper-Smelting Department of the Consolidated Mining & Smelting Co. of Canada Works at Trail,' by James Buchanan, superintendent; read by S. S. Fowler. 'Notes on the Consolidated Mining & Smelting Co.'s Electrolytic Lead Refinery at Trail,' by J. F. Miller, superintendent; read by the branch secretary. 'The Effect of Lime on the Solubility of Silver in Cyanide Solutions,' by H. W. Foester, of Nampa, Idaho; presented by R. S. McCaffery. 'Mining and Metallurgy as Practised in the Sudbury Nickel Fields, Sudbury, Ontario,' by Charles J. Murphy, Fernie, Crow's Nest Pass; presented by the branch secretary. 'Notes on Metal-Mine Accidents and First Aid to the Injured,' by E. Jacobs, Victoria. There were brief but interesting discussions on some of these papers.

A Draeger pulmotor, lent for the purpose from the provincial government mine-rescue station at Nanaimo, Vancouver island, was shown each evening, R. S. McCaffery demonstrating the method of using it; also a locked dynamite-cap box, patented by A. S. Hamilton, master mechanic for the Western Fuel Co., Nanaimo. This safety box is used in some of the Vancouver Island coal mines.

Charles W. Drysdale, of the Geological Survey of Canada, who was present at the meetings, brought with him a letter from the Director of the Survey, R. W. Brock, to the effect that he had been selected to bring the information up to date, and to familiarize himself with local conditions, so as to be able to edit the report on the 'Structural Survey of Rossland Camp,' made several years ago by Mr. Brock and others, but which has not yet been completed. R. S. McCaffery announced that the fall meeting of the Spokane local section will be held in October at Wallace, Idaho. The ballot for chairman of the Western branch of the Canadian Mining Institute for the ensuing year resulted in the almost unanimous election of W. J. Sutton, Victoria.

In connection with the meeting, the *Rossland Miner* published some interesting information concerning the history of Rossland 'camp,' and included a table of annual production, the aggregates of which are as follows:

Production from 1894 to 1912, inclusive:	
Ore mined, tons	4,104,228
Metal production:	
Gold, ounces	2,018,152
Silver, ounces	3,383,951
Copper, pounds	86,838,170
Total value	$55,557,452
Production of the Consolidated Mining & Smelting Co. of Canada in 16 years:	
Ore smelted, tons	3,143,927
Metal production:	
Gold, ounces	1,146,912
Silver, ounces	20,224,623
Lead, pounds	250,970,644
Copper, pounds	50,789,983
Total value	$52,167,034

American Institute Land Debt

It was announced at the annual meeting of the American Institute of Mining Engineers that through the efforts of Dr. James Douglas the whole of the money necessary to wipe out the land debt of the Institute had been secured or guaranteed. Under date of June 4, Dr. Douglas has reported the following details:

"I have pleasure in making the following statement concerning subscriptions to the land fund of the American Institute of Mining Engineers up to June 1, 1913:

"Amount of land debt unsubscribed August 2, 1912, $68,000; amount subscribed in response to requests by the undersigned, $68,000; amount so far collected, $48,405; amount at present uncollected, $19,595. Of this uncollected balance, $17,639.75 is due by men who subscribed $1000 or more; $1100 is due by men who subscribed $100 to $1000; $945 is due by men who subscribed less than $100.

"In order that the full amount might be reported at the annual meeting of the Institute as having been subscribed, certain members who had already contributed liberally subscribed the balance not then subscribed for. Since that time a number of subscriptions have been received and others are expected, so that I hope that the guarantors will not have to be called upon for their additional donations. Now that the dues will not have to be raised in order to relieve the Institute of debt, I

hope that many of the members who hesitated to subscribe to the fund while the result was still doubtful will contribute their share."

The Board of Directors has presented to Dr. Douglas an illuminated testimonial, of which the following is a copy of the text:

"The members of the Board of Directors and of the former Council long realized that the activities of the Institute were very seriously hampered by the burden of debt and the attendant interest charges which have rested upon it. We have all longed for the day when the Institute might be free from them and might devote its resources entirely to its own distinctive work. It remained, however, for your unerring judgment to select the point to which individual effort might be applied so as most effectively to serve the needs of our great Society. With characteristic unselfishness, you volunteered to do what you could to remove the burden.

"Not only has the effort proved timely, but the man behind the effort was the one whose appeal carried greatest weight. No other member of the American Institute of Mining Engineers possesses the regard, confidence, and affection which are yours, and no one else could have made the same appeal to the membership. While we rejoice at the successful issue, we are no less gratified at this mark of the esteem in which you are universally held.

"We, your old friends and associates in the Board and Council, ask you to accept this expression of our thanks as Officers of the Institute, and with it a further expression of our profound respect and affection for yourself."

This was signed by the following members:

A. E. Carlton, S. B. Christy, F. W. Denton, Karl Eilers, J. W. Finch, James Gayley, J. A. Holmes, Robert W. Hunt, J. H. Janeway, Jr., Hennen Jennings, Robert E. Jennings, Sidney J. Jennings, William Kelly, James F. Kemp, Edmund B. Kirby, Charles Kirchhoff, A. R. Ledoux, Thomas H. Leggett, W. Lindgren, Frank Lyman, Edward P. Mathewson, C. W. Merrill, R. V. Norris, W. J. Olcott, Charles F. Rand, R. W. Raymond, Joseph W. Richards, L. D. Ricketts, C. Snelling Robinson, George C. Stone, Bradley Stoughton, Joseph Struthers, B. B. Thayer, Gardner F. Williams, Edward L. Young.

The cutting of the 'reef' in the Hercules vertical shaft of the East Rand Proprietary Co. on April 20 has created considerable interest in South Africa and Europe. The news was cabled as follows: The Main Reef series was intersected in the Hercules vertical shaft at a depth of 4236 ft. The 'reef' has been disclosed on both sides of the shaft, with the following results: Main Reef Leader, width 13 in., value $3.20; Main Reef, width 19 in., value $1.80 per ton. The Main Reef Leader is a compact highly mineralized orebody, of good appearance. The Main Reef consists of three 'leaders,' 9, 5, and 5 in. wide, respectively. The cross-cut from this shaft on the 3000-ft. level has cut the Main Reef Leader during the week. The average value for 25 ft. driven is $93, over a 'reef' width of 13.2 in.

Mining Ore by the Million Tons

The following figures will give an idea of the huge tonnages mined yearly by certain large concerns in the United States, as given in the latest reports:

		Tons.
Panama canal	(a)	30,249,369
Yukon Gold Co.	(a) (b)	8,297,363
Utah Copper Co.	(d)	5,315,321
Anaconda group	(d)	4,576,289
Nevada Consolidated	(d)	2,825,515
Calumet & Hecla	(d)	2,806,610
Hull-Rust	(f)	2,232,112
Leonard	(f)	2,198,119
Canisteo	(f)	2,099,880
Ray Consolidated	(d)	1,565,875
Homestake	(b)	1,528,923
Mahoning	(f)	1,518,643
Norrie group	(f)	1,500,732
Genoa	(f)	1,315,840
Uno South	(f)	1,305,216
Hill	(f)	1,188,908
Chino	(d)	1,120,375
Dale	(f)	1,106,808
Miami	(d)	1,040,744
Sauntry-Alpena	(f)	1,025,301
Cleveland Cliffs group	(f)	1,004,684
Adams	(f)	993,523
Newport	(f)	973,391
St. Joseph Lead Co.	(e)	932,220
Holman	(f)	919,699
Alaska Treadwell	(b)	892,192
Shenango	(f)	805,413
Spruce	(f)	740,801
Bunker Hill & Sullivan	(e)	697,560
Chisholm	(f)	695,859
Stevenson	(f)	682,514
Copper Queen	(d)	669,399
Pioneer	(f)	647,237
Virginia group	(f)	619,594
Moctezuma	(d)	596,000
Susquehanna	(f)	583,910
Commodore	(f)	576,855
Uno North	(f)	545,033
Kinney	(f)	530,080
Detroit	(d)	519,632
Clark	(f)	500,768
Zenith	(f)	478,682
Fayal	(f)	468,019
Alaska United	(b)	450,147
North Butte	(d)	434,854
Goldfield Consolidated	(b)	415,786
Superior & Pittsburg	(d)	288,429
Utah Consolidated	(d)	251,500
Alaska Mexican	(b)	233,659
Portland	(b)	217,923
Calumet & Arizona	(d)	179,788
Wasp No. 2	(b)	158,840
Tonopah Belmont	(c)	127,920
North Star	(b)	101,181
East Butte	(d)	96,601

(a) Cubic yards. (b) Gold mining. (c) Silver mining (d) Copper mining. (e) Lead. (f) Iron.

The new tank steamer *El Segundo*, the latest addition to the fleet of the Standard Oil Co., arrived at San Francisco by way of the Straits of Magellan, on May 9. The distance of 15,000 miles was covered in 65 days. The vessel is equipped with a triple-expansion engine capable of developing 2500 hp. at 100 r.p.m., thus giving it surplus power for towing oil barges along the coast. For this purpose the tanker is equipped with a towing machine, and carries 1500 ft. of 2-in. steel-wire hawser.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Extralateral Rights and the Prospector

The Editor:

Sir—It might be as difficult to come to a decision as to 'What is a prospector?' as in the case of the definition of 'ore.' In your issue of March 29, Mr. Van Wagenen gives a definition of a prospector in the following words: "The prospector is the individual who will wander over the country and search for undiscovered mineral outcrops." Then he claims there are no prospectors in any part of the world except the United States west of Texas. Surely the other countries where mineral deposits have been found contain individuals who are only too prone to "wander over the country."

During late years in eastern Canada there have not only been hundreds of prospectors in the country lying with a few days' travel of the railways, but there have been parties searching for mineral deposits along Ungava's distant shores and in the interior of that little-prospected region. Three or four well equipped parties have left this spring for Ungava.

The only explanation for some of the arbitrary, not to say absurd, statements by Mr. Van Wagenen in your issues of March 29 and April 19 that I can think of is that he had a brief experience in eastern Canada a few years ago. He may have experienced some of our wintry winds or the black flies in June, both of which discourage tenderfeet.

Outside of the part of the United States in which Mr. Van Wagenen says are to be found the only prospectors, he claims that discoveries are made only by accident, or by "pure accident." He is strong on accidental discoveries. Have not many of the great mines of the world, even within his favorite region, been discovered by accident? For example, was the finding of Stratton's Independence not due to "the desultory prospecting of a carpenter"? Many other instances of the kind have been cited; but surely the discoveries that have been made in Ontario, for example, are in point, since the finding of Cobalt ores was not due to accident. To use Mr. Van Wagenen's definition, "the individuals who wander over the country in search for undiscovered mineral outcrops" in some cases found them. Hundreds of these men have done nothing but search for mineral months at a time. They spend all their time at the work. How many discoveries have the thousands of prospectors, that Mr. Van Wagenen says are to be found in his favorite states "wandering over the country searching for undiscovered mineral outcrops," made within the last three years? Is the number equal to that of the important discoveries made in Canada during the same period?

Mr. Van Wagenen probably has the idea that a prospector should be a more picturesque figure than are the great majority of men who have been searching for mineral deposits in Canada during recent years. In so far as eastern Canada is concerned, we have none of the semi-lunatic type of the western hills that has been described by various authors. Our prospectors are business-like men on the whole, and many of them differ from the old-time prospector in that they have a fair technical knowledge. Their qualifications, however, should be judged by the results they have achieved. Is there any state or territory in North America in which more productive mineral areas have been brought to light during the last five years than in Ontario? Outside of Cobalt, there are Gowganda, South Lorrain, Casey, Alexo, Porcupine, Kirkland Lake, Swastika, and others, all the discoveries having been made by men searching for mineral deposits, and not by hunters, tourists, or farmers. This Ontario country is much more difficult to prospect than is the average Western country. Deposits cannot be found here with the spyglass, nor has the prospector the assistance of a bronco or other four-footed beast to assist him in transporting his supplies. Most of our important deposits have been found by downright hard work.

As to the actual number of prospectors engaged in Ontario, I have not definite figures at hand, but I think it is safe to say that there have been probably twice as many as any other state or province in North America during the last three years. Then, the annual reports of the Minister of Mines, British Columbia, show that there has been a considerable number of men prospecting in that province during late years.

Mr. Van Wagenen is also strong on extralateral rights. In the case of many discoveries that I have seen it would have been much better for the prospector to have been given a few feet of the horizontal extension of his vein than to have been given extralateral rights. In the majority of the mining areas of the world, extralateral rights are of no importance to anyone excepting a lawyer who may be employed in lawsuits to which these so-called rights often lead.

GEOLOGIST.

Toronto, May 10.

The Editor:

Sir—Referring to the communications of Mr. Goodale, Mr. Brock, and 'Canadian,' in your issues of May 3 and 24, I would reply as follows:

It seems to me that all these gentlemen continue the error of confusing the prospector with the claim locator. Mr. Goodale will hardly assert, for instance, that because 11,456 individual free miners certificates were taken out during 1911 in British Columbia, that there were that many prospectors in the field in that year. The statement is its own refutation, for such a number at work during the short season of that high latitude would not only make British Columbia hum, but boil over. And when the gentleman ingenuously adds that only 6539 claims were located by this army of 11,456 prospectors, who had paid out $57,280 for the privilege, a complete *reductio ad absurdum* is established. Mr. Goodale appears never to have heard of the dodge

of relocating a claim to save the cost of annual assessment.

Mr. Brock cites the cases of Cobalt and Porcupine as evidences of prospecting activity in Canada. Does he not forget that the mineral-bearing lodes of the former were discovered by railroad graders in the course of their labor, and that the first samples of gold quartz from the latter were brought in by a fur hunter, who tripped and fell on the croppings and almost bit them off? I was through about 100 miles of the Canadian bush north of Cobalt during the summer of 1911, and to the best of my knowledge did not encounter a single "telecum." And, by the way, what is a "telecum," anyway?

The Ungava prospecting party cited by 'Canadian' will, I hope, meet with the biggest kind of success. Certainly Ungava needs such attention, and promises results to true explorers. But I have my doubts about prospecting "parties." Let us wait until the returns come in in this case. Such "parties" generally get away with more Old Scotch than dynamite, and carry a larger stock of fishing rods and ammunition than of picks and drills, and the real details of their operations, perhaps fortunately, rarely appear in the public print.

The true prospector is neither a hunter, a fisherman, nor a professional claim-locator. He is an explorer, pure and simple. Only those who have had personal and intimate relations with the working miner know him, and understand the part he plays in opening a new country. He is a distinct American product. His only remote antecedent among English-speaking people that I am aware of, was the old Cornish 'fossicker,' whose title is a derivative from the same Latin verb that gives us the word fossil (something dug from the ground). The 'fossicker' was a digger—generally on the sly—in old and abandoned mine workings, a searcher for little bunches of ore that had been missed by previous operators, or hidden by himself when working for them; and his activities, being illegal, often landed him in jail.

When gold was discovered in California, and an untouched mineral field of vast size was freely thrown open for exploration, the prospector came into existence. I think that the word cannot be found in dictionaries published prior to 1850-55. In ten years, being allowed liberty of search, the lure of extralateral rights and a simple method for initiating titles, he opened up and explored preliminarily a region comprising a million and a half square miles of mountain, plain, and desert, and left more than a thousand new mining camps in the wake of his journeyings. He is not so numerous now among us as he used to be, or as we would like him to be, for the West is becoming too well settled for individuals of his temperament and characteristics. The bulk of what are left of his tribe are in Alaska, where wire fences are not, and the whisky still has some 'bite' in it. There he is opening a new empire for Uncle Sam, where already more business is being done in a week than in the Yukon Territory or British Columbia adjoining in six months. Of course, the claim locators and relocators and promoters keep doggedly on his trail, as of old, and generally manage to extract more profit from his activity than he does himself; but that is the way of the world, and inevitable. Sooner or later he will be simply a memory, unless, by the time Alaska is fairly well explored, he can be turned loose, under the stimulus of the American mining law, into Mexico. What a paradise for the poor man he would make of that wretched country, and what a field for investment for the rich. Above all, how the 'greaser' would disappear before him, or else learn to work more and *fiesta* less. And so, while he still remains one of our institutions, and in spite of his many faults and inconvenient characteristics, let us give him the honor that is his due, and not confuse him with the class that have to deliver $5 to the nearest government recorder before they can be allowed to go out and repeg their last year's locations, or stake out a bunch of 'wild-cats' to sell next winter to the 'suckers' in the lobbies of the hotels in the nearest city of importance.

THEO. F. VAN WAGENEN.

Denver, May 28.

[This discussion has become a quibble as to definitions. Mr. Van Wagenen believes that extralateral rights are essential, or at least almost so, to stimulate prospecting, and denies that there are true prospectors save where extralateral rights are granted. Our Canadian friends maintain that their woods are full of men who persistently search for mineral and who, as a matter of fact, do find it. They also point to the rapid development of the mining industry in Ontario and other provinces as evidence of the fact that extralateral rights need not be given to develop mining. To all this Mr. Van Wagenen retorts that these finders of mineral are not 'prospectors.' And so the discussion comes back to a matter of definition. Here let it rest. We cannot conceive that it is a matter of importance what name is used for the men who find and develop the lodes, so long as the latter be discovered, and certainly all must agree that the mineral industry is developing as rapidly in countries outside the domain of the American mining law as in it: and that is the main point.—EDITOR.]

The Largest Tube-Mill Plant

The Editor:

Sir—In the article 'The Largest Tube-Mill Plant,' in the *Mining and Scientific Press* of May 10, you state as follows:

"In designing the works he (Mr. Aitken) was ably assisted by C. A. Banks, of Waihi, and now the Jewel mine, British Columbia."

I would like to state regarding this, that, although the flow-sheet was arrived at prior to my joining the staff of the Waihi-Paeroa Gold Ext. Co., in August 1909, I myself was responsible for the designing and erection of this 20 tube-mill plant; and after its satisfactory completion I received a reference to this effect, signed by the directors and given under the seal of the company.

CHARLES A. BANKS.

Greenwood, British Columbia, June 3.

Special Correspondence

NEW YORK

COPPER MARKET DULL.—EUROPEAN STATISTICS.—AMERICAN PRODUCTION FOR MAY.—A. S. & R. AND THE MEXICAN SITUATION.—YUKON GOLD EXPANDS.—HEINZE AND THE STORY OF WEST DOME.

The copper market has been increasingly dull lately, there being almost a cessation of buying at the end of the last week, though small lots of electrolytic changed hands at 15c. on June 5. Periodical cessation of buying is a normal feature of the copper market, as the principal consumers buy in lots large enough to meet their requirements for a considerable period, and the principal producers commonly have their output sold ahead for two or three months in advance. As the monthly statement of the Copper Producers' Association was expected on Monday, June 9, it was only natural that buyers should be holding off in the expectation of placing large orders at lower prices in the event of the declaration of a large surplus. Sellers were theoretically maintaining a price of 15⅞c. per pound during the week, but as they were receiving no offers, this was not difficult. It was reported that 600,000 lb. of electrolytic was offered last week for four months delivery at 15⅛c., but was not taken. Custom house clearances continue surprisingly large, having been 38,251 tons for May, as compared to 32,984 in May of last year. European stocks decreased 3164 tons in the two weeks ended June 1, and the visible decreased 2514 tons, being 40,190 tons. The visible in England, France, and afloat thereto on June 1 was 29,534 tons, while stocks at Rotterdam decreased 1875 tons. Americans refuse to be completely convinced by European statistics, however, as they seem to be so little in accord with the industrial situation. It is possible, of course, that consumers are replenishing depleted stocks, but it is also possible that large stocks are going into retirement in the hope of a rising market. At any rate the better the statistical position of copper gets, the weaker the market shows; which may or may not illustrate Lincoln's famous saying as to amount of insight the public possesses.

Production figures for May are now generally available. The Anaconda, at both of its smelting plants and including custom ore, produced 25,600,000 lb., as stated last week. The Phelps-Dodge properties made 13,000,000 lb., of which 7,160,000 is credited to the Copper Queen, the Detroit 2,002,000, custom ores 1,141,000, and the Moctezuma, which is affected by the troubles in Mexico, only 1,696,000 lb., as compared with 2,735 in April. The Miami produced 1,948,900 lb. in May, as compared with 2,312,000 in April. It is hoped to make normal production during June, but there is some doubt whether it can be attained so quickly, following the recent cave. The May production of Chino amounted to 4,003,723 lb., or about the same as last. Of the $2,500,000 bonds of the Chino, $1,600,000 had been converted on June 5. At the Ray Consolidated the output was slightly larger than last month, being 4,520,000 lb. The Shannon output for May is given as 1,080,000 lb. May figures for Utah Copper are not yet available, but in April the output was 9,835,000 lb., produced at a cost of 8.8c. per pound. The yield in May is expected to be slightly larger. The Granby production for April was 1,857,452 lb. copper, 26,403 oz. silver, and 4603 oz. gold. A recent visitor to the Hidden Creek property is reported as stating that 16,000,000 tons of ore has there been developed by drilling and underground exploration. Work on the new smelter is progressing slower than was hoped, and it will not be in operation before the first of next year. Reports from Houghton state that the energies of Thomas A. Edison have been invoked to devise a new process for treating the tailing of the Calumet & Hecla and the Quincy. No statement is made as to the nature of the process. Possibly it has not even been determined as yet.

The American Smelting & Refining Co. has only about two-thirds of its normal furnace capacity in operation. At Chihuahua all six furnaces are in operation, and at Matahuela the three furnaces are in normal operation. On the other hand, the whole plant at Velardeña has been shut down for the past two months, with little prospect of speedy resumption. At Monterey, out of ten furnaces, with a capacity of 460,000 tons per year, only three are in operation, while at Aguascalientes six out of the ten are running. Most of the difficulties centre about railway traffic, the chief trouble of the smelters being due to inability to get supplies of coke and oil in, and shipment of bullion out. The Company maintains impartiality as to the warring factions and the revolution has affected smelting directly in only a small degree. The Guggenheim Exploration Co. is reported in New York to have acquired additional dredging land in the Iditarod, in Alaska, and along the American river in California. The company has increased its dividend rate to 12%. It is interesting to note

THE IDITAROD COUNTRY, WHERE THE YUKON GOLD CO. HAS BEGUN DREDGING.

that at the annual meeting of the company all the retiring directors were re-elected, with the exception of John Hays Hammond, who was succeeded by O. B. Perry. Evidently Mr. Hammond is getting more and more dissociated from the Guggenheims. The Yukon Gold Co. has declared a regular yearly dividend of 1½%, payable June 30.

The verdict in the suit of the Union Bank against F. Augustus Heinze to recover upon his notes held by the defunct Mechanics' & Traders' Bank was a good deal of a surprise, and is somewhat amusing. The defense made by Mr. Heinze in the suit was that he gave the bank, as security for the loans, certain mining shares which he later instructed them to sell and take up the loans. This the bank authorities failed to do, and Heinze put in a counterclaim for $130,000, representing his balance of the value of these securities if they had been sold pursuant to his orders. Much to the general surprise, the jury in its sealed verdict, found that he was entitled to $149,825, representing the depreciation in the value of his securities since the date upon which he instructed the bank to sell them. It is not clear whether this frees him of any obligation to repay the $195,000, to which the bank's claim was finally reduced. The outcome is illustrative of Mr. Heinze's ability to 'come back,' and awakens memories of the West Dome, of which the story has not before been told. At a time when he was in an exceedingly tight place in New York and was barely out of custody, he made a trip to Toronto, where he took the best suite at a hotel and sent out his emissaries to let it be known that he had an option on the West Dome and was willing to let others come in on it. They even approached Sir T. G. Shaughnessy, who snorted at the idea of his ever having anything to do with Heinze, but after

a telephone conversation with him, not only went to see him, but put up some money and suggested to his friends to do as well. Mr. Heinze made no claims for the West Dome, stating that it was a gamble, and it afterward proved to be a poor one. But the incident shows his ability to weather adversity and to win over his enemies.

During the month of May the sales of gold bars at the U. S. Assay Office in New York ran up to $2,873,334, making the transactions the largest for that month in four years. Of the amount passing over the counter during May, $2,561,845 was in gold bars exchanged for gold coin, and $311,489 was the value of gold paid depositers. The total does not include $27,311 exported.

BOSTON

REORGANIZATION OF BOSTON & CORBIN.—COPPERMINES MERGER.—JUNEAU DEMANDS ROOM TO SWELL.—TONOPAH STOCKS ON THE CURB.

Confidence is expressed in the reorganization plan and personnel of the Boston & Corbin Copper Co., which is almost identically the group which rescued Arizona Commercial after Mr. Amster's first financial embarrassment. The reorganization committee, headed by Harry M. Stonemetz, of the Stock Exchange house of J. W. Bowen & Co., is cleaning up the situation in a business-like way and is receiving unanimous support. The obligations of the company are being taken up and an independent examination is being made of the mine and mill with the view to adopting plans for future operations.

Two old Butte men, John D. Ryan and William B. Thompson, have been rendering the copper industry good service along the lines of peacemaking and consolidation. Mr. Thompson, who has many friends in Boston, has done this conspicuously in both the Inspiration Consolidated and Coppermines Consolidated mergers, bringing together in the two a number of hitherto rival and discordant copper interests. He has, besides, in both groups interested large banking interests. The Ely merger is regarded in Boston with approval, as it seems to be the only solution in sight of the local and physical difficulties presented by the constituent properties.

New England investors, who have put so much money into the Alaska Gold Mines Co., are interested in the memorials sent from the Territorial Legislature of Alaska to Congress asking for an appropriation to reclaim an area of tide flats in the town of Juneau so as to permit the town, which is growing so rapidly as already to be in a congested condition, to have more building room. Juneau is on the mainland on the eastern shore of Gastineau channel, a body of tidal water, approximately 20 miles in length, separating the mainland from Douglas island. Opposite the town are the Alaska Treadwell mines. The Alaska Juneau company will erect this summer a stamp-mill and reduction plant within the corporate limits of Juneau. The Alaska Gold Mines Co., operating locally as the Alaska Gastineau Mining Co., is spending several millions of dollars in the development of its properties near Juneau and in building dams and installing machinery for an electrical power plant to be used in its operations. Other mining companies in the vicinity of Juneau have extensive development plans. The result of mining activity, particularly on the part of the Alaska Gold Mines Co., has been that the Juneau population has doubled in the past year. There are now about 2000 people there, and it is expected that the population will more than double in another year. The townsite embraces 126½ blocks, four of which are reserved by the United States Government, 18 are held by churches, hospitals, and public buildings, 3 by fraternal organizations, 86 are devoted to business purposes, and 52 are on a steep hillside and are unfit for building purposes. It is proposed to build a dike and let the débris carried down by Gold creek fill up the flat within a year. Juneau wants a School of Mines building and a Territorial University, and it is desired that these be erected on the redeemed tide flat area.

It is understood that the Boston Curb will be enlivened in the near future with the addition of a few Tonopah and Goldfield stocks. The Curb governing board has felt it necessary, under legal instructions, to require rigid compliance with rules in submitting applications for listing new stocks. The Curb here is not a Curb at all, but an indoor organization, and its limitations and sense of responsibility are the same as those of the Stock Exchange. A qualified list is maintained, in which are listed all stocks which have met with every requirement, and an unqualified list, which is open only to those companies which have but partly met with requirements.

The proposal to reduce the share capitalization of Greene-Cananea will be acted upon favorably at the annual stockholders' meeting in Duluth on June 16. By changing the par value of shares from $20 to $100, the unit required by the New York Stock Exchange, it is claimed that shares will be appraised as better collateral in bank loans.

The Old Dominion-Bigelow litigation is still strung out. The copper company wants to be at liberty to declare a dividend of $10 per share on trust receipts next month. Godfrey M. Hyams, former associate of Albert S. Bigelow, wants to stop payment of more than $1,000,000, which he claims should be charged to capital account.

FAIRBANKS, ALASKA

NEWSBOY MINING CO.'S OPERATIONS.—SPALDING AND RONAN LEASE.—OPERATIONS OF VARIOUS LESSEES.

Continuous work on the Hudson brothers' property on Ester creek has opened a considerable quantity of ore, and it is the intention of the owners to start milling soon. A working shaft has been sunk during the winter, and several hundred feet of drifts were driven. The dump contains several hundred tons of ore ready to be taken to the mill as soon as a suitable road can be constructed. A complete 2-stamp Nissen mill is on the ground, ready for the first shipment. The Newsboy Mining Co. has sold a further $15,000 worth of stock for the purpose of doing more development on the property at the head of Cleary creek. While the mine has already produced about $40,000, this, together with the original subscription, has been expended in developing the property. With the present cost of operation, most of the ore so far opened is too low grade to be milled at a profit, but will be available when a tramway to the mill is built to cut the present haulage cost. As indications on the 300-ft. level are favorable for better ore, the shaft will probably be sunk to the 500-ft. level and drifts driven each way. L. B. Rhoads, of Bedrock creek, has consented to supervise the exploration work.

CHENA CUSTOM MILL IN FAIRBANKS DISTRICT.

After a trial treatment of 8 tons of ore from the Big Eldorado property at the Fairbanks test-mill, which yielded $20 per ton, Al. Goodwin has decided to continue work on the vein discovered last fall. The ore-shoot has been found to dip toward the Big Eldorado side, and work will be done in that direction. A shipment of five tons from the upper shaft of the Friedrich vein at Ridgetop is now awaiting treatment at the same mill. The Spalding & Ronan lease on upper Dome creek has been making regular weekly clean-ups of $2000 to $5000, and as better rock has been

opened, the average for the summer should be at least $5000 per week for the 2-stamp mill. Mr. Ronan and Mr. Spalding have charge of the mine, while L. A. Freestone is millman. This property has the record of production in the district for the size of its reduction plant. On the adjoining claim, the Wild Rose, Keegan & Cole, the lessees, are also in good ore, and should produce considerable gold this season.

Development on the Pioneer claim, at the head of Fairbanks creek, owned by Angus McDougald, has opened 160 ft. of backs for some distance along the vein, and stoping will begin at once. The ore will be milled in the Furstenau Little Giant mill near the head of the creek, if it is found to be suitable for the work. Otherwise, shipments will be made to the Willis mill on Chatham creek. While owned by L. J. McCarty this claim produced about $10,000, and this will be the first ore milled on a large scale since the change of ownership. The Hungerford and Foster lease, on the Empire group, on upper Chatham creek, has had two clean-ups since the beginning of 1913, both of which showed good results. The lessees will continue work this summer, as the property is close to the Willis mill, and the ore being stoped yields a good profit. On the same creek the Chatham Mining Co. is making the best showing in that vicinity, as regular weekly clean-ups of several thousand dollars have been brought in since the first of the year.

One of the best undeveloped prospects seems to be the vein found by Geo. Perrault at the head of Fish creek. A sample across the 2-ft. vein assayed $580 per ton in gold and 2% bismuth. It is to be hoped that the croppings are a fair indication of value to be found at depth. The rock is of different character from most of the properties in the district, and occurs near a granite contact.

The placer output for the Fairbanks district should at least equal, if not surpass, that of last year, according to the estimates of local bankers who have toured the producing creeks recently. Many of the winter dumps are 'sluicing' better than expected, and on all the creeks many large plants will be busy throughout the summer on good 'pay.' In the Cleary and Chatanika district, at least six sets of operators are now sluicing, while several open-cut propositions will be sluicing later. Nine large plants are working in the Ester creek district, with several more to commence later. Goldstream and tributaries are being worked by 17 plants, while Dome and Vault are the scene of operation of 13 more. Some of the last are hoisting 'pay' that will materially help the total. While the Fairbanks creek placers are not supporting so many large plants, some of these are in richer gravel than anywhere in the 'camp.' Everything points to a prosperous season among the placer miners. The rate war inaugurated by the invading White Pass Co., that will materially reduce the cost of supplies, and the railroad legislation now being agitated at Washington, D. C., will all serve to keep the district in expectation of better times when the large amount of low-grade ground available can be worked at a fair profit.

The consulting engineer of the Tatlanika Power Co., Walter Gordan Clark, will be in on the first boat, and that beneficial scheme will probably come to a head this summer. Cheap power would mean a lot to the community.

LONDON

SOUTH BLOCKS INCREASES RESERVE.—SELECTIVE FLOTATION AT BROKEN HILL.

Recent exploration work at the South Blocks mine at Broken Hill belonging to the Zinc Corporation have shown that the orebody has greatly extended in width recently. It will be remembered that this mine contains two parallel lodes, one high in lead and the other high in zinc. The work so far done has been chiefly on the former. The thickness in the upper levels has averaged 10 to 18 ft., but on the eighth level the cross-cut continued in ore in a most gratifying manner, and the daily cables of progress formed exciting reading. Finally the width of the lode was proved to be 50 ft. Probably further development will show that the zinc lode is another leg of this orebody, which itself will prove to be the main lode of the district. In the original developments in the centre of the district the wide orebody came right to the surface and was not split in this way. The actual quality of the ore as exposed on the eighth level is not quite clear, for while some averages are moderately high, others are low in all three metals, lead, zinc, and silver. The developments at the new lode at the British mine are not proving the existence of the bonanza prognosticated on its discovery last year, and much work will have still to be done before a sound judgment can be passed. By the way, the engineers at the British have scrapped the Elmore zinc plant and are erecting one on the Minerals Separation system.

While writing of Broken Hill, it is interesting to note that selective flotation in the treatment of slime is rapidly progressing. The flotation of galena first and blende afterward has been adopted at the South mine and also at South Blocks. At the latter the process has been evolved under the guidance of James Lyster, the mill foreman. Galena can be raised without any acid being added, and subsequently the modification of the floating medium by the addition of acid raises the blende. Unfortunately for South Blocks, the ore contains much calcite, and the amount of acid used in consequence is prohibitive, so at present only the lead is being saved from the slime. It is a fact often forgotten by outsiders that the proportion of calcite and other carbonates in Broken Hill ores varies greatly at the different mines. At the Proprietary it just happens that the right amount of carbonate is in the ore to suit the Potter-Delprat process. At most of the other mines this process would never do, as the calcite would eat up large amounts of acid or acid sulphate.

JOHANNESBURG, TRANSVAAL

APRIL OUTPUT.—CROWN MINES FIRST AGAIN.—ROUND AND RECTANGULAR SHAFTS.—VENTILATION.

The April output of gold was, on the whole, highly satisfactory, although as compared with the previous month there was an actual decrease of 5578 oz. This is explained by the fact that April was a shorter month, but nevertheless the average output for April was per working day the highest yet recorded. The output from the Rand alone was 755,853 oz., value £3,210,682, and from the outside districts 29,116 oz., value £123,676. The stamps at work continue to increase, not so much perhaps on account of new mines starting up, as on account of the low-grade mines finding it necessary to keep the tonnage milled on the increase, in order to maintain and if possible to increase working profits. Thus the Simmer Deep brought into use in April an additional 20 stamps, and the Jupiter, a neighboring low-grade mine under the same control, 10, while Randfontein Central, where labor is more plentiful than before, an additional 15 stamps in the big mill were dropped, thus bringing the total number of stamps at work to 865 out of 1000 available. This increase did not, however, restore the Randfontein Central to the first position, that going again to the Crown Mines, where, with 660 stamps and 25 tube-mills, 196,600 tons was milled, yielding an output valued at £297,073, as against £275,843 at the Randfontein Central, with 865 stamps and 29 tube-mills, milling a total of 230,820 tons. A similar difference separated the East Rand Proprietary Mines from the Randfontein Central, so that as time goes on the Crown Mines seem to be making its position at the head of the list more secure. Judging from the April output, the gold production for May ought to constitute another record, and providing the supply of native labor can be kept at anything like its present level, other record outputs seem sure to follow. The labor position generally, however, goes worse at this period of the year, and already the number of natives available for work at the gold mines is beginning to show a decline. There are, however, several good light stoping drills now available on the Rand, so that to some extent the mines are now better prepared for a decline in the labor supply than formerly.

As an illustration of the difficulty experienced in providing an adequate amount of ventilation to promote the

necessary efficiency and combat miners' phthisis in the deep-level mines of the Rand, the decision of the Eckstein group to sink large circular brick-lined shafts on the City Deep and Crown Mines for ventilation purposes alone may be quoted. An 18 ft. diameter circular shaft has just been successfully sunk on the New Modderfontein property, and at a cost that favorably compares with the ordinary rectangular shaft usually in use on the Rand. At Modderfontein, it is understood, however, that the circular shaft is designed for hoisting as well as for ventilation. These circular shafts are being sunk with an area approximating that of a 7-compartment rectangular shaft usually sunk on the Rand, but as a circular shaft is usually only divided into two winding compartments, there are, of course, conditions under which a 7-compartment rectangular shaft is to be preferred. Compound or inclined shafts such as are generally in use on the Rand are not suited to the employment of cages, generally used in circular shafts, and for round shafts to show the same hoisting capacity as rectangular shafts, special planning of the underground workings is necessary, and up to the present this has not always been found possible on the Rand. On this and other accounts, circular shafts have not been hitherto regarded with favor on the Rand, and comparatively few are in use for hoisting purposes. When, however, it comes to the important matter of deciding the shape of a shaft on the question of ventilation alone, then the majority of engineers would have no hesitation in recommending the adoption of the circular shape, especially seeing that with a similar area, a circular shaft must be quite double the efficiency of a rectangular shaft, when so divided up into compartments as is usual on the Rand. The short experience here with rectangular shafts of even large dimensions for very deep-level mines has not been altogether satisfactory from a ventilation standpoint, and several of the large deep-level properties have on several occasions been almost closed because of lack of air.

ONTARIO

POWER SITUATION.—PORCUPINE GOLD MINES CO.'S AFFAIRS.—MINING ACCIDENTS.—LABOR AT COBALT.—DOME MINES CO.

Shortly after the Wawaitin power-plant started delivering power again to Porcupine, some of the generators were burned out during a severe electrical storm. The damage, however, is much less serious than on the previous breakdown, and the companies are endeavoring to give the Dome and the Hollinger sufficient power to carry on operations. The rest of the district is still running at reduced capacity, but the power company should be able to meet all requirements within a short period.

The Porcupine Gold Mines Co., generally known as the Vipond, is offering to its shareholders $125,000 first mortgage 7% bonds, redeemable June 14, 1915. The bonds carry a 25% bonus of common stock, and are offered at par. They are redeemable at $102, and accrued interest in whole or in part on any interest date prior to maturity. The security is a mortgage on all the property and franchises of the company. This action was authorized by the shareholders at a special meeting last February. The creditors of the company are prepared to take bonds in part payment of their claims, and shareholders of the company are assured that unless the bonds are subscribed for, that a reorganization of the company will be necessary. A special meeting of the shareholders of the Dome Extension mine was called for May 28 to ratify the proposed increase in capitalization from $2,000,000 to $3,000,000. This increase is necessary in order to provide funds for further development.

The official report of mining accidents in Ontario for the first three months of the current year shows a regretable increase in the number of casualties, both fatal and non-fatal, as compared with the corresponding period of 1912. The inspector is at a loss to suggest a reasonable explanation, as the accidents are not confined to any particular locality and the increase is common to all branches of the industry. During the period there were 21 fatalities in the mines, against 8 in the corresponding period of the previous year. In the quarries there were 4 fatalities, and in metallurgical works 5, as against none for 1912.

After two unsuccessful attempts, agitators in the Cobalt district finally succeeded in having a vote cast on May 25 to decide whether or not a strike should be called. The result of the ballot was made known on June 1, and it was found that the men had voted against going out. The agitators argued that, when the eight-hour law comes into force in January 1914, the mine managers intended to make a cut in wages, and as it would be inadvisable to call a strike in the winter time, they wish to call it now while conditions are favorable, and have this point decided. While this argument was advanced by the mine managers at the time they were protesting against the passage of the law, they have practically all stated that since the legislature sanctioned the eight-hour day, that no attempt would be made to cut wages. The men in the Cobalt district have no grievance when their condition is compared with the men in the Western 'camps.' The class of labor is poorer, while the rate of wages is practically the same, as drill-runners are paid $3.25 to $3.50 per day, and are charged only 60c. per day for board.

At the annual meeting of the Dome Mines Co. the shareholders authorized the increase in capital from $3,500,000 to $5,000,000. Only such an amount will be issued as is necessary to increase the capacity of the mill by an additional 60 stamps. It is expected that 50,000 shares will be issued to the shareholders at par. The amount realized will be more than sufficient to permit of the proposed extensions.

PLATTEVILLE, WISCONSIN

RECORD OF THE MONTH.—MINERAL POINT COMPANY CONTINUES TO BUY MINES.—VINEGAR HILL AND WISCONSIN ZINC ALSO BUSY.—DEEP ORE FOUND AT THE MARSDEN.

Active operations over the field for the month may be summed up briefly as follows: H. Lewis of Highland sold 51% of the stock of the Franklin Mining Co. to the Mineral Point Zinc Co. for $60,000. The O. P. David Mining Co. is installing pumps, compressors, hoists, and a tramway at a new shaft completed this month near Montfort. The Mineral Point Public Service Co., operating an independent electric power and lighting line, reached Livingston with transmission wires. Linden is developing two new mines and shipping heavily. One of the most magnificent zinc oxide furnaces in the world is now complete at Mineral Point, the property of the Mineral Point Zinc Co., at a cost of $1,000,000. The famous Empire mine, at Platteville, the most consistent zinc producer and the greatest dividend payer ever developed in the Wisconsin field, played out entirely during the month, and track, pumps, and hoists were pulled. The Vinegar Hill Zinc Co. brought a new 125-ton power and concentrating plant into commission at Big Patch, five miles south of Platteville. A big body of zinc ore has been developed.

The famous Baxter mine, at Cuba, was closed down for good and the concentrator is running on the tailing accumulated, and making six tons of concentrate per day. The Crawhill mine at Shullsburg, which paid $28,500 dividends per month the past year, laid off 60 men during the month, giving the low prices for zinc ore as the cause. Several other mines in this district have been shut down for the same reason. At Hazel Green, the Cleveland Mining Co. is erecting a complete mine equipment at the Scrabble Creek mine, and the Lawrence property, newly developed, is being equipped throughout. The famous Marsden mine, now the property of the Mineral Point Zinc Co., having been bought for $165,000. A big force is getting it in operating order. A number of miners' cottages are being built. Drilling below the old levels showed 50 ft. of mineralized rock. This is one of the biggest finds ever made in the field. A score of Keystone machines are at work prospecting new allotments in the Benton district with uniformly satisfactory results. The Wisconsin Zinc Co. purchased the Federal Lead & Zinc Co's holdings at Day Siding on May 19. No figures were given out for publication. Detailed figures of production and prices for the month are given on page 924.

General Mining News

ARIZONA

Gila County

(Special Correspondence.)—The flotation tests at the experimental mill at the Inspiration are understood to be quite satisfactory to date, the only trouble being caused by the chalcocite ore in a granite gangue, instead of the usual schist. As soon, however, as the difference in the ore was realized, a change in the proportions of chemicals promptly overcame the difficulty.

Globe, May 5.

The Inspiration Consolidated Copper Co. has finally decided to adopt the compressed-air system for its haulage underground. The locomotives will be furnished by the H. K. Porter company of Pittsburgh, and will be of the 10 and 14-ton type. This system will be installed throughout the mine, including the Live Oak division, and charging stations will be placed at regular intervals. The 10-ton locomotives will be used for haulage between the Joe Bush and the main shafts, while the 14-ton size will be used for haulage between the Live Oak workings and the main shafts. The first cost of installation of the compressed-air system will be much greater than that of electricity, but it is stated that through avoiding the inconvenience of trolley wires overhead in the haulage drifts and around the chutes, together with the economy in operation by compressed air over that of electricity, the choice is more than justified. An air-compressor which will compress air to 1000 lb. pressure will be installed. This compressor will be placed near the hoisting plant at the main shafts, and a specially made pipe will be used for distributing the air to the various charging stations throughout the mine. The electric locomotives now in use will be gradually displaced from the haulage service and disposed of.

The Gibson copper mine, in the Globe district, has been leased by Sultan & Wayne. At one time this property yielded rich ore. The old Stonewall Jackson mine at McMillen is also being reopened. Down to a depth of 600 ft. the ore contains silver.

On June 2, in the presence of about 1200 people, No. 2 blast-furnace of the Calumet & Arizona company's new plant was blown in.

Pima County

A property of the Calumet & Arizona, which is attracting considerable attention, is the steam-shovel project in the Ajo mountains of Arizona. It is stated that 85 drill-holes have shown a good grade of ore, and that the management is now certain of having developed a big disseminated orebody which, having little overburden, will be mined by steam-shovels.

Yavapai County

The Emporia mine, in the Groom Creek district, is being reopened. At the Climax, 28 men are employed and the 10-stamp mill is working full time. After a period of six years, the Gold King property is being developed.

Yuma County

(Special Correspondence.)—The work of repairing the shaft in the Fortuna mine is in progress, and several carloads of lumber have arrived and are being hauled to the mines. A part of the water-pipe and some of the pumping machinery have also arrived. Twenty men are now employed in the work of timbering and several more will be employed on the pumping plant.

Blaisdell, June 5.

CALIFORNIA

Amador County

(Special Correspondence.)—Work at the Plymouth mine, now being reopened by Bewick, Moreing & Co., continues to show most encouraging results. Ore-shoots have now been opened on the 1500, 1600, and 1850-ft. levels, and in such position as to indicate that two separate shoots have been found. On the 1500-ft. level a shoot 110 ft. long, averaging 3½ ft. wide and $5 per ton, has been opened south of the shaft. On the 1600-ft. level, what is presumably the same shoot has been opened for a length of 25 ft., and averages $7.20 per ton for the full width of the drift. In a cross-cut the ore has been driven through for 16 ft. and has an average value of $6.50, the face of the cross-cut still being in ore. The full extent of this shoot on the 1600-ft. level has not yet been defined and, according to the rake of the shoots in the mine, this orebody has not yet been reached on the 1850-ft. level. The second ore-shoot was found north of the shaft on the 1600-ft. level and showed a value of $6 per ton over 115 ft. along the drift. On the 1800-ft. level this ore-shoot is opposite the shaft and drifts have been driven on it both north and south for a total distance of 300 ft., of which 275 ft. shows an average value over the width of the drift, of $6.25 per ton. Here again the full width of the orebody is still to be determined so that definite estimates of reserves cannot yet be made. The finding, however, of these two ore-shoots at such depth has confirmed the judgment of the engineers opening the property and greatly stimulated interest in the Mother Lode.

Plymouth, June 9.

Butte County

The Butte Creek Consolidated Mining Co. is being sued for $15,000 by Lloyd C. Johnson for alleged negligence of the company. Johnson was employed on the dredge, 12 miles from Chica, and had a hand badly mangled.

Calaveras County

It is stated that the Calaveras Copper Co., at Copperopolis, has shipped to the Selby smelter 75 tons of ore averaging 8.32% copper, which realized $1065. On cars No. 155 and No. 156, amounting to 97 tons and averaging 8.70% copper, the company realized $1469.

Eldorado County

Jay H. Robinson, one of the lessees of the Beebe mine in Georgetown, has secured underground right of way through

TOWN OF BODIE, MONO COUNTY.

a good part of the property on the west side of the town, following the Beebe vein for several hundred feet southward. Mr. Robinson stated that his company will be ready to begin extensive development work on the Beebe mine after the middle of June.

Mariposa County

(Special Correspondence.)—The Bondurant Mining Co. is reopening one of the older mines in the Coulterville district. The Bondurant mine has produced a good deal of gold in the earlier days from the workings above the 400-ft. level. In reopening this mine many thousands of tons of good ore in place was found, which 30 years ago was considered of no value. New development to determine the extent of the ore-shoots is now being carried on with headings on the 300-ft. level, at present over 600 ft. apart, and both in excellent milling ore. This development is in the east belt of the Mother Lode, and often pockets of specimen ore are found without any indications or change in the general value of the vein. A 10-stamp mill was put into working condition last year, and a mill-run made of a general sample of the vein. The results of this test have proved satisfactory to the management, and it has been decided to drive an adit from the north fork of the Merced river to further develop the property. This will open up 1400 ft. of backs in the mines. Even

tually the stamp-mill will be removed to the river, which will insure plenty of water and allow all ores to be handled by gravity. G. H. Gerkin is superintendent in charge of the work, which has been financed by A. L. Adams and associates of Boston.

Coulterville, May 31.

The property of the Oaks & Reese Mining Co., situated in Hunters valley, has been leased for three years. The mine will be unwatered and there is a mill on the property. About 25 locations have been filed with the recorder, as a result of bonding the copper claims of W. Boldt and W. M. Eubanks, near Mariposa.

Modoc County

Nine sacks of ore sent to the Selby Smelter recently, from the Sunshine mine, at High Grade, returned $417 per ton.

Nevada County

A fire broke out in the Champion mine on June 6, and probably it will have to be sealed. This property was recently acquired by the North Star Mines Co. of Grass Valley.

Plumas County

The Independence mine, near Quincy, has been acquired by well known Sacramento people. About two years ago rich ore was shipped from the mine to the Selby smelter.

Shasta County

J. S. Strode is building a 10-stamp quartz mill on his Black Hawk claim, a mile above the Mad O. mine, near Whiskeytown. The mill will be ready for operation by the first of July.

An asbestos boom has been started on Mears creek west of Sims. Twenty-eight claims were located on June 9 westward along the creek as far as Trinity county summit. Another rich shoot has been opened in the Gladstone mine, at French gulch. Thirty stamps and 120 men are employed, while regular dividends are disbursed. Concentrate is shipped to San Francisco. I. O. Jillson is manager.

Tuolumne County

Three years ago the Rawhide Gold Mining Co. entered suit against the Dutch Gold Mining Co. for $150,000 for damages by reason of workings of the App mine being flooded with water from the Dutch, and $100,000 for payment for ore said to have been taken by the Dutch company. The United States District Court dismissed the action, the first-named company having no basis for its suit.

COLORADO

Clear Creek County

(Special Correspondence.)—The Mineral Chief mine, including the 50-ton concentrating plant below town, is reported as having been sold by C. E. Pughe, of Longmont, to Eastern capitalists, for $100,000. Work was started last week in repairing the premises. E. J. Butts has taken a bond and lease upon the Sunburst, Scepter, and Astor groups of mines on Democrat mountain. Development has been started, and as soon as the premises have been repaired, ground will be thrown open to lessees. A greater campaign of development will be started at the Centennial mine during the present month, and shipments of ore started for the Argo reduction plant at Idaho Springs. David Kennedy is owner. J. R. Campbell, of Denver, is opening the Fort Dodge property on Leavenworth mountain. The 450-ft. adit is to be extended, while cross-cutting will be started to cut a number of veins. The Onondago Mining Co., owning the Ruler and Comet mines on Griffith mountain, has started development. Work is being carried on through the Capital adit, as well as near the summit of the hill. A. H. Osborne has been appointed manager. Shipments of lead-zinc ore have been started from the Phonolite property. L. B. Davenport, the owner, is sending the product to the Scotia mill, where it is concentrated. Work has been resumed in the advance of the Silver Plume adit, which is prospecting the vein system of McClellan mountain. W. H. Stevens of Silver Plume is manager.

Georgetown, June 2.

Gilpin County

Electric motors are to be installed to drive the surface equipment of the Carr mine, and development will be started. The shaft is about 900 ft. deep, and an examination has been made to 750 ft. Gas has interfered with mining, and fans are being installed. The Cleveland & Central City Mining Co. has cut 3 ft. of rich copper-gold-silver ore in the Barnes property.

Pueblo County

One hundred and fifty men, forming the 10 o'clock shift of the United States Zinc Co.'s smelter, at Blands, three miles east of Pueblo, went on strike on the night of June 5 to enforce a demand for increased wages. About 500 employees of the company are concerned in the strike, which is a result of the enactment of the new eight-hour law for mine and smelter employees. The men demand an increased time scale because of the shorter day.

Teller County (Cripple Creek)

Water in the mines receded 7 ft. in May. The present flow is 8600 gal. per minute. According to local figures, the production during May was reported as follows:

	Tonnage.	Average value.	Total.
Golden Cycle	33,000	$20.00	$660,000
Portland	10,100	22.00	202,200
Smelters	3,800	65.00	247,000
Portland at Victor	14,218	3.30	47,919
Stratton's Independence	10,326	2.30	24,472
Ajax	3,400	3.40	11,560
Dante	2000	3.25	6,500
Joe Dandy	1,650	2.20	3,600
Wild Horse	1,400	3.25	4,500
Isabella	500	2.00	1,000
Total	80,394	$15.09	$1,208,751

The yield in carloads from individual mines was as follows: El Paso, 152; Vindicator, 64; Modoc, 4; Isabella, 70; American Eagles, 17; C. K. & N., 22; and Abe Lincoln, 11 cars. Rich ore is being mined on the 350-ft. level of the El Oro Mining & Milling Co. The Doctor Jack-Pot company has bought the Work company's claims for $100,000.

The San Juan

There are 620 men employed in the Ouray district, including 175 at the Camp Bird, 78 at the Atlas, and 60 at the Wanakah.

IDAHO

Shoshone County

Reports from Burke state that the cross-cut from the 550-ft. level in the new 3-compartment shaft being sunk in the Marsh mine, near the Hecla, opened ore on June 3. It is about five feet wide, half of which is high grade and the remainder milling ore. The point where the discovery was made is 550 ft. below the floor of the adit-level, and 150 ft. lower than the bottom of the old incline shaft, while the vertical depth from the surface is a little more than 1000 ft. The new 150-ton mill for the Green-Hill-Cleveland company is nearly complete. The zinc ores will be treated by concentration and flotation, the latter being perfected by George Wyman when at the Hercules mill.

MONTANA

Receipts of gold at the United States Assay Office at Helena in May, from Montana counties, were $98,057, divided as follows: Chouteau, $29,013; Fergus, $25,826; Granite, $419; Jefferson, $149; Lewis and Clark, $7819; Madison, $32,546; Missoula, $796; Powell, $1363; and Silverbow, $124.

Lewis and Clark County

The Penobscot Mining Co., of Helena, will add to its equipment for electric drive, five motors, ranging from 10 to 25 hp., one 10-kva. and three 50-kva. transformers, and switchboard, all of which have been ordered from the General Electric Company.

Silverbow County

(Special Correspondence.)—It has been definitely ascertained that the large purchase of claims in the south-

eastern part of the district is for the North Butte company. For months Charles Mattison, a well known attorney, has been quietly securing shares of the Idaho-Montana, the Amazon-Butte, and other claims in the locality, and the deeds have been made out in the name of W. D. Thornton, president of the Greene-Cananea company. At first it was supposed that Mr. Thornton was acting for John D. Ryan, president of the Amalgamated company, but Mr. Mattison denied the rumor, and at the same time refused to say anything beyond what could be ascertained from the public record, as to the recording of the deeds.

Butte, June 6.

The success of all the so-called regular candidates for office in the election held on June 5 by the Butte Miners' Union, the parent body of the Western Federation of Miners, was conceded this afternoon by socialist watchers. The regulars polled a vote of two to one against the socialists. The I. W. W. candidates were a poor third. This is the first time in years that such a reversal has been shown in the Butte Miners' Union.

NEVADA

Clark County

(Special Correspondence.)—The Quartette property has been sold by the Quartette Mining Co. to Charles H. Jonas and B. F. Miller, Jr., for nearly $500,000. This is a large deal, and includes the Rambler, Boston, Fourth of July, Red Iron and John groups, the Searchlight hospital, Quartette railroad, and Searchlight Western Telephone & Telegraph Co. Two years ago the company discontinued operations on its own account, after having thoroughly worked the mine to the 1400-ft. level, leaving little ore in the mine. A lease was given to Mr. Jonas by the company on its entire holdings, he in turn sub-letting sections of the properties and different levels of the mine to former employees, which in most cases turned out profitably. The mill, which had lain idle for some time was overhauled. The equipment on the property at the present time consists of a 40-stamp mill, 150-ton cyanide leaching plant, and 75-ton modern slime plant. There are 97,000 tons of tailing which assay between $3 and $4 per ton, now being treated in the new slime plant recently installed by the Colorado Iron Works for Mr. Jonas, who, while a Harvard graduate, started in the mine as a shoveler. He has now not only got experience but the mine, too.

Searchlight, June 7.

Eureka County

The Buckhorn Mines Co. will install considerable new electrical apparatus at its mines at Beowawe and Palisade. In the power-plant equipment are included two 345-kva. generators with 35-kw. exciters; one 10-kva., two 25-kva., and eight 219-kva. transformers and switchboard apparatus. For operating mining machinery, 24 motors, ranging from 10 to 100 hp., will be employed. All this electrical equipment will be supplied by the General Electric Company.

Humboldt County

On No. 10 level of the Seven Troughs Coalition mine, 18 in. of ore assaying about $200 per ton has been opened. This is the third important development during the past few weeks. A large body of high-grade ore has been opened in No. 5 adit of the National Mines Co. The National Mammoth Extension Mines Co. is making good progress with its adit through the Wheeler lease. At Rochester, it is proposed to construct a railroad to the Southern Pacific.

Lyon County

Ore received at the Mason Valley smelter during the week ended June 7 was as follows: Mason Valley mines, 2151 tons; Nevada-Douglas, 1124 tons; and other mines in district, 1012 tons; a total of 4587 tons. Seven carloads of matte were shipped.

The development in the Mason Valley mine during the past two months has been favorable, particularly on the 72-ft. level below No. 4 or main adit, where are excellent prospects of opening a long shoot of about 3% copper ore. Cross-cuts in the upper levels have indicated the probabilities of a long ore-shoot above No. 2 level.

Nye County

There is a good deal of activity at the placer claims in Manhattan gulch. The American Flag is the farthest down, and bedrock is at 80 ft., and with 25 ft. of driving, the channel will be cut. A good deal of work is being done by lessees and others, who are washing good gravel. That on the Fairview averages $5 per yard from 15 ft. width and 3 ft. thick. T. Wilson has a washing plant of 200-ton capacity per 8-hour shift. The Snowden Placer Co. is raising 15 to 20 yards per day of $5 gravel; and the San Antone Placer Co. has 10 men employed producing gravel worth $5 to $8 per yard.

The Railroad Valley Co. is about to drill a second deep hole for potash on its property, and hopes the results will be conclusive.

Storey County

The report of the Truckee River General Electric Co., which supplies power to the Comstock mines and other districts, shows the following results for 1912: Operating revenue, $276,585; operating expenses, $87,616; interest on funded debt, $69,895; surplus for year, $119,511; dividend of 4% on common stock, $120,000; surplus at December 31, 1912, $514,521. Julius H. Berghaufer and W. H. Moise, members of the San Francisco Stock Exchange, on June 9 brought suit for $25,000 damages each against the Mexican Gold & Silver Mining Co. for alleged libel. The directors of the company are named as the defendants. The controversey is over the booklet and various circulars written by Whitman Symmes and circulated by him and his associates.

White Pine County

Preparations are being made by the Nevada Consolidated company to start mining the Ruth ore. This will be hoisted

TOWN OF ELY.

through the Star Pointer shaft, which was sunk for this purpose six years ago. The Star Pointer shaft is equipped with a 140-ft. head-frame and 300-hp. General Electric geared hoist. Production from the Veteran section will be reduced.

NEW MEXICO

Socorro County

An interesting copper prospect, operated by Constable, Christensen, and Cooper, has been opened at the north end of Magdalena mountain. The ore consists of black and red oxides, chalcopyrite, and carbonate of copper. It is reported that the old iron Mack is to be reopened. This is a famous mine that figured largely in the old days of wild-catting.

TEXAS

El Paso County

Threats to close every smelter in the southwest and northern Mexico are made in a written declaration signed by Charles Moyer, president of the Western Federation of Miners. The announcement was made to striking employees of the El Paso smelter by Charles Tanner, national organizer for the federation. Moyer could not remain here to deliver personally his message and hurried to Denver. The federation declares that it intends to unionize every Guggenheim smelter or close down the plants. A high stockade has been built around the El Paso smelting plant to protect the works from the strikers, who have been out

for two months. The fence is made of heavy lumber and is more than six feet high, with a double strand of barbed wire run around the top of the fence. The searchlight, which has been part of the protective work at the plant, is not working at night now. A stylish straight-front corset of concrete has been fitted to the big smokestack at the smelter, according to the *El Paso Herald*. The stack was discovered to be losing its form, and the engineers planned a new set of stays for it.

UTAH

Juab County

Rich ore, containing bromide of silver, is being mined in a raise above the 2000-ft. level of the Yankee Consolidated. At the Grand Central mine, work has been suspended on the 2400-ft. level on account of a flow of water in the winze. The May Day tailing dump contains about 60,000 tons, with gold, silver, and lead, and a cyanide plant is to be erected for its treatment.

Salt Lake County

The United States Assay Office has been removed from the old location to the top floor of the remodeled post-office building at Salt Lake City. This office averages about $100,000 per month in bullion from Utah, Nevada, and Idaho.

Summit County

The Silver King Coalition Mines Co., will add to the equipment of its mines at Park City a 240-kva. motor-generator set with 14-kw. exciter, which will drive a new 200-hp. motor for operating an electric hoist. All the electrical machinery and switchboard apparatus have been ordered from the General Electric Co. During May ore shipments from Park City district totaled 173 cars, with 6576 tons, of which the Silver King Coalition contributed 3434 tons, Daly-Judge 1639, and Daly West 1192.

Tooele County

On June 25 the Consolidated Mercur Gold Mines Co., whose mine and mill is now permanently shut down, will pay a dividend of 3c. per share, amounting to $30,000. This is the result of a general clean-up in the mill. Other revenue will be received from sales of machinery.

CANADA

British Columbia

The Portland Tunnel Co.'s adit at Stewart is now in 1160 ft., in hard rock. Twenty-four men are employed. The Bitter Creek placers are being examined by Vancouver people. Good antimonial-lead ore has been opened in the Ruth and Francis property. During the winter, 20 to 25 men were employed at the Inland Empire mine, in the Sookie mountain district, doing 800 ft. of development. The 10-stamp mill started for the season on May 28. It is proposed to construct a 500-hp. hydro-electric plant, and a 35-stamp mill.

CHILE

Stephen Birch, vice-president of the Braden Copper Co., has returned to New York from an extended visit to the company's property in Chile, prepared to recommend that the plant be increased to double its present capacity. He stated before leaving Chile that there are now time about 4000 men employed on the property, managed by skilled Americans. The railway from Rancagua to the mines, 72 km. (50 miles) long, which is owned by the Company, has been well ballasted and put in excellent condition. All the power used in the mining and milling operations is developed by use of the Cachapoal river, and the Company owns one of the best power-sites and plants in Chile. Operations at the new mill and the old mill are being carried on with the ordinary wet method of milling, the slime being treated by the Minerals Separation process. A crushing plant for fine grinding is now being built, and upon its completion there will be treated 3000 tons of ore per day. It is also proposed to smelt the concentrate on the property, and a plant for this purpose is now nearing completion. The present production is at the rate of 20,000,000 lb. of copper per year, and with the completion of the smelter in a few months it should be about 36,000,000 pounds.

COLOMBIA

(Special Correspondence.)—A 20-ton cyanide plant is being erected at the Chicago mine, in the district of Guamoco. The general scheme is: crusher, ball-mill, and tube-mill, using Dorr thickeners and agitators for continuous decantation. The plant will not be running before the beginning of 1914, owing to the difficulties of mule transportation in Colombia.

Cartagena, April 22.

MEXICO

Chihuahua

Rebels who have been in the vicinity of Yoquivo for several weeks have disappeared entirely, and it is the impression that they have gone toward the south to join forces with Pancho Villa's band. The Yoquivo Development Co. and other large properties in the district are working without hindrance. Charles Qualey is general manager of the Yoquivo mine.

Durango

The Bacis Gold & Silver Mining Co. has been forced to suspend operations on account of the unsettled conditions. Mr. McNeill, manager, and the staff of the mine, have gone to Mazatlan, Sinaloa. This company has a stamp-mill and sand, slime, and concentrate-treatment plants.

Jalisco

The concentrating plant of the Magistral-Ameca Copper Co., in the Ameca district, is working full time. Ore averaging 5% copper is being milled, producing about 16 tons of concentrate per day. This is shipped to the Aguascalientes smelter.

Mexico

The Esperanza mill worked 28 days in April and treated 5360 tons of ore, and 10,763 tons of tailing, producing $64,441 from the mill and $46,369 from 508 tons of concentrate smelted. Total operating expenses were $89,585, leaving a profit of $21,225. Development covered 1091 ft. On the San Carlos vein, the various drifts were advanced 248 ft., showing an average of $15 gold per ton over 60 in., while in the 226 ft. driven on the raises, the average was $26 over the same width.

Sonora

Advices from the south are to the effect that there has been severe fighting between the state and federal troops in the vicinity of Santa Rosa, a station on the line of the Sonora railway between Ortiz and Empalme, with heavy losses. At Cananea there is no trouble, the vigorous administration of the newly appointed prefect, Ignacio Bonillas of Nogales, having wrought a great change in the delicate situation existing there. Supplies are going into the district by rail.

The Del Pilar mine, near Santa Cruz, and 40 miles northwest of Cananea, is said to have been sold to the Manhattan Development Co. for $88,000. Work on the 300-ft. level has been encouraging, and shipments this year have averaged 12% copper. The Manhattan company has been operating in this state for several years. The Oputa district, in the Moctezuma country, is showing activity of late.

A considerable decrease in the amount of ore shipped from Mexico is shown by the May report of the Agua Prieta customs collector. Altogether, 280 cars, or 10,745 tons, passed through the 'port'. Nacozari led as usual, despite the strike which was in progress for several days, sending out 205 cars, or 8341 tons. Churunababi was second, with 1563 tons, while El Tigre had 474 tons. The Vaquero shipped 51 tons in two carloads. Two carloads came from the Archipelago. The other shippers which sent out one car each were La Fortuna, La Union, El Temblor, La Violeta, La Gloria, Agua Buena, Luz Roja, Panama, La Sonora, Rosario, and Alicia. El Tigre also shipped 60 bars of bullion weighing 6820 lb. El Temblor shipped 20 sacks of high-grade gold-silver ore valued at $10,000. The estimated values for the month, in Mexican currency, were: copper, ₱989,200; silver, ₱461,700; gold, ₱273,900; total, ₱1,724,800.

Schools and Societies

COLUMBIA UNIVERSITY held its Commencement day on June 4, and over 2000 students graduated; a record for the 159 years of the institution's life.

The UNIVERSITY OF ILLINOIS Department of Mining Engineering was opened in 1911. The course during the freshman and sophomore years includes the same elementary training in languages, mathematics, mechanics, drafting, physics, and chemistry as the other engineering courses, with the addition of elementary geology, and the elements of mining, such as blasting, drilling, timbering, shaft-sinking, and tunneling. The mining laboratory is fully equipped for every test from rock-crushing to analyses and mine-rescue apparatus.

PLANS FOR THE ESTABLISHMENT of a state school of mines at El Paso, Texas, in compliance with the law passed by the last legislature creating that institution, are being matured. The legislature made an appropriation of $15,000 for the purchase of necessary equipment for the school, and also provided for its maintenance for the ensuing two years. It devolves upon the people of El Paso, however, to purchase the necessary site and provide for the buildings. In a discussion on the subject at a recent meeting of the Chamber of Commerce of that city, it was proposed that the old military school property there be purchased and converted into a suitable building. It is also proposed that the county of El Paso purchase the property and present it to the state. While it is expected that the attendance of the new institution will be small in the beginning, the fact that El Paso is situated in the centre of a rich and rapidly developing mining region leads to the belief that it will soon become a large and well recognized factor in training men for the mining industry.

Obituary

WILLIAM HALLOCK died on May 20, at Providence, Rhode Island, following a stroke of paralysis, at the age of 57. After graduating from Columbia College in 1879, he took the degree of Ph.D. at Würzberg, and for nine years was physicist of the United States Geological Survey, serving for part of the time also as professor of physics in the Corcoran Scientific School, and later as professor of chemistry and toxicology in the National College of Pharmacy. Returning to Columbia in 1892, he was made associate professor of physics, becoming professor in 1902. He was prominent in social organizations as well as in the scientific field, and leaves many friends to regret the loss of the man, as well as the scholar and teacher.

J. HOWARD JOHNSTON died on May 8, in Peru, of pneumonia. A graduate of Dartmouth College, he went to Peru in 1870, where, with Henry Meiggs, he took a prominent part in railway building, first on the Central and later on the Southern lines. He was chief engineer at one time of the road from Arequipa to Peru. It was under his direction that the Galera tunnel, the highest railway tunnel in the world, was driven. Later he formed the firm of Backus & Johnston to work a *hacienda* near Casapalca. Mining and smelting operations were at first profitable, but were so affected by the Chile-Peruvian war that the firm engaged in brewing to recoup its fortunes, eventually re-developing an important and profitable mining and smelting business. In recent years Mr. Johnston, who had accumulated a large fortune, resided near Nice in France, until the death of his partner, Jacob Backus and a crisis in the affairs of the smelting company caused him to resume active management. Although then over sixty years of age, he modernized the smelter and quickly put affairs on a profitable basis again. Mr. Johnston was one of the pioneers of the west coast of South America and leaves a host of friends on both continents.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

C. T. CARNAHAN is in Mexico.

A. J. SALE is in New York City.

THOMAS F. COLE is in New York.

J. H. JANEWAY, JR., is in Colorado.

STEPHEN BIRCH has gone to Alaska.

ERNEST KLEPETKO was at Lima recently.

F. J. MARTIN has been in San Francisco.

R. H. SWEETSER was in New York last week.

WALTER DOUGLAS is visiting New York City.

H. A. BUEHLER was in Washington recently.

F. W. DEWOLF was in New York city recently.

JOHN ROOKE-COWELL is staying in New York City.

ALTON L. DICKERMAN was in New York last week.

R. G. THOMAS is visiting Arizona mining districts.

ALBERT BURCH was in San Francisco last Saturday.

POPE YEATMAN has returned to New York from Chile.

ELLIOTT S. MCCURDY was in San Francisco last week.

HOWLAND BANCROFT is at the Engineers' Club, New York City.

D. C. JACKLING and R. C. GEMMELL were at Ray last week.

W. J. COX is investigating the Ayacucho goldfields in Peru.

FRANK LANGLUTH is superintendent at the Dome mill, Porcupine.

DWIGHT E. WOODBRIDGE is in New York City on professional work.

CYRIL H. JAMES has returned from Amador county and gone to London.

W. H. ALDRIDGE has returned to New York City from a trip to the West.

FOREST B. CALDWELL was in San Francisco from the Candelaria last week.

W. H. KRITZER is erecting a mill for the El Oro M. & M. Co., at Cripple Creek.

HANS C. BEHR has opened an office in the Woolworth building, New York City.

G. M. COLVOCORESSES has returned to New York City from professional work in Canada.

ARTHUR C. HEAP, of London, was in New York City recently and has gone to Chicago.

EDWIN F. GRAY is now general manager for the Consolidated Coppermines Company.

C. W. MERRILL and C. C. BROADWATER have returned from a vacation trip to Santa Barbara.

I. O'REARDEN, manager of the Javali and Escandolo mines in Nicaragua, is visiting Panama.

C. W. PURINGTON has severed his connection with the Pioneer Company of Siberia, Limited.

H. D. MCCASKEY married Miss MARY LOUISE FULLER at Catasauqua, Pennsylvania, June 7. They will live at The Kenesaw, Washington, D. C.

PER GEYER, professor of geology in the University of Stockholm, is visiting California before attending the Canadian meeting of the International Geological Congress.

MILTIADES T. ARMAS, of Paris, who has recently joined the firm of DuBois, Mixer & Armas, Philadelphia, Pennsylvania, has gone to Bolivia. Mr. Armas will have charge of all the South American work of the firm.

BERNARD MACDONALD is making his headquarters again at the Sierra Madre Club, Los Angeles, having recently returned from Parral, Chihuahua, which place has been without mail or railroad communication since the beginning of April.

VICTOR C. ALDERSON has been retired from the presidency of the Colorado School of Mines. Mr. Alderson came to Golden about ten years ago from Chicago, and his administration has been characterized by great improvement in and marked growth of the school.

The Metal Markets

LOCAL METAL PRICES

San Francisco, June 12.

Antimony	12—12½c	Quicksilver (flask)	$41
Electrolytic Copper	16¼—16½c	Tin	50—51½c
Pig Lead	4.60—5.55c	Spelter	7—7½c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES

(By wire from New York.)

NEW YORK, June 12.—The generally unsettled conditions have seriously affected all prices, lead alone remaining firm, another proof of its close control. Copper has dropped below 15c., the average for the week being 14.76 electrolytic, compared with 15.18 last week. Additional shipments of gold to the amount of $2,000,000 have been announced, and the usual seasonal demand for money has been intensified by this and the uncertainties of the political situation.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
June 5	60.12	May 7	60.08
" 6	59.75	" 14	60.25
" 7	59.62	" 21	60.66
" 8 Sunday		" 28	60.08
" 9	59.75	June 4	59.99
" 10	59.75	" 11	59.75
" 11	59.50		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	59.26	Oct.	63.16	....
May	60.88	60.21	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
June 5	4.33	May 7	4.40
" 6	4.33	" 14	4.33
" 7	4.33	" 21	4.33
" 8 Sunday		" 28	4.33
" 9	4.33	June 4	4.33
" 10	4.33	" 11	4.33
" 11	4.33		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.64	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	6.08	....
May	4.20	4.34	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
June 5	5.00	May 7	5.31
" 6	5.00	" 14	5.28
" 7	4.95	" 21	5.28
" 8 Sunday		" 28	5.19
" 9	4.93	June 4	5.11
" 10	4.90	" 11	4.94
" 11	4.90		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	5.23	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

ALUMINUM

According to figures collected by W. C. Phalen for the U. S. Geological Survey, 65,000,000 lb. of aluminum was consumed in the United States in 1912, as compared with 46,125,000 in 1911. Both production and imports increased. Bauxite continues to be the source of material, but the problem of preparing aluminum from clay is still being studied. The Aluminum Company of America has purchased riparian rights in North Carolina and Tennessee, apparently in anticipation of the competition of the Southern Aluminum Company. Improvements and extensions to the plants in New York, Pennsylvania, and Illinois are also planned. Many new and increased demands for the metal must be met. Powdered aluminm is coming into use as a pigment and as a precipitant in cyanidation. Aluminum foil is replacing tin foil. Difficulties in the production of forms and tubes have largely been surmounted, and this business is expanding rapidly. For transmission lines, a steel reinforced cable is now made. Manufacture of cooking utensils is increasing, and now large vats for breweries, canneries, and similar establishments are being made. There is as yet no sign of the business being overdone.

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
June 5	14.90	May 7	15.30
" 6	14.80	" 14	15.54
" 7	14.80	" 21	15.50
" 8 Sunday		" 28	15.43
" 9	14.75	June 4	15.18
" 10	14.75	" 11	14.79
" 11	14.75		

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.66	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	15.42	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
July	1912	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720
April	"	104,269,270	106,565,760
May	"	75,549,108	102,654,720
June	"	67,474,225	90,025,600

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
May	1912	126,737,836	72,702,237	69,485,945
June	"	122,315,240	66,146,229	61,449,650
July	"	137,161,920	71,093,120	60,121,600
August	"	145,628,521	78,722,418	70,485,150
September	"	140,089,819	63,460,810	60,264,796
October	"	145,405,453	84,104,734	47,621,342
November	"	134,695,440	69,369,795	55,906,550
December	"	143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February	"	130,943,881	59,676,402	72,168,623
March	"	136,251,849	76,585,471	77,699,306
April	"	135,333,402	78,158,837	85,894,727
May	"	141,319,416	81,158,800	68,286,097

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
May 15	40	May 29	41
" 22	40	June 5	41
		" 12	41

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	40.25	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	49.10	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, June 11.
Associated Oil 5s	98
E. I. du Pont 4½s	83½
Natomas Con. 6s	90
Unlisted.	
Associated Oil 1st ref	80
General Petroleum 6s	58

Unlisted.	Closing prices, June 11.
Natomas Dev. 6s	100
Pacific Port. Cement 6s	99
Riverside Cement 6s	77
Standard Cement 6s	91½
Santa Cruz Cement 6s	80
So. Cal. Cement	76

STOCKS.

Listed.	Closing prices, June 11.
Associated Oil	36½
Amalgamated Oil	82½
E. I. du Pont Powder pfd	88
Pacific Coast Borax, pfd	100½
do com	80
Pacific Crude Oil	35c
Sterling O. & D.	1.00
Union Oil of Cal	80
West Coast Oil, pfd	90

Unlisted.	Closing prices, June 11.
Mascot Copper	1½
Noble Electric Steel	9
Natomas Consolidated	11½
Pacific Coast Borax, old	206
Pacific Portland Cement	59
Riverside Cement	45
Standard Cement	17
Standard Oil of Cal	187
Santa Cruz Cement	87½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 12.

Atlanta	$ .14	Mizpah Extension	$ .47
Belmont	6.20	Montana-Tonopah	1.20
Big Four	.50	Nevada Hills	.95
Buckhorn	1.30	North Star	.82
Con. Virginia	.05	Ophir	.08
Florence	.37	Pittsburg Silver Peak	.60
Goldfield Con	1.82	Round Mountain	.40
Goldfield Oro	.12	Sierra Nevada	.02
Halifax	1.20	Tonopah Extension	2.00
Jim Butler	.70	Tonopah Merger	.69
Jumbo Extension	.22	Tonopah of Nevada	6.00
MacNamara	.17	Union	.05
Mexican	.60	West End	1.20
Midway	.40	Yellow Jacket	.21

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	June 12. Bid	Ask		June 12. Bid	Ask
Adventure	$ ⅛	1⅛	Mohawk	$ 43	43½
Allouez	29⅜	30	North Butte	24⅛	24⅞
Calumet & Arizona	60⅛	60⅝	Old Dominion	42⅛	43
Calumet & Hecla	415	430	Osceola	77	78
Centennial	10⅛	11	Quincy	56	58
Copper Range	40	40½	Shannon	7⅜	7½
East Butte	9⅜	10	Superior & Boston	2⅛	2⅜
Franklin	5⅛	—	Tamarack	22	23
Granby	54⅜	55	U. S. Smelting	35	35½
Greene Cananea	5⅞	6	Utah Con.	7⅛	8
Hancock	15½	16½	Victoria	90c	1
Isle-Royale	17⅜	18	Winona	1⅛	—
Mass Copper	2⅛	3	Wolverine	45	47

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

June 12.

	Bid.	Ask.		Bid.	Ask.
Alaska Mexican	9¼	10¼	Mason Valley	5	5½
Alaska Tread	36¾	40¾	McKinley-Dar.	1⅝	1⅞
Alaska United	18⅜	20⅜	Miami 6s	168	173
Alaska G. M.	9	9⅛	Mines Co. Am.	2½	2¾
Braden Cop. 6s	110	120	Nipissing	8⅛	8¼
B. C. Copper	2	2¼	Ohio Copper	1½	1⅝
Davis-Daly	1⅞	2⅛	San Toy	18	20
Dolores	2	4	Sioux Con.	2	4
El Rayo	1	2	S. W. Miami	5	6
Ely Con.	6	7	So. Utah	¼	⅜
First Nat.	1⅝	1⅞	S. O. Calif.	162	164
Giroux	1½	1⅝	Tri Bullion	⅛	¼
Greene-Can.	5¾	6	Tuolumne	2⅛	2¼
Hollinger	15	16	United Copper	⅝	¾
Iron Blossom	130	135	Wettlaufer	10	12
Kerr Lake	3	3⅛	Yukon Gold	2⅜	2⅝
La Rose	2	2⅛			

LONDON QUOTATIONS

(By cable, through the courtesy of Catlin & Powell Co., New York.)

	June 12 £	s.	d.		June 12. £	s.	d.
Alaska Mexican	2	2	6	Oroville	0	6	3
Alaska Treadwell	8	0	0	Rio Tinto	71	10	0
Alaska United	4	2	6	Santa Gertrudis	1	5	0
Arizona	1	18	9	Stratton's	0	2	6
Camp Bird	0	17	6	Tanganyika	2	2	6
El Oro	0	15	0	Tomboy	1	7	6
Esperanza	0	18	9	California Amalg		3	9
Granville	0	11	3	California Oilfields	4	2	6
Mexico Mines	5	12	6	Kern River Oilfields		6	3
Messina	1	10	0	Pacific Oilfields		2	6

AUSTRALIAN

	June 12. £	s.	d.		June 12. £	s.	d.
British Broken Hill	2	3	9	Mount Boppy	0	15	0
Broken Hill Props	2	17	6	Mount Elliott	5	0	0
Golden Horse-Shoe	3	1	3	Mount Lyell	1	2	6
Great Boulder Props	0	13	9	Mount Morgan	3	7	6
Ivanhoe	3	1	3	Waihi	1	16	9
Kalgurli	2	3	9	Waihi Grand Junc	0	17	6

STOCK TRANSACTIONS IN MAY

The volume of stock transactions on the New York Stock Exchange during May reached a total of 5,418,952 shares, against 8,463,967 in April, and 12,832,000 in May 1912. The par value of bonds sold during the past month amounted to $41,820,000, as compared with $55,468,000 in April and $60,500,000 in May of last year. The aggregate of stock transactions for the first five months of 1913 is thus brought up to 36,296,012 shares, against 62,562,035 sold during the corresponding period in 1912. Bond sales for the five months of 1913 amounted to $241,247,000, as compared with $346,846,000 last year.

The Oriental Consolidated M. Co. clean-up for May, as reported by cable, was $159,000.

The United Globe company of Arizona has declared a dividend of $7.50 per share, making a total of $59 since 1907.

The Yukon Gold Co. has declared the usual quarterly dividend of 1½%, payable June 30 to stock of record June 19.

COPPER PRODUCERS' ASSOCIATION REPORT

The Copper Producers' Association statement, May 8, shows a decreased surplus. The details are as follows:

	Pounds.
Stock of marketable copper of all kinds on hand at all points in the United States, May 1, 1913	75,549,108
Production of marketable copper in the United States from all domestic and foreign sources during May	141,319,416
Deliveries for consumption, May	81,158,800
Deliveries for export, May	68,286,007
Stock of marketable copper of all kinds on hand and at all points in the U. S., June 1	67,474,225

Recent changes in surplus have been as follows, in pounds:

	Increase.	Decrease.
May 1912	.....	15,450,386
June	.....	5,280,639
July	5,945,416	.....
August	.....	3,579,046
September	16,364,213	.....
October	13,679,380	.....
November	9,419,095	.....
December	19,148,523	.....
January 1913	17,885,770	.....
February	.....	896,134
March	.....	18,032,928
April	.....	28,720,162
May	.....	8,074,883

TIN STATISTICS

Statistics published June 2 by the Metal Exchange in New York were not considered so favorable as anticipated, according to L. Vogelstein & Co., who say that Straits shipments were larger and deliveries smaller than expected. Straits shipments were 6075 tons, the largest record except May 1908, when 7000 tons was shipped. For the five months to date the increase compared to the corresponding period 1912, amounts to 1549 tons. June shipments are estimated at 4800 tons, which, if correct, will bring the total excess for six months up to 2000 tons. The firm believes, however, that this ratio of increase will not carry through the year, and that the total for twelve months will not exceed 60,000 tons.

London-Holland deliveries decreased 634 tons. The decrease in United States deliveries amounts to 1500 tons, or

at the rate of 300 tons per month. It is not believed that this rate of decrease will keep up unless present reactionary tendencies in business continue. Even so, there will have to be more buying than has been witnessed for the last 60 or 90 days. Best opinion is that America was overbought earlier in the year, but, if so, this condition must now largely be corrected,

Owing to large supplies and small deliveries referred to above, the visible increased 3888 tons. Quantities and prices at end of May for the past several years compare as follows:

May 31.	Visible, tons.	Spot London.	Spot N. Y.
1913	13,710	£216	47¼
1912	14,345	200	44⅞
1911	15,938	210	45⅝
1910	18,998	150	33¼
1909	18,208	132	29⅛
1908	15,424	129	28¾
1907	12,015	190	42½

MAY COPPER PRODUCTION

	Pounds.		Pounds.
Ahmeek	1,572,225	Miami	1,948,900
Ailouez	665,850	Moctezuma	2,695,881
Baltic	1,882,000	Mohawk	1,314,000
Calumet & Hecla.	5,007,324	Osceola	1,759,815
Centennial	185,545	Phelps-Dodge total.	12,999,119
Champion	2,424,000	Ray	4,520,000
Chino	4,003,723	Shannon	1,080,000
Copper Queen	7,160,021	Superior	389,975
Detroit	2,001,633	Tamarack	655,885
Franklin	304,000	Trimountain	1,094,000
Granby	1,857,452	Utah, Apr.	9,835,000
Isle Royale	528,809	Wolverine	886,000

COPPER EXPORTS

During the week ended June 5 these amounted to 6999 tons, making 172,770 tons since January 1.

L. Vooelstein & Co. report the German consumption of foreign copper for the months January to April, inclusive, 1913 as follows:

	Tons.
Imports of copper	72,819
Exports of copper	3,650
Consumption	69,169

These figures may be compared with consumption during the same period in 1912 of 67,285 tons. Of the above quantity, 61,312 tons was imported from the United States.

SILVER PRICES AND PURCHASES

China alternated as buyer and seller of silver during the greater part of May, although the Indian takings have been more or less regular, according to the *Wall Street Journal*, which says: "These two factors, along with the improvement of underlying conditions by such noteworthy events as the final conclusion of the Chinese loan, have served to keep bars at an even tenor during most of the month. May, opening at 27 11/16d. in London, reached its maximum at the middle of the month at 28 3/16, closing at 27 11/16, averaging 27⅞. The New York quotation ranged from 60 to 61c. as high, 59⅞ as low, closing at the same as the opening. It is believed by exchange specialists that the influence of the Chinese loan on silver prices will depend a good deal on the dates of payment of interest and amortization, the details of which have not yet been disclosed. Bar prices continue, however, to compare well with this stage of the year in preceding seasons. The average of 27⅞d. for the middle of the month at 28 3/16d., closing at 27 11/16, in April, 28 in May 1912, and 24 9/16 in 1911. A possible feature in the market about which foreign bullion dealers are inquiring, is the possibility of the United States Treasurer becoming a purchaser. Under present and prospective conditions, nothing but extraordinary demands from crop sections is likely to call for increased minting of minor coins. During 1912 the United States Government made purchases of silver bullion at mints and assay offices amounting to 7,031,263 oz., at a cost of $4,072,626. Of this quantity, 3,462,471 oz. consisted of commercial bars."

WISCONSIN ZINC AND LEAD PRODUCTION

Bad weather and exceedingly bad wagon-roads impeded production and shipment over the entire field during the first 10 days of the month of May, and tariff agitation and low prices on the inferior grades of ore during the remainder of the month militated against a normal monthly output. Notwithstanding these drawbacks, a fair showing was made in shipments from the leading camps direct to smelter and to local separating stations operating at several points in the field. The shipments for the month of May are shown below:

	Zinc, lb.	Lead, lb.	Sulphur, lb.
Benton	2,873,000	82,800	3,531,120
Hazel Green	2,400,000	165,000	.....
Mifflin	2,284,000	.....	.....
Galena	2,008,000	.....	1,384,000
Linden	1,366,000	57,900	308,830
Platteville	1,206,000	.....	.....
Cuba	1,280,000	.....	.....
Shullsburg	1,078,000	273,580	.....
Montfort	292,000	.....	.....
Mineral Point	2,220,000	.....	.....
Scattering	150,000	.....	.....
Total	17,247,000	579,280	5,223,950

Gross production for the month from mines, 13,620,470 lb.; net to smelters, 10,122,300 lb.; surplus ore in bin at various points in the field, 2000 tons. Shipments from Mineral Point represent high-grade calcined ores delivered by the Mineral Point Zinc Co. to the smelting works at DePue, Illinois. Lead ore shipments shown for Shullsburg came from Rodhams mine, sold during the month by the land owner, John Rodhams, to A. Kasch, of Sheboygan, representing a waiting firm. Sulphur shipments for Benton came from the Wilkinson mine; for galena from the Joplin Separating Works, and for Linden from the Linden Zinc Separating Co., owned and controlled by Indianapolis interests. Wisconsin is producing no 60% grades of zinc ore. The average Wisconsin grade drops to about 30%. Platteville, one of the most active camps in the field, reported prices for zinc ores for the month of May as follows: 30% ore, $16 per ton; 35%, $19.50; 40%, $23; 45%, $27; and 50%, $32. This indicates a basis of $40 for 60% standard zinc ore.

OKLAHOMA LEAD AND ZINC OUTPUT

The production of lead and zinc in Oklahoma in 1912, according to J. P. Dunlop, of the United States Geological Survey, was valued at $1,101,042, compared with $812,190 in 1911. The quantity of lead concentrates sold in 1912 was 4,257 tons, valued at $231,678, of which all but 1 ton came from the Miami district. The quantity of zinc carbonate and silicate sold was only 92 tons, valued at $2550. Most of this concentrate came from the Peoria district, where little mining was done in 1912. The shipments of sphalerite concentrates in 1912 amounted to 12,129 tons, valued at $494,379.

NEW JERSEY ZINC OUTPUT

The well known zinc mines at Franklin Furnace, Sussex county, N. J., decreased their output of metal, according to H. D. McCaskey, of the United States Geological Survey, from 154,890,900 lb. of zinc (all figured as spelter), in 1911, to 139,510,008 lb. in 1912. Owing to better prices during the later year, however, the estimated value of the output increased from $8,828,781 to $9,626,191. The quantity of ore sold or treated was 374,064 short tons in 1911, and 459,585 tons in 1912. No production of gold, silver, copper, or lead is reported from New Jersey, and the Franklin Furnace zinc mines are the sole producers of zinc.

James Lewis & Son's Mid-Monthly Report

Under date of May 16, the copper situation was as follows: After selling at £67 cash on May 1, standard copper advanced to £70 on the 13th, the war in the Balkans being concluded, and the American statistics being considered favorable. In the absence of speculative buying, cash fell yesterday to £68 12s. 6d., and on May 16 closing quotations were £69 5s. cash and £69 1s. 3d. three months prompt. Sales for the fortnight amount to about 18,000 tons. American refiners having sold electrolytic copper freely, both for domestic consumption and export, at 15.5 and 15.75c. per pound, and at £72 10s. per ton c.i.f. for delivery over the next two months, advanced their price to 15.87c. and £73 10s. This checked business. Manufacturers in the United States and Europe have fully supplied their requirements for some time to come. In four months of 1913, American and European stocks have decreased 7950 tons, whereas in 1912 they decreased 20,803 tons. This year, however, the quantity afloat from the United States to Europe on May 1 was about 15,000 tons more than on that date in 1912.

Imports from the United States into England and Europe were 86,768 tons fine during the first four months, and 53,642 tons from other countries. The consumption in Europe was 99,037, and exports 41,209 tons. The consumption in England was 24,017 tons; in France, 29,122 tons; in Germany, 35,024 tons; while shipments to Italy, Austria, and Russia from the United States amounted to 10,874 tons, against 14,968 tons in 1912. Exports of sulphate of copper from England were 13,154 tons.

Copper in Maryland and Pennsylvania

From 225,200 short tons of low-grade copper ore in Maryland and Pennsylvania, and magnetic iron ore carrying small quantities of copper-bearing pyrite in Pennsylvania, there was an output in 1912, according to H. D. McCaskey, of the United States Geological Survey, of 502 fine ounces of silver and 594,022 lb. of copper, valued in all at $98,323. The corresponding production in 1911 was valued at $83,194. The Maryland output was derived from concentrate produced at the New London mine, in Frederick county; the Pennsylvania output came in small part from low-grade matte reported produced and shipped from Charmian, where a blast-furnace has been built to treat the secondary copper ores of the Catoctin schist, but mainly from the Cornwall iron mines, in Lebanon county, where the Gröndahl process has been in operation for some years, raising the purity of the iron ores and at the same time producing as a valuable by-product briquetted copper-bearing pyrite for sale to copper smelters. The total production of copper from these Cornwall iron mines in the five years 1908-1912 has been 2,852,160 pounds.

Lead and Zinc Production

By J. P. Dunlap

Figures of production for 1912, by regions, have been collected by the United States Geological Survey, and are as follows:

Region.	Concentrates. *Lead.	Concentrates. †Zinc.	Metal. Lead.	Metal. Zinc.	Total value of metal
Joplin	45,328	299,421	35,915	152,465	$24,272,520
‡Southeast Missouri	218,803	1,091	146,913	378	13,274,334
Upper Mississippi valley	4,315	120,451	3,331	37,115	5,421,660
Kentucky-Southern Illinois	948	1,243	701	491	130,848
Northern Arkansas	39	1,881	31	748	108,014
Arbuckle mountains, Oklahoma	.....	250	.....	110	15,180
Total, 1912	269,433	424,337	186,891	191,307	$43,222,556
Total, 1911	270,833	381,579	188,669	172,698	36,667,782

*Includes both galena and lead carbonate concentrates.
†Includes sphalerite, zinc carbonate, and zinc silicate concentrates.
‡Includes a small production from the Central Missouri region.

Mineral Exports of Bolivia in 1912

Abstract from *Bulletin* of the Pan American Union.

In the table below are given the mineral exports of Bolivia. The figures have been secured in advance of official publication from the Bolivian statistical office, through the courtesy of Don Ignacio Calderón, Bolivian minister to the United States.

	Weight, metric tons.	Value, bolivianos.*
Tin barilla	38,379	59,870,766
Silver, in bars	.....	4,310,294
Copper barilla	4,681	3,370,589
Copper, untreated	377	32,046
Bismuth barilla	382	2,015,896
Bismuth, untreated	68	74,624
Zinc	9,010	332,245
Wolfram	472	295,235
Gold, in bars	.....	144,275
Lead	766	78,627
Magnetic iron	98	8,642
Antimony	.....	5,128
Miscellaneous	.....	7,486
Total	.....	70,545,853
Value, in United States gold	.....	$27,512,882

*One boliviano equals approximately 35c. U. S. coinage.

Kansas Lead and Zinc Mines

The value of the mine output of lead and zinc in Kansas in 1912 was $1,680,744, compared with $1,428,318 in 1911, according to J. P. Dunlop of the United States Geological Survey. The quantity of ore treated was approximately 774,000 tons. The quantity of concentrates sold and the value in 1912 were as follows:

	Short tons.	Value.
Galena concentrate	3,003	$158,798
Lead carbonate concentrate	33	1,335
Sphalerite concentrate	21,258	1,005,509
Zinc carbonate and silicate concentrate	125	3,152

The recoverable metal content of the lead and zinc concentrates was 2371 short tons of lead, valued at $213,390, and 10,633 tons of spelter, valued at $1,467,354.

Missouri Mineral Output

There was an increase of about $4,700,000 in the value of the silver, copper, lead, and zinc output from Missouri mines in 1912, according to J. P. Dunlop, of the United States Geological Survey. The value of these metals was $34,914,761, compared with $30,171,311 in 1911. The production in 1912 was as follows:

	Quantity.	Value.
Zinc, short tons	136,551	$18,884,038
Lead, short tons	177,069	15,936,210
Copper, pounds	440,725	72,719
Silver, fine ounces	35,438	21,794

Company Reports

GIBRALTAR CON. G. M., LTD.

This company was formed by John Taylor & Sons in 1895, to acquire a gold mine in the Adelong district of New South Wales. Milling commenced in 1897, but after the payment of a dividend in 1898, reconstruction for the purpose of providing new capital was necessary in 1900. Results since then have been unsatisfactory. The report for 1912 shows that developments during the year have been more encouraging, for between the 600 and 900-ft. levels a fair amount of profitable ore was disclosed. Owing to shortness of funds, it has not been possible to adopt a vigorous policy of development, but the directors have under consideration a scheme for expanding operations, should the recent improvement continue. During the year, 6040 tons of ore was milled, and 5540 tons of sand and slime cyanided, with a yield of £25,127, or about 1 oz. per ton. A profit of £6035 was made, which went to satisfy in part the adverse balance of £8888 with which the year commenced.

MOUNT BOPPY G. M. COMPANY

This company was formed by John Taylor & Sons in 1899, to acquire a gold mine in the Cohar district of New South Wales. At the time of flotation, the metallurgical plant of the Gallymont mine was purchased. Dividends have been paid regularly from 1902 to 1911. Operations were seriously curtailed during 1912 by the severe drought, the months of May and June being practically lost. The yield per ton treated also showed a slight decline. Not only was no dividend paid for 1912, but it has been deemed advisable to raise £30,000 additional capital by the issue of preference shares, in order to pay for the new plant erected for the better treatment of the sulphide ore. During the year, 53,990 tons of ore was hoisted and milled, 6896 oz. gold being recovered by amalgamtion, 9861 oz. by cyanidation, and 360 oz. in concentrate, making a total yield of 17,117 oz., worth £72,485, or 6⅓ dwt. per ton. The working expenditure was £73,610, in addition to which £2246 was paid as tax and £2551 allowed for depreciation. The development during the year has been satisfactory. The future of the mine depends largely on the nature of the lodes in depth. At present the two lodes constitute the two sides of a 'trough,' and how this will behave at depth is the cause of some speculation. The reserve on December 31 was 208,597 tons. The new plant containing 4 tube-mills and Moore filters has been erected. James Negus is the superintendent.

OOREGUM GOLD MINING CO. OF INDIA, LTD.

This company owns one of the John Taylor & Sons group of gold mines in the Kolar district of India, and has been producing since 1888. The grade of the ore has never been so high as at the Mysore mine, and on more than one occasion considerable anxiety has been felt as to future developments. Nevertheless, dividends have always been paid. During the year 1912, much of the development was disappointing, but toward the latter part of the time, ore of better quality was disclosed, so that on December 31 the reserve stood at practically the same figure as on January 1, the amount being estimated at 186,393 tons. The report of R. H. P. Bullen, the superintendent, refers to discoveries at the 4610 ft. level of ore of higher grade. At one place such ore has been found below 1000 ft. of barren ground. During 1912 the ore hoisted was 145,558 tons, and the yield 82,212 oz., worth £347,943, being a recovery of 11½ dwt., or 47s. 10d. per ton. The working cost was £177,963, or 24s. 5d. per ton. In addition, £6447 was spent on plant, £6193 on the Manighatta option, £8000 paid for ground on the dip, £8564 as income tax, £5000 written off for depreciation, and £15,000 placed to reserve. The shareholders received £120,231, being 40% on £120,000 preference shares, and 30% on £240,722 ordinary shares. The total yield to date has been £6,278,650 from 2,248,710 tons of 2000 lb., and the dividends have aggregated £2,085,069. The slime plant was started in March 1912. The Manighatta property, 16 miles to the north, on which the company had an option, proved to be a failure, and has been abandoned.

SONS OF GWALIA, LTD.

This company was formed in 1898 to acquire a gold mine at Mount Leonora, in the North Coolgardie district of West Australia. The company has also an interest in the Northern Ontario Exploration Co., Ltd., and the California Exploration Co., Ltd., which is reopening the Plymouth mine. Bewick, Moreing & Co. are the general managers. The best results were obtained in the years 1903 to 1905. The report now issued covers the year that ended December 31, 1912, and shows that the ore reserve equals three and three-quarter years' supply, the average grade being much the same as the year previous. During the year, 155,603 tons of ore was hoisted and sent to the mill, where 24,867 oz. was recovered by amalgamation, 6041 oz. by cyaniding sand, 20,514 oz. by cyaniding slime, and 4862 oz. in concentrate. In addition, 969 oz. was obtained by the treatment of accumulated slime, 784 oz. from cyanide slag, and 338 oz. from old amalgamation plates, making a total of 58,376 oz. The income was £263,670, and £3100 was received as interest and from other sources. The net profit, after taxes were paid and depreciation allowed, was £59,493, and £23,473 undivided profit was brought forward from the previous year. The shareholders received £69,062, being at the rate of 21¼%. Adjoining property has recently been purchased, and additional ground is under option.

RAND MINES, LIMITED

This company was formed in 1893, with a capital of 2,200,000 shares of $1.25 each, and holds large interests in the following mines on the Rand: Bantjes Consolidated, City Deep, Crown Mines, Durban Roodepoort Deep, East Rand Proprietary Mines, Ferreira Deep, Geidenhuis Deep, Jupiter, Main Reef West, Modderfontein B., New Modderfontein, Nourse Mines, Rose Deep, South Deeps, Village Deep, Village Main Reef, and Wolhuter; also in the Turffontein Estate, Booyseus Estate, General Estates, Government Gold Mining Areas, and the Victoria Falls & Transvaal Power Co. The revenue during 1912, from dividends on shareholdings, shares sold, and other sources, was £1,205,664. Cash and cash assets were £682,643 at the beginning of the year, which, added to the profit of £1,138,382, made a total of £1,821,025. Dividends paid amounted to £1,169,297, and expenditure on investments, £127,460, leaving cash and cash assets at £524,268. Total dividends amount to £9,059,052. The mining companies and other consumers connected to the company's water system were supplied with 834,000,000 gal., on which a profit of £23,687 was made. The 1911-1912 rainfall was 26.64 in., against 34.04 in. during the previous year, while indications for the current year are not good. The reservoirs held 537,412,000 gal. at the end of 1912.

In October last, most of the mining companies became members of the Native Recruiting Corporation, Limited. The chief object for which this corporation was formed was to eliminate indiscriminate competition for native labor and to provide for the equitable distribution of all available native labor among the members.

BUTTE & SUPERIOR COPPER COMPANY, LTD.

This company was organized in 1906 and started operations the following year on 89 acres in the northern section of the Butte district, Montana. The claims included the Black Rock and others, which had produced a considerable quantity of high-grade silver ore in the early days, and it was supposed that these enrichments indicated underlying copper deposits, similar to others in the district. The main shaft was sunk 800 ft., when prospecting opened zinc ores instead of copper. During 1910 and 1911, the shaft was sunk to 1600 ft., and the vein opened at 200-ft. intervals. No metallurgical investigations were undertaken

until 1910, when a mill at Basin, 25 miles from Butte, was leased. Until the end of 1911 this plant was operated irregularly on ore won during development and mining. From frequent experiments, it was decided to erect a mill at the mine embodying results obtained at the old plant. A flotation process, designed by J. M. Hyde, is in use. Litigation over patents is in the courts and still undecided.

Late in 1911 the company's finances were strengthened, made necessary by operations on a more extensive scale than was anticipated. During 1912 two lots of stock were issued, making a total of 271,135 shares at the end of the year. This enabled the property to be developed, adjoining property acquired, making a total of 245 acres, and the new mill completed. One section of this was working for about five months in 1912, and was considerably remodeled. When the whole plant is complete it will have a capacity of 1000 tons per day. Development has proved the total amount of ore reserves between the 1000 and 1400-ft. levels to be 1,200,000 tons, averaging 21.7% zinc and 7.9 oz. silver per ton. The headings of all levels in the Black Rock claim are still in ore, and there is every evidence of a long life for the company. A large head-frame was erected at the mine, and a hoist of 1500-ft. depth capacity installed. Notwithstanding the intermittent character of operations, and extraordinary expenses during the year, the year's work showed a profit. Current assets total $844,520, including cash, $519,558; shipments in transit, $187,083, and supplies, $136,680. Current liabilities total $281,231. The surplus is $1,488,664.

MINES COMPANY OF AMERICA

The financial statement for the year that ended December 31, 1912, shows that the different properties which are being worked by this company have not suffered to any great degree because of the revolutionary disturbances that have been so common throughout northern Mexico and in the districts in which the company's mines are situated. All of the mines have been in continuous operation, and the balance-sheet shows a net profit for the year of 1912 of $581,757.71. The subsidiary companies are the Dolores Mines Co., El Rayo Mines Co., Creston Colorado Co., and La Dura Mill & Mining Co. Details regarding the properties are given on another page.

The investments of the company in mining properties amount to $8,506,693, and the total assets $9,006,798. The company is capitalized at $9,000,000, of which capital stock $8,364,663 has been issued. The profit and loss account shows the dividend receipts plus interest to amount to $147,691 for this period. The net profit for the year was $120,086. The total assets of the subsidiary companies of the Mines Company of America is given as $6,416,562. The operating account shows the receipts from the sale of bullion and concentrates to have amounted to $2,344,321, which with receipts from other sources of $38,725, makes a total of $2,383,047. The expenditure for mining and milling during this period was $1,778,094, making an operating profit of $604,953. The income and surplus account, as at December 31, 1912, is as follows:

Credits:	
Mine profit	$ 604,953.02
Interest	7,584.68
	$ 612,537.70
Debits:	
General expenses and taxes	30,779.99
Net profit for year 1912	$ 581,757.71
Surplus and reserve Dec. 31, 1911	2,198,982.23
	$2,780,739.94
Deduct depreciation	206,983.98
	$2,573,755.96
Deduct dividends paid	147,487.10
Surplus and reserve Dec. 31, 1912	$2,426,268.86

Decisions Relating to Mining

Specially reported for the MINING AND SCIENTIFIC PRESS.

MINERAL CHARACTER OF LAND DOES NOT EXCUSE DISCOVERY

The land department retains jurisdiction to consider and determine the character of land claimed under the mining laws until deprived thereof by the issuance of patent; and an adjudication that land is mineral does not preclude subsequent investigation by the land department as to its character, nor does it dispense with the necessity of making a discovery of mineral thereon as a basis for a mining location and patent.

C. Henry Bunte, 41 Land Decisions, 520. January 29, 1913.

NUMBER OF CLAIMS THAT MAY BE LOCATED.

There is no limit prescribed by law to the number of claims which a single locator may locate or otherwise acquire on any lode, provided only that each claim does not exceed 1500 ft. in length. In early days the different mining districts adopted rules limiting the number of claims that could be located by one person, but we know of no such regulations in force in the state of California at the present time. The only requirement is that the locator shall conform to the law in making his locations and shall do $100 worth of assessment work on each claim for each calendar year after the year in which the claim is located.

TIMBER CUTTING—UNLAWFUL WHEN

When a mining company bought from an entryman timber which had been unlawfully cut and sold from a homestead, it is no defense in a suit by the Government for the value of such timber to say that the land under homestead entry and from which the timber was cut, was in fact "more valuable for mineral than other purposes," and therefore locatable under the mining laws which permit timber to be cut for mining purposes. The land was covered by a homestead entry which was valid until canceled and operated to withdraw the land from the provisions of laws applying to public mineral lands.

Bunker Hill & Sullivan M. & C. Co. *v.* United States (Idaho), United States Supreme Court. January 6, 1913.

TRESPASS FOR CONVERSION OF ORE—DAMAGES

In an action to recover the value of ore unlawfully taken from plaintiff's mine, the court instructed the jury that if they found that the ore was either recklessly, wilfully, or intentionally taken by the defendant company, then the measure of the plaintiff's damages is the enhanced value of the ore when and where it was finally converted to the use of the defendant, which in this case would be the full amount recovered and realized therefrom by the defendant. It was held on appeal: (1) that it was proper to include the word 'recklessly' in the charge as to grounds for award of the higher measure of damages; (2) that the fact of trespass having once been established, the burden of proof is shifted to the defendant to show that it was not wilful, intentional or malicious; (3) that where it appeared from the evidence that defendant had been warned by plaintiff that he was committing a trespass on plaintiff's ground and made no effort to ascertain the truth of the matter, but for more than a year was working so close to plaintiff's line that he must have with reasonable diligence been able to ascertain that he was committing such a trespass, the verdict of the jury finding that a wilful trespass was committed will not be disturbed.

Liberty Bell Gold Mining Co. *v.* Smuggler-Union Mining Co. (Colorado), 203 Federal, 795. March 3, 1913.

PULP-WOOD STATISTICS indicate that 1,846,910 cords of pulp wood were cut in Canada during 1912. Of this, 866,042 cords were manufactured into pulp in Canadian mills, while 980,868 cords were exported in the raw or unmanufactured state. This is an increase of 21.5% over the total cut of 1911, an increase of 28.8% in manufacture of pulp, and an increase of 16.6% in export of raw pulp-wood.

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

FERRO-VANADIUM ores are being mined at the Ragra mine in Peru, by the American Vanadium Co. of Pittsburgh.

IRON-ORE SHIPMENTS from all Lake Superior ranges from 1844-54 to the end of 1912 amounted to 574,125,258 tons, of which 48,221,546 was shipped during 1912.

EXCAVATION by steam-shovels at Panama in April totaled 2,655,095 cu. yd., and 979,095 cu. yd. by dredges. The total to May 1 was 198,243,402, leaving 19,894,897 cu. yd. to be removed.

EXPORT DUTIES on rubber from the state of Para, Brazil, are from 19 to 22%, and it is proposed to make these uniform for the years 1914 to 1918, on the basis of 18, 16, 15, 12, and 10% for each year, respectively.

EXPENDITURE on the Panama canal by the United States is as follows: civil administration, $6,197,073; law, $37,360; sanitation, $15,796,420; construction and engineering, $174,148,736; fortifications, $2,537,752; and general, $87,393,247; making a total of $286,110,590.

MINING in Guatemala is carried on in many of the 'departments' on the slopes of the Andean cordillera. In Las Minias mountains, gold, silver, copper, lead, and zinc ores are found. The mining code of the country is favorable to the development of the industry, and transportation facilities are good.

THE ROYAL MINT in London, in calling tenders for the supply of 50 tons of copper in ingots weighing from 14 to 18 lb. each, stipulates that the metal must be of the following purity: copper, 99.8%, containing not more than 0.005% lead, 0.005% tellurium and selenium together, 0.001% bismuth, 0.001% tin, 0.001% antimony, 0.01% iron, and 0.02% arsenic.

RESULTS of five tests between the Dorr and the Hendryx agitator at the Liberty Bell mill showed practically no difference in extraction and a saving of about 6 hp. for the former. This agitator holds about 35 dry tons of ore. The power required was about 0.4 or 0.5 hp. for the arms, and about 40 cu. ft. of air, as closely as could be determined.

THE destruction of a set of outer cloths every month on the Merrill precipitating presses at the Homestake is not a serious cost. A 53-in. triangular press uses about 60 in. of fabric 53 in. wide for one cloth covering both sides of a plate. At 20 to 27c. per yard, this costs $10.70 to $13.50 to replace a set of outer cloths on a 30-frame press, and from this up to $18 for 40 frames. The expensive chain-cloth is quite unnecessary. It is preferable to destroy the cloths, since washing involves shrinkage and curling, and increases the liability to leaks through ill-fitting cloths or faulty joints, resulting from edges doubling under the bearing surfaces of the press plates.

IN the treatment of old tailing dumps at Kolar, India, little or no free acidity was found, but on one or two of the mines a large amount of latent acidity was encountered. At Ooregum mine this was found to be caused by the presence of sulphate and chloride of magnesium. These salts were traced back to the water used in the mills and cyanide works, and their action on cyanide is commonly represented by the following equation:

$$MgSO_4 + 2KCN + 2H_2O = MgH_2O_2 + K_2SO_4 + 2HCN$$

The admixture of caustic soda with the cyanide solutions neutralized the destructive action of the magnesium salts, and it was found merely necessary to add the caustic soda to the cyanide solution instead of being applied as a preliminary alkaline wash. Cheaper alkalies were experimented with, but caustic soda was proved to be the most satisfactory, and its use has now become more general on the Kolar goldfield, where the use of alkalies is found to be necessary.

ORE-LOADING DOCKS on the Great Lakes are as follows: Chicago & Northwestern railway, 6 docks with 1634 pockets having a storage capacity of 337,000 tons; Duluth & Iron Range railway, 6 docks, 1086 pockets, and 200,100 tons; Duluth, Missabe & Northern railway, 3 docks, 1152 pockets, and 172,800 tons; Great Northern railway, 4 docks, 1352 pockets, and 405,600 tons; and seven other companies with 11 docks, 1916 pockets, and 353,400 tons capacity. Details of all docks are as follows: length, from 240 to 2336 ft.; width, from 25 to 63 ft.; height above water, 43 to 80 ft.; cubic feet per pocket to bottom of stringers, 1839 to 5600; angle of pockets, 37.30 to 50.50°; and length of spouts, 21 to 34.5 feet.

THE object-glasses and eye-pieces of all instruments used in topographic work should be properly focused. The cross-wires projected against a distant object should appear immovable when the eye only is moved. Before the adjustments are commenced the instruments must be firmly set up and leveled. An instrument may at times appear to be out of adjustment because some part is loose. The object-glass may be partly unscrewed or an adjusting screw may be only partly tightened. Level bubbles or cross-wires occasionally become loosened; therefore, before commencing the adjustment of an instrument, look out for such defects. When it is thought that an adjustment has been completed, always test it before using the instrument. All adjusting screws should be screwed tight enough to hold, yet not so tight as to injure the threads or put a severe strain on any other part. Especial care should be taken not to strain the cross-wire screws. Adjustments should be made in the order given, for some adjustments depend on the accuracy of others previously made, and a change in one may affect the others.

ON the Rand, some of the chemists have experimented with regard to the value of calcined crude soda ash as compared with lime for neutralizing acid water, the advantage of the former being said to lie in its complete solubility and cheapness, with a good neutralizing effect. Tests made by W. B. Marshall are as follows: Crude soda, 64% and lime 70 units used. Theoretically 165 parts Na_2CO_3 64% equals 86 parts lime 70 units. Two baths were taken containing 5 gal. of water and three-quarters the quantity of sulphuric acid required to neutralize 35 gr. Na_2CO_3. Added 35 gr. CaO to one bath and 35 gr. Na_2CO_3 to the other. Stirred for 5 minutes and 100 c.c. of each taken and titrated with $N_{10}H_2SO_4$. Soda solution required, 30.8 c.c. Lime solution required, 25.9 c.c. Test repeated after a further two hours. Soda solution required, 30.8 c.c. Lime solution required, 28.5 c.c. Thus demonstrating the greater actual efficiency of the soda. The calcined crude soda ash, containing about 70% real Na_2CO_3, is recommended for neutralizing and softening water in place of lime, from two points of view, namely, efficiency and working costs. Sodium carbonate is a readily and totally soluble chemical, giving a soluble product, sodium sulphate, which is not a cyanicide. There is no loss of undissolved material. Experiments prove that though, weight for weight, lime is theoretically capable of neutralizing more acid than soda, yet, owing to the slow rate of solution of the former, soda is actually more efficient. Demonstrations of this can be given. As only a small percentage of the soda ash is insoluble, and the product of neutralization is soluble, the problem of choked pipes is solved by the use of crude soda instead of lime. These remarks regarding solubility apply equally to the case of softening water for boilers, with the additional advantage in favor of soda that permanent hardness (so-called) is also removed. There are no impurities, such as iron, aluminum, magnesium, calcium, or sulphates, to cause trouble. The soluble impurities present are chloride and a trace of potassium. The cost is similar to that of lime.

Book Reviews

LAKE SUPERIOR IRON ORE ANNUAL. Compiled by the *Iron Trade Review*. P. 71. Ill., charts. The Penton Publishing Co., Cleveland, Ohio, 1913. For sale by the *Mining and Scientific Press*, San Francisco. Price, leather $2, and cloth $1.

The immense tonnages of iron ore produced by the mines in the Lake Superior region, their iron content, price, the railroad traffic, ore-dock systems, lake traffic and handling of ore at points on the lower lakes is too well known to demand any extended reference. In the volume under review, all these details are summarized interestingly. The output from all ranges in 1912 was 44,365,100 tons averaging 51.96% iron, prices varying from $2.85 to $3.75 per ton for non-bessemer and bessemer, respectively. Total shipments since 1844-54 to 1912, inclusive, were 574,125,258 tons. The Hull-Rust mine was the leading shipper in 1912, with 2,232,112 tons. The illustrations show ore docks and steamers. The book is an unusually complete and convenient summary for the region.

RAILROAD CONSTRUCTION, By Charles L. Crandall and Fred A. Barnes. P. 321. Ill., index. McGraw-Hill Book Co., New York. For sale by the *Mining and Scientific Press*. Price $3.

As stated in the preface this book is the successor to mimeograph notes prepared by the authors for the use of the civil engineering students at Cornell University. As might be expected, it is therefore entirely descriptive and does not enter very deeply into discussion. It is exactly the book for every young resident engineer who finds himself for the first time in responsible charge of work. The chapter headings are: Introductory, Earthwork, Rock Excavation, Tunneling, Masonry, Foundations, Culvert and Bridge Masonry, Trestles and Bridges, Track Materials and Roadbed, Estimates and Records. A bibliography at the end of each chapter will appeal to the experienced engineer who has a problem of his own to solve and wants to see how someone else handled a similar case. On the whole, the book, while not exhaustive, is well worth reading and owning.

Recent Publications

GREAT EROSIONAL WORK OF WINDS. By Charles R. Keyes. Reprint from *Popular Science Monthly*, May 1913. P. 10.

THIRTY-FIRST ANNUAL COAL REPORT OF ILLINOIS. Compiled by Martin Bolt for the State Mining Board. P. 423. Springfield, 1913.

PANAMA-PACIFIC INTERNATIONAL EXPOSITION, San Francisco. Booklet, 'Information for Exhibitors.' A brief description of the Exposition, extracts of important rules and regulations, and an analysis of the plan and scope of the exhibit departments. 48 pages. Illustrated. 6 by 9 inches.

THE CLIMATE OF SAN FRANCISCO. By Alexander G. McAdie. Bulletin 44. P. 33. Ill. U. S. Department of Agriculture. Weather Bureau. Washington, 1913. This is an interesting little publication compiled by the local officer in charge of the Weather Bureau. The situation of the city, its rainfall, causes of fogs, and temperatures are described in a readable manner.

TOPOGRAPHIC INSTRUCTIONS OF THE UNITED STATES GEOLOGICAL SURVEY. Compiled by R. B. Marshall, chief geographer. P. 241. Ill., index. U. S. Geol. Survey. Washington, 1913. This is a useful bulletin, well worth study by engineers engaged in examining mining districts. It includes details of organization, supplies necessary, care and use of instruments, field work, computations, map construction, and the United States system of topographic work, admittedly the largest and most successful organization for this work in the world.

ORE DEPOSITS OF THE HELENA MINING REGION, MONTANA. By Adolph Knopf. United States Geological Survey, Bulletin 527. P. 143. Ill., maps, index.

The dominant geologic feature of this district is the granite mass which forms the northern extension of a great intrusion in southwestern Montana, known as the Boulder batholith. The orebodies are mainly silver-lead and gold-silver deposits, and contrast sharply with the copper ores of the Butte district. The report contains micro-photos of rocks and geologic maps.

U. S. Geological Survey publications. Advance chapters from 'Mineral Resources of the United States, 1912.' Washington, 1913:

PRODUCTION OF SAND-LIME BRICK IN 1912. P. 7.

FUEL BRIQUETTING IN 1912. By Edward W. Parker. P. 10.

PRODUCTION OF SLATE IN 1912. By A. T. Coons. P. 20.

PRODUCTION OF GRAPHITE IN 1912. By Edson S. Bastin. P. 11.

PRODUCTION OF MICA IN 1912. By Douglas B. Sterrett. P. 15.

PRODUCTION OF FELDSPAR AND QUARTZ IN 1912. By Frank J. Katz. P. 11.

Bureau of Mines publications. Washington, 1913:

MONTHLY STATEMENT OF COAL MINE ACCIDENTS IN THE UNITED STATES. Compiled by Albert H. Fay. P. 11.

QUARRY ACCIDENTS IN THE UNITED STATES, 1911. Compiled by Albert H. Fay. Technical Paper 46. P. 32.

COAL-MINE ACCIDENTS IN THE UNITED STATES. January and February, 1913. By Frederick W. Horton. P. 12.

ALASKA. Report of the Mine Inspector for the fiscal year ended June 30, 1912. Compiled by Sumner S. Smith. P. 24. Table.

APPARATUS FOR GAS-ANALYSIS LABORATORIES AT COAL MINES. By George A. Burrell and Frank M. Sibert. Technical paper 14. P. 24. Ill.

DRILLING OF GAS AND OIL WELLS. Proposed regulations, with comments thereon. By O. P. Hood and A. G. Heggem. Technical Paper 53. P. 28. Illustrated.

COMMERCIAL TREND OF THE PRODUCER-GAS POWER-PLANT IN THE UNITED STATES. By R. H. Fernald. Bulletin 55. P. 93. Map, index. This is an interesting publication, and a summary appeared on the 'Concentrates' page of this journal, June 7.

MAP OF THE COAL, OIL, GAS, IRON ORE, AND LIMESTONE AREAS OF WEST VIRGINIA. By Ray V. Hennen and C. E. Krebs, and geologic features by I. C. White. Published by the West Virginia Geol. Survey and the State Semi-Centennial Commission. Morgantown, 1913.

University of Illinois publications. Engineering Experiment Station. Urbana, 1913:

TESTS OF REINFORCED-CONCRETE BUILDINGS UNDER LOAD. By Arthur N. Talbot and Willis A. Slater. Bulletin 64. P. 104. Ill. In view of the large number of reinforced buildings now being erected in the United States, the details of tests under ordinary building conditions are of great value.

ENTROPY-TEMPERATURE AND TRANSMISSION DIAGRAMS FOR AIR. By C. R. Richards. Bulletin 63. P. 20. Ill., charts. This bulletin presents the theory and use of three graphical charts, by the aid of which all problems pertaining to the compression, expansion, and transmission of compressed air may be solved with a minimum of labor and with a degree of accuracy which is satisfactory to engineering work.

COAL-MINING INVESTIGATIONS IN ILLINOIS. Preliminary report on organization and method of investigations. The State Geological Survey, in coöperation with the Bureau of Mines, and the University of Illinois Department of Mining Engineering. P. 71. Ill., maps. Urbana, Illinois, 1913. This state's coal mines employed 77,000 men and produced 53,679,118 tons of coal in 1911. About two to three lives have been lost annually per 1000 men employed. By this investigation into mining methods, there should be a decrease in accidents and more efficient work done.

Use of High Explosives in Northern Mines

By F. H. Gunsolus

It would seem that the miners in cold countries would not encounter many problems of different character from those met with elsewhere in the use of high explosives, and to a certain extent this is true. On the other hand, there are certain conditions met by those who use explosives in high latitudes which require precautions not needed where temperatures do not reach such a low point. One of these conditions is known as the 'sweating' of dynamite. When a shipment of a carload of dynamite is made from a factory to a mine in the middle of winter, it frequently takes two weeks or more to travel to its destination, during which time it is exposed to zero weather for several days at a time, and is not only frozen, but remains very cold for a considerable time after it is moved to a warmer temperature either in the mine or in the thawing house.

Dynamite itself is a very poor conductor of heat, and an open box placed in a room having a temperature of 60°F. may remain a long time before the outer portions of the dynamite thaw, while the explosive in the middle of the box remains frozen and cold for a very long time, just as though it were packed in sawdust, which it really is. A great many mining companies thaw their dynamite by natural heat, merely taking it down into the mine and storing it in underground magazines and allowing it to thaw either in the boxes or by opening the cases and spreading the dynamite out. When the dynamite is received after having been exposed to zero temperature for several days, it is, of course, very cold and the moisture from the humid mine is deposited upon it in large quantities. Sometimes so much moisture gets into the dynamite in this way as not only to lower its sensitiveness, but also to make it much less efficient and to cause misfires, blow-outs, and burned-up charges, which are dangerous, inconvenient, and disagreeable.

This may also apply to the blasting caps, which are even more susceptible to moisture than the high explosives, from the fact that they are exposed at one end, and that end is the one where they are ignited. If a blasting cap be taken from a temperature of zero down into a hot humid mine and left several days, it will frequently absorb so much moisture that either the fuse will not explode it at all, or if it does, it will be so weakened that an incomplete detonation of the dynamite will take place, or perhaps it may only set fire to the dynamite, causing a burned-out charge.

The remedy for both these conditions is simple. When the weather has been cold during the transportation of the dynamite, the dynamite should not be taken directly into the mine, but should be kept on the surface long enough for it to warm up so that moisture will not be deposited upon it. The blasting caps themselves do not require thawing, but underground storage is certainly not to be recommended for them, both on the ground of the possible loss of efficiency and on account of the danger of carrying such caps around in the mine in quantity. So many accidents happen to women and children due to miners carrying blasting caps around loose in their pockets and these being found by children at home, that care in preventing them from being taken from the work is well worth the trouble.

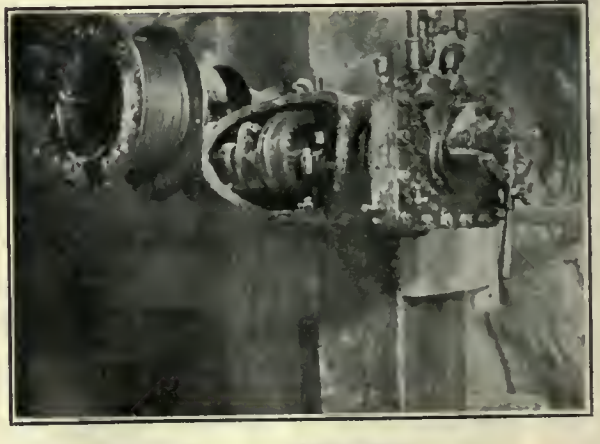
In thawing the dynamite it is much better to warm it gradually, say for several days at a temperature of 70 or 80°F., than to attempt to thaw it quickly in a few hours at a temperature of 100°F. or over. Not only does the high temperature increase the sensitiveness of the dynamite, but it also makes the nitroglycerine less viscous and more likely to leak and to run out of the cases. Leaky dynamite and leaky nitroglycerine are dangerous anywhere. Although the use of the new Red Cross dynamites and du Pont gelatin, which have a much lower freezing-point than the older brands of high explosives, tends to reduce the amount of danger and trouble due to freezing of nitroglycerine, they still require thawing when subjected to low temperatures for a considerable length of time, and they become cold and sweat under conditions mentioned above just as readily as any kind of dynamite. The gelatin dynamites do not become affected by moisture as readily as the granular dynamites, and this is a great advantage in their use where there are low temperatures outside and high humidity and water underground.

Even the fuse requires attention when used in northern mines, as it becomes brittle and hard when very cold, and when uncoiled in this condition the waterproofing compounds will crack underneath the outer covering, so that they cannot readily be seen, but these cracks will admit moisture or water and will also cause the fuse to spit out sidewise and render it liable to ignite the dynamite and cause burned-out charges again. It is frequently necessary to lead the fuse down toward the bottom of the charge in cases where there is liability of blowing off the collar of one hole from the explosion of another timed to take place before it. When the fuse travels down the bore-hole alongside of the powder, if the latter is taken out of its wrappers or split, or the paper shells slit, the liability of ignition is increased. In these cases it is preferable not to remove the powder from its wrappers or to slit it, but to load it in its paper covering entire. It is almost impossible to ignite dynamite from the side spit of the fuse through the paper wrapper.

Fuse should not be exposed to high temperatures for any length of time, as this sometimes causes the waterproofing composition to melt and run into the powder train and make the fuse go out. The temperature of about 70 to 80°F. is right for the rooms where fuse is stored in large quantities. It should not be stored in humid mines at all, as the powder will absorb enough moisture at the ends and in the sides in a few days to make its burning through rather uncertain. Du Pont gelatin is difficult to ignite either from side spit or from falling sparks, which is another point in favor of this type of explosives for use where burned out charges have been frequent.

A Power Windlass

A small winze hoist has been designed by the Nevada Engineering Works, of Reno, Nevada, which is said to be giving excellent service in some of the largest mines in that district. It is operated ordinarily by compressed air, and is capable of raising a load of 450 lb. at a reasonable speed. There is a single reel for wire rope, and a gypsy-head over which a fall line may be handled if needed. The



THE NEVADA WINZE HOIST.

motor is reversible, and with a single lever the hoist is started, stopped, and reversed. The load cannot run down, and no brake, automatic or otherwise, is used. The Nevada winze hoist is light and compact, and may be bolted to a post of a tunnel set, or to a stull wedged in at any desired point in the mine. The total weight is 500 lb., which can easily be separated into three pieces for convenience in handling. The usefulness and economy of such a hoist will appeal to every mining man. Its portability, its safety, and the fact that no skilled operator is required, make it fill a decided want in light hoisting work.

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EDITORIAL STAFF:

San Francisco

H. FOSTER BAIN - - - - - - - - Editor
EUGENE H. LESLIE } - - - Assistant Editors
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New York

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T. A. RICKARD - - - - Editorial Contributor
EDWARD WALKER - - - - - Correspondent

SPECIAL CONTRIBUTORS:

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Gelasio Caetani C. W. Purington.
Courtenay De Kalb. C. F. Tolman, Jr.
F. Lynwood Garrison. Horace V. Winchell.

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EDITORIAL

THE enthusiast who threw a bag of flour at the Rt. Hon. H. H. Asquith doubtless considered that the most effective method of giving the Prime Minister the sack.

IT IS SAID that Mr. D. C. Jackling is to go on the board of the General Petroleum Company; presumably Hayden, Stone & Company have been enlisted in the campaign for financing this rapidly growing new-comer among California oil companies.

IRON AND STEEL production is slowing down, standing now at about one-half the total furnace capacity. While unfilled orders are also decreasing, specifications are coming in at a good rate. The situation is not regarded as acutely serious by the steel men, as they interpret it as meaning postponement rather than abandonment of proposed construction.

ALASKAN railway matters are assuming a more hopeful aspect. Apparently there is good prospect of Congress providing funds for the building of the much needed trunk lines to the interior. Regardless of differing opinions as to the wisdom of government ownership of railway lines, it is generally agreed that this is the only practicable means of meeting the present situation.

OREGON, among other states, is struggling with a new 'blue sky' law. As one of its requirements is that absolute value must be shown for every dollar of capitalization, the financing of new enterprises involves difficulties. We believe in 'blue sky' legislation, but we do not believe in the sudden enactment into law by all the states of any method of control barely conceived and inadequately tested. Kansas modified its own law at the time other states were rushing to copy the original.

EFFECT of atmospheric corrosion upon sheet metal is markedly decreased by the presence of small amounts of copper, not exceeding 0.2 per cent, according to an extensive series of experiments carried out by Mr. D. M. Buck. The governing conditions of the atmospheric corrosion of steel are not yet completely understood. Theoretically, a pure iron is the most resistant to rusting, but Mr. C. F. Burgess has shown that the resistance is increased by the presence of small amounts of copper, nickel, or manganese. So far the most effective method of preventing iron from rusting is the coating of its surface with tin, zinc, paint, or cement. If further experience demonstrates the presence of small

amounts of copper to be as effective in the prevention of rusting as experiments so far indicate, the saving in labor and cost of material in many fields of industry will be important indeed.

TREADWELL costs and performance are matters of perennial interest, and we are glad to present this week a general summary for the year 1912. Mining and milling a million and a half tons at an average cost of $1.28 per ton constitutes an enviable record, but it should be noted that at the Treadwell proper the costs were even less. It is to be remembered that the Treadwell companies do not capitalize their construction. The new cyanidation plant, the central hoist, and the additions to power equipment are paid for out of earnings; as a result profits are real and not fictitious. Engineers will be interested in the proposal to create practically a new mine below the 1750-foot level, leaving a 200-foot pillar, or floor, across the vein to protect lower workings while mining the pillars above. This plan is ingenious and, so far as we know, is new. It will be interesting to learn what the added safety costs, as the work proceeds.

REVIVAL of interest along the Mother Lode of California is one of the encouraging features of recent gold mining. The success that has attended the re-opening of the Plymouth mine by Bewick, Moreing & Company, as detailed in our news columns last week, has given new confidence to those who would re-open the old mines mainly on faith in the persistence of the ore-shoots. It is unfortunate that no consolidated map of the ore-shoots of the Mother Lode has ever been made. It would be of much practical as well as scientific interest, but conflicting claims as to ownership have so far prevented any such compilation. As a next best, we present this week the first part of a general summary of production and conditions along the Lode, written by Mr. J. H. G. Wolf, who, having spent much time and money in making the necessary studies, is none the less generous enough to share results with his fellow engineers. As Mr. Wolf says, when the Kennedy finds ore-shoots unchanged at a depth of nearly 4000 feet vertically below a surface itself determined by erosion of possibly 8000 feet of strata, speculation as to persistence of ore-shoots becomes interesting but difficult.

LEACHING work at the Braden mine has been held somewhat in abeyance pending the solution of the problems connected with concentration of the ore; the mine, concentrator, and flotation plant having, up to the present, taxed the capacity of the hydro-electric plant upon the Cachapoal river. Recently another unit was added to the power plant, and it is stated that a test run will soon be made with the leaching plant. A brief description of this plant, by Mr. Pope Yeatman, appeared in the *Mining and Scientific Press* of December 16, 1911. The process to be employed consists of roasting the concentrate from milling operations in Wedge furnaces and utilizing the escaping SO_2 gas to manufacture in lead chambers, the H_2SO_4 to be employed in leaching the calcine. The copper sulphate solution resulting from the leaching will then be electrolyzed. It is hoped in this way to produce cathode copper at a very low cost, since the cost of the hydro-electric power available is low. Only a part of the concentrate will be thus treated at first, though there is a possibility that similar treatment may be applied to the ore. Later in the year we hope to be able to present more data concerning the interesting work in progress at this and the Chuquicamata.

The Steel Investigation

Probing into the activities of the United States Steel Corporation, in the suit of the United States Government to dissolve that organization under the Sherman act, has been in progress in New York for some weeks, and a great volume of evidence has been submitted. The testimony of Mr. James A. Farrell, the president of the corporation, was summarized in our issue of May 24. Since that time Messrs. Charles M. Schwab, E. H. Gary, and Percival Roberts, Jr., have been summoned to the witness stand. Mr. Schwab awakened much interest by replying with some warmth to the question as to whether another steel company could make the same variety of products and export to the same extent as the Corporation, stating that, if he lived long enough and had money enough, the Bethlehem Steel Company, of which he is chairman, would do so. Mr. Schwab was the first president of the United States Steel Corporation and was largely instrumental in its formation, but did not disclose many new facts of importance concerning it. Mr. E. H. Gary brought out the interesting point that George F. Hoar had rendered an opinion in 1891 that pools and agreements could be entered into without violating the Sherman act, saying that "it seems to me that a contract, although partly in restraint of trade, which is reasonable and reasonably limited in point of time, which has for its object merely the saving of the parties from a destructive competition with each other, is not prohibited by the statute above referred to. The question whether this contract is reasonable will be for the courts." Twenty years later the reasonableness of combinations in restraint of trade was first taken into consideration by the federal courts.

That any pools were formed subsequent to the organization of the corporation, or that there had ever been any division of territory in the United States, or agreements with foreign producers, was emphatically denied by Mr. Gary. Another interesting point in his testimony was the suggestion that in times of great depression "it is of decided benefit to our competitors to have such an organization ready to push throughout the world our different lines and allow our competitors to keep their mills running and their debts paid." It is interesting to recall in this connection that in the autumn of 1911, when there was a great temporary shortage in the tin supply in this country, consumers were allowed to draw freely upon the stock of the Steel Corporation without being 'held up' for higher prices. Speaking of standard prices of steel products, Mr.

Gary drew attention to the fact that a man's hat of good quality everywhere costs $5, and has for many years past. It is well known that the iron ore reserves of the Steel Corporation are limited in amount as compared to those of its competitors, so that his testimony in this regard was simply confirmatory.

Mr. Roberts, who is a director in the Pennsylvania Railway Company, as well as in the Steel Corporation, introduced testimony of more legal than human interest, except for the statement that since he has been a director in both companies he has never taken any step to influence the action of either in its dealing with the other. Mr. Roberts' opinions upon the subject of average price quotations are not in coincidence with those of Mr. Gary, and since the points involved are applicable to all metals, they will be made the basis of a subsequent editorial.

Leaching Copper Ores in Chile

The technological problems involved in the exploitation of the copper ores in the extensive deposits of the Chile Copper Company at Chuquicamata are of unusual interest. Some details concerning this property have already appeared in our columns. The new company has taken over a group of properties formerly worked on a modest scale by a number of European and Chilean companies, following exploratory work under the direction of Mr. Pope Yeatman, which has demonstrated the existence of 100,000,000 tons of ore averaging 2.48 per cent copper, and nearly double that amount of possible ore. Previous mining had been confined to shallow workings, in which the ore is of lower grade than in depth. The methods employed were exceedingly crude, consisting of mining the surface material, called *yampara*, in open pits and screening. The copper mineral present has commonly been designated atacamite, $Cu(OH)Cl.Cu(OH)_2$, but the careful study incident to the forming of a plan for working the deposit on a large scale has disclosed the interesting fact that the atacamite is present in only minor amount, the principal copper mineral present being brochantite, $CuSO_4.3Cu(OH)_2$. Since a small amount of chalcanthite, the natural 'blue vitriol,' is also present, it is not astonishing that brochantite has been confused with atacamite, both being crystalline and emerald or dark green in color. The copper mineral being most friable, the fine screenings were comparatively rich and were shipped to smelters, while the coarse fragments were thrown upon the waste dump. Exploratory work upon a large scale disclosed an orebody over 8000 feet long and of variable width, up to 700 feet. The orebody is somewhat irregular and its exact shape and extent have not yet been thoroughly defined by drilling, but the ore has been proved to persist to depths as great as 1000 feet in places, changing in depths from brochantite to chalcocite, bornite, and chalcopyrite; about three-fourths of the ore developed so far consisting of brochantite, and one-fourth of sulphides. As might be expected, the brochantite ore tends to become richer near the zone of transition into sulphides. Small veins also occur at intervals throughout the main mass, giving rise to local enrichment, so that assays as high as 15 per cent copper are in places found, though the deposit as a whole averages slightly under 2½ per cent. The deposit is usually well adapted by nature to steam-shovel mining, since the ore outcrops in the crest of a low ridge some distance from the main range, so that the capping is practically confined to the minimum of side slopes. A short branch from the main railway line from Antofagasta now reaches within one mile of the deposit, so that the physical conditions of exploitation are unusually favorable.

Careful study of the metallurgical problems involved has been made by Mr. E. A. Cappelen Smith. Solution of the copper content of the brochantite ore presents no difficulties, as that mineral is easily soluble in dilute sulphuric acid even when crushed to between ½ and ¼ inch size. The ore yields little or no slime in crushing, so that leaching is easy. An 8 or 9 per cent solution of sulphuric acid will be used. Since the copper is already present in the form of sulphate, its subsequent precipitation yields a larger amount of sulphuric acid than was used in its solution, so that there is no consumption of acid. Precipitation of the copper offers more difficulty. Dissociation of cuprous sulphate by the electric current yields free sulphuric acid at the anode, which liberates the chlorine present. This attacks the copper being deposited on the anode, leading to a considerable loss in electrical efficiency. Little trouble is experienced from ferrous sulphate, a source of difficulty in ordinary leaching, as the iron minerals, perhaps because of the coarseness of ore, seem not to be attacked by the solution used and no increase in iron content, beyond 2 or 3 grains per litre, follows the repeated use of the solution. An additional difficulty at Chuquicamata is the nitric acid produced by the action of the sulphuric acid upon the nitrates which are present in small amounts on the surface deposits of this part of Chile. By the use of proper means, chlorine is eliminated from the solution, but this leads to an increased attack upon the anode. Details of the methods pursued to obviate these difficulties are not available, but plans for the construction of an 8000-ton plant are already well advanced, so that the experimental work, based upon several hundred tons of ore treated, must have proved correspondingly satisfactory. There is practically no gold and silver present in the ore, and arsenic, antimony, and bismuth are fortunately also absent. As a result, the solutions from leaching do not become foul through repeated use. This is indeed a fortunate combination of circumstances which greatly facilitates the work of leaching in a country of limited water supply. All stages of the treatment, as far as the electric precipitation, can thus be done at unusually low cost, so that the comparatively expensive precipitation is not expected to bring the total cost of production above 6 cents per pound of copper. Electric power for the precipitation of copper will be furnished by an oil-fired power-plant at the sea coast, electric power costing about $60 per horse-power per year.

The Mother Lode of California

By J. H. G. Wolf

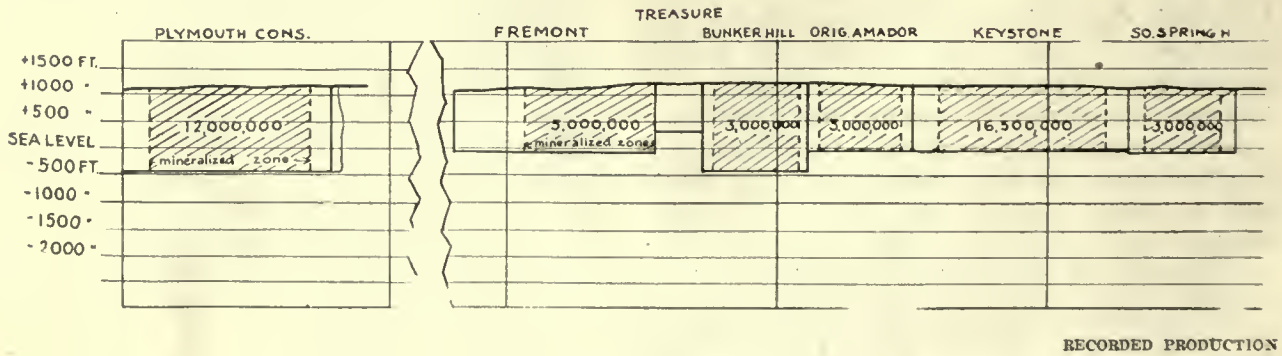
There is no mining district in Western America better known than the Mother Lode of California. There are 'mother lodes' in other countries and in other regions, using the term in the sense of the principal lode in a particular mineral district; in California the term is used in its general sense and applies to a mining region some 90 miles long. This stretches from the Consumnes river on the north beyond the town of Plymouth, southeastward through Amador, Calaveras, and Tuolumne counties, to Mariposa in Mariposa county, and has a width of from 20 to 25 miles. Its northern extremity is about 30 miles due east of the city of Sacramento.

In popular conception the Mother Lode of California is a continuous vein or ore-channel stretching through the counties mentioned, that can be mined profitably anywhere along its length. Properly, no such condition exists; in fact, the term applies to a region that is traversed by three distinct mineral belts striking roughly parallel with the continental folding and parallel with each other. The ores from the region, with the exception noted on the west belt, yield gold with only a parting value of silver.

Belts of the Mother Lode

The three belts of the Mother Lode are called the west, central, and east belts, and the veins of each have specific characteristics. The west belt, skirting the low foothills that border the great central valley of California, contains mostly copper-bearing veins, as near Ione in Amador county, Camp Seco and Copperopolis in Calaveras county, and Mt. Green in Mariposa county, together with gold-bearing veins at Hornitos in Mariposa county and at Hodson near Copperopolis in Calaveras county. The central belt, traversing the lower foothills at an elevation from 1000 to 1500 ft., has the gold-bearing veins of great thickness, and the important mines of the state. The ores, as a rule, are low-grade, averaging no higher than the Homestake in South Dakota. Several of the mines are successfully working ores of a lower grade than the Alaska Treadwell. The vein system of this belt lies, broadly speaking, near or along a contact of the shales and slates of the Calaveras formation (Paleozoic) and the Mariposa clay slates (Jurassic) with intrusive bodies of greenstone, chiefly diabase.[1] The ore-bearing veins are generally two in number and in a zone a few hundred feet wide. In Amador county, where the central belt has been most highly developed, one vein usually lies on the contact of greenstone with slate, and the other wholly within the slates on the west of the contact, or wholly within the greenstone on the east. These veins, while low-grade in value, vary in thickness

[1] California State Mining Bureau, *Bull.* 18.



from a few feet to 40 ft. and afford large tonnages when in ore. The east belt is characterized by narrower veins, with higher grade ore than the central belt, and shorter ore-shoots, but more of them. This belt extends from the vicinity of Bagby, on the Merced river in Mariposa county, northwestward through the mid-foothill region, at elevations of from 1500 to 3000 ft., to Defender and Volcano in Amador county, and if projected further, on the extension of its strike, would include the mines of Grass Valley and Nevada City in Nevada county. The ores of the Grass Valley mines have the same general characteristics as ores of the Mother Lode, and by some authorities are accepted as a part of same, though by most the Grass Valley district is considered distinct.

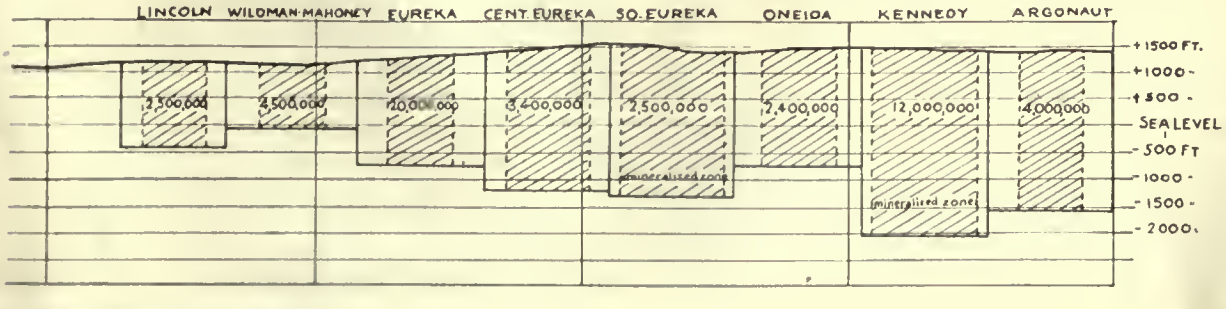
Central Belt in Amador County

The nearest approach to the popular conception of the Mother Lode, that of its being a continuous vein of uniform production, is in Amador county, where there is a series of mines from the Plymouth Con., at Plymouth, on the north, to the Argonaut on the south, a distance of eight miles. Development work of the past year indicates that it may soon be possible to continue this continuous string of producers southward four miles farther, through the Zeile, South Jackson, and Hardenburg mines to the Mokelumne river. The Zeile has been a good producer for many years, and has been worked continuously since 1879. It has reached a depth of 1500 ft. The South Jackson is being reopened, while the Hardenburg has been reopened and has begun to produce within the past year. Work on the South Amador (formerly the Amador Queen) has ceased. Since the mines from the Argonaut northward have the same general characteristics as to ore and ore occurrence, and fresh data are available, particular reference will be confined to them.

From Argonaut to Plymouth

Between Plymouth and Jackson there are 14 mines that have been worked more or less regularly since the early fifties. The placer diggings of '48 and '49 were early traced up to the Lode, where the rich outcrops diverted attention to vein-mining, and there was then launched an industry which made history for the state, as well as large individual fortunes. The Raymond reports of '68 to '76 show that early operations were centred more on the east belt, with its narrower veins of rich ore, and it was not until the late seventies, through the completion of the Amador canal, that the mines of the central belt assumed the prominence they have held since. From that time the record has been one of excellence in every particular, and while it cannot be said that mining and milling methods have been developed here that have materially advanced the art of mining, the business itself has gained a standing, through the performance of these mines, which has lifted it to the position of a dignified industry.

The map above shows in addition to the property lines the positions of the shafts and mills of the individual mines. The figures given at shafts are: (1) elevation of collar; (2) vertical depth (or elevation) of bottom of shaft above or below sea-level. Below is tabulated the wonderful production of some of the properties, which is probably nowhere exceeded in Western America, except in the case of the Comstock lode. In the 35,675 ft. of the lode possessed by the mines enumerated the distance over



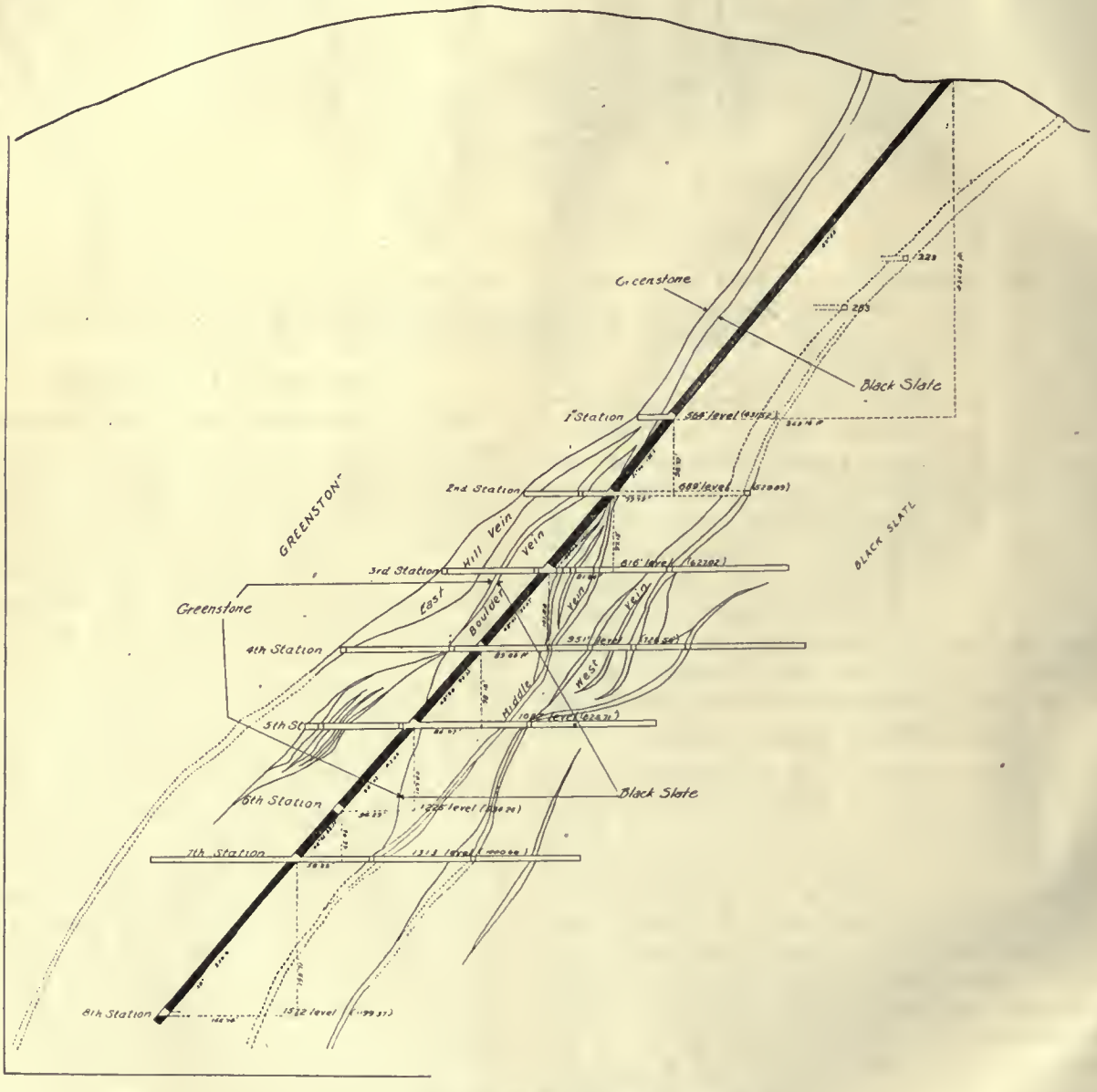
OF THE MINES ALONG THE LODE.

which mineralization extends is roughly 21,950 ft., which amount of ground has yielded to date some $93,800,000. The total length of pay-shoot worked in this part of the lode is probably 5000 ft., or one-seventh as in the instance of the Comstock.

Five of the fourteen mines are said to be paying dividends and but two are inactive; four of them have yielded over $10,000,000 each, and one, the Kennedy, is being mined at a vertical depth of 3550 ft., or over 4000 ft. on the incline. During the past year the Kennedy shaft has been sunk to 3850 ft., which is 2350 ft. below sea-level. At this depth the vein is reported to have the same character and value as upon the 3550-ft. level. The 100-stamp mill is kept supplied with ore from the 2330 to 3500-ft. levels. It takes about two years to exhaust one level.

It has been determined, by miles of exploration, that the Kennedy-Argonaut vein occupies a fault-fissure, which is independent in strike and dip of the enclosing rocks, and that the branching or splitting of the lode produces at times two or three veins in one particular horizon, all of which may be profitably worked. This tendency is present in other mines, and veins thought to be distinct may be, in fact, branches of one lode. Above is shown a good example of branching, and the tendency to form ore upon the contact as well as in the two walls. The ores are uniformly of higher grade in the black slate than in the greenstone. The Zeile mine, south of the Argonaut and in the town of Jackson, are wholly within the greenstone, while the other important properties have both formations.

Much has been staked by other properties on the success of the Kennedy, as the geological conditions are practically the same for all the properties in this part of the region. Since it has been determined that the surface erosion along the vein system has been about 8000 ft., there is reason to believe that there are many years of profitable mining ahead. If the present veins are but the stumps of veins which once towered 8000 ft. above the present surface, and if profitable mining has been proved, at least in one instance, to 4000 additional depth, it may be pertinent to ask, even though difficult to speculate upon, how much deeper ore exists.



TYPICAL CROSS-SECTION, SHOWING BRANCHING OF THE LODE.

Central Belt South of Amador County

Leaving the Mokelumne river and passing into Calaveras county, the feature of the belt so pronounced in Amador county, that is, its series of pro-

ductive properties, is lost. The vein below Mokelumne Hill has been profitably worked, below 2000 ft.; in the vicinity of Fourth Crossing, below San Andreas, there have been a few moderate producers, but it is not until Angels Camp is reached that the belt again assumes the character it has in Amador county. In Angels Camp there are five producers within a mile; the principal mine, the Utica, has yielded some $13,000,000 from a moderate depth of less than 2000 ft. The geological conditions here are entirely different from those in Amador county. The country rock is amphibolite schist, and the two main fault-fissures, having nearly the same strike, intersect in dip, and form the principal veins. Much gold has also been won from the intersection of small vertical fissure veins arising out of the main east-dipping fault-fissures.

A few miles south of Angels Camp is Carson Hill, which district extends to the Calaveras river. The principal mine is the Melones, where 120 stamps are dropping profitably upon ore yielding, it is said, but $1.65 per ton. Proceeding southward into Tuolumne county, there are groups of mines in several localities, as at Tuttletown, Rawhide, Quartz, Stent, and near Jacksonville. The nearest approach to a continuous line of producers is in the vicinity of Stent, from the Dutch to the Jumper, some three miles. Those mines have been satisfactory producers, though for intermittent periods. Some have been developed extensively, as the Eagle-Shawmut, which has workings for 2400 ft. deep, and is equipped with a 100-stamp mill. South of Jacksonville there have been producers of importance as far as Mariposa county, in which county the Mother Lode seems to lose the distinctive character possessed in the counties to the north, that is, of having three separate belts.

The East Belt

The east belt lies from 6 to 12 miles east of the central belt. There is no semblance to a continuous ore-channel as the series of mines from the Argonaut to the Fremont may be assumed to present. The mines of each district enumerated herewith are upon a series of parallel veins in each locality, as in Tuolumne county at Groveland and Soulsbyville; in Calaveras county at Railroad Flat, Sheep Ranch, and West Point; and in Amador county at Defender, Pine Grove, and Volcano.

SCENE ON EAST BELT OF THE MOTHER LODE IN AMADOR COUNTY. LONE STAR MINE IN THE FOREGROUND.

BELTS OF THE MOTHER LODE.

Broadly considered, the Mother Lode region is in Paleozoic rocks, termed locally the Calaveras formation, consisting of a series of slates, schists, and other sedimentaries, and with these are associated Mesozoic igneous rocks. The igneous intrusions along the central belt are somewhat limited in thickness, and are not always continuous in length. Approaching the east belt, the igneous rocks appear more as regional intrusives, and the veins may be either in the sedimentaries, or in the intrusives, or along contacts. On the central belt the intrusives are mainly diabase (greenstones) and are older than those of the east belt, which are classed by the United States Geological Survey as granodiorite and quartz-monzonite. Flows of andesite and rhyolite have covered the country in places, and can be seen on the tops of ridges where spared from erosion. At Soulsbyville, in Tuolumne county, there is a regional intrusion of granodiorite some 10 miles long and 8 miles wide. This intrusion projects southwest from the main body of intrusives forming the core of the Sierras, into the Calaveras formation, and extends to within a few miles of the central belt at Stent and Jamestown. Tongue-like projections of the same intrusion occur in Calaveras county, in the vicinity of Sheep

Ranch, also at West Point, and again in the Pioneer district of Amador county, at Defender, and reaching toward Volcano.

General Observations

In each of the districts there are important properties; at Soulsbyville the Black Oak mine is yielding a daily tonnage of ore of higher value probably than any mine in the state. In the same district are the Soulsby mine, with a credited production of $6,000,000, and the Confidence, some miles eastward, with a production of $5,000,000. Their operations, however, are more connected with the early days than with the present. In Calaveras county, the Sheep Ranch mine has yielded $4,000,000 from workings 1200 ft. deep and a long pay-shoot. Near West Point the Lockwood, Champion, and Lone Star, all in the granodiorite, have all done well; in Amador county the Defender and the Pioneer in the granodiorite, and the Marklee, Downs, Mitchell, and others in the slates have been worked to moderate depths with profitable results, though never on a scale that would produce large returns in a limited time.

The mines of the east belt have never been worked with the same persistence and capital as those of the central belt. Few, if any, of the properties, generally speaking, have had good metallurgical results, with extractions above 75%, or what would be required as commercially satisfactory elsewhere in California and Nevada. The history of the Black Oak mine affords a good example of this observation. Located in 1878, the mine had obtained a depth of but 200 ft. in 1888, at which time there were required 36 miners underground and 12 men in the mill to keep the 10 stamps of 850 lb. each fed with ore. By 1905 the depth obtained was some 1100 ft., the stamps had been increased to 35 in number, and a cyanide plant for the treatment of the tailing and the raw concentrate (after regrinding) had been added. These improvements, however, were not enough to yield a good commercial extraction, and while a production of over $2,000,000 had been obtained up to that period, and often profitably, for the ore was always of fairly high grade, the mine was closed down a year or two later; this decision was necessary partly because of the company's inability to pick up the ore in depth where faulted.

The mine was reopened about 1910 by experienced and successful operators from Nevada. Within a year practical results were obtained in finding the faulted segment of the vein at 1300 ft. depth; it was found that the faulting was of reverse instead of normal thrust, and that the ore-shoot was longer and more uniform in depth than near the surface. As was fitting for the new mine, the old milling practice was discarded in its entirety and the modern all-sliming process was substituted, even to omitting amalgamation.[2] The difference between the early extraction of 75% and the 95% of today on the same ore represents not merely the difference between profit and loss, but permits the treating of lower grade ores, larger tonnages, and the winning of the profits in much less time.

[2]See 'The Black Oak Mill,' *Mining and Scientific Press*, November 30, 1912.

The Sheep Ranch mine, rated as a profitable producer, represents another example of conditions that heretofore were against obtaining economical results. Due to obtaining only 80% extraction by amalgamation from the stamps, and to the fact that the concentrate is of low value, $20 to $30, which is characteristic of the belt, the ore was sorted in the mine to keep the grade to $12.50 per ton. This resulted in high mining costs, due largely to high cost of power, wood being used as fuel, and also to the large amount of water that had to be handled; these factors militated against good results and produced intermittent operations, particularly after the cream of the ore near the surface had been skimmed by the first operators, the Haggin, Tevis, Hearst interests.

(To be Continued)

Electric Power From the Falls of Iguazu

*An important and costly installation of an electric light and power-plant will probably be the outcome of the arrangements now being concluded between Argentina and Brazil for the utilization of the magnificent waterfalls known as the Iguazu, which are situated on the borders of the two republics, and the common use of which was agreed upon by treaty in October, 1903. The republic of Uruguay is also interested, and in all likelihood the three states will join in the carrying out of some scheme in the advantages of which all will participate. There is sufficient power to be obtained from the Iguazu falls to supply the whole of the requirements of these states in the direction of light and motive power for 100 years to come.

New Signal Device for Railways

The Lehigh Valley railroad is testing acetylene gas flashlights in connection with its automatic block signals, as well as in its audible and visible highway grade crossing signals. The tests are now being conducted near South Plainfield, New Jersey. The object of using flashlights in place of the steady burning lights is to make the signals distinctive, so that there may be no more possibility of confusing them with other lights than there is of confusing the rays of a government lighthouse with the other lights on shore. The acetylene flashlight apparatus is of the same character as that used by the Government in its isolated lighthouses.

Underground Crusher Stations

In the Round Mountain Mining Co.'s mine, at Round Mountain, Nevada, are two crusher stations. During the year 1912-13, the following work was done: No. 1 produced 6382 tons of $4.69 ore, and 16,306 tons of waste worth 77c. per ton; while No. 2 produced 15,590 tons of $7.12 ore, and 40,589 tons of waste worth 97c. per ton. The cost of crushing, screening, and transport, including repairs, was 5 to 6c. per ton.

*Abstract from the *West Coast Leader*.

The Treadwell Group of Mines, Alaska, in 1912

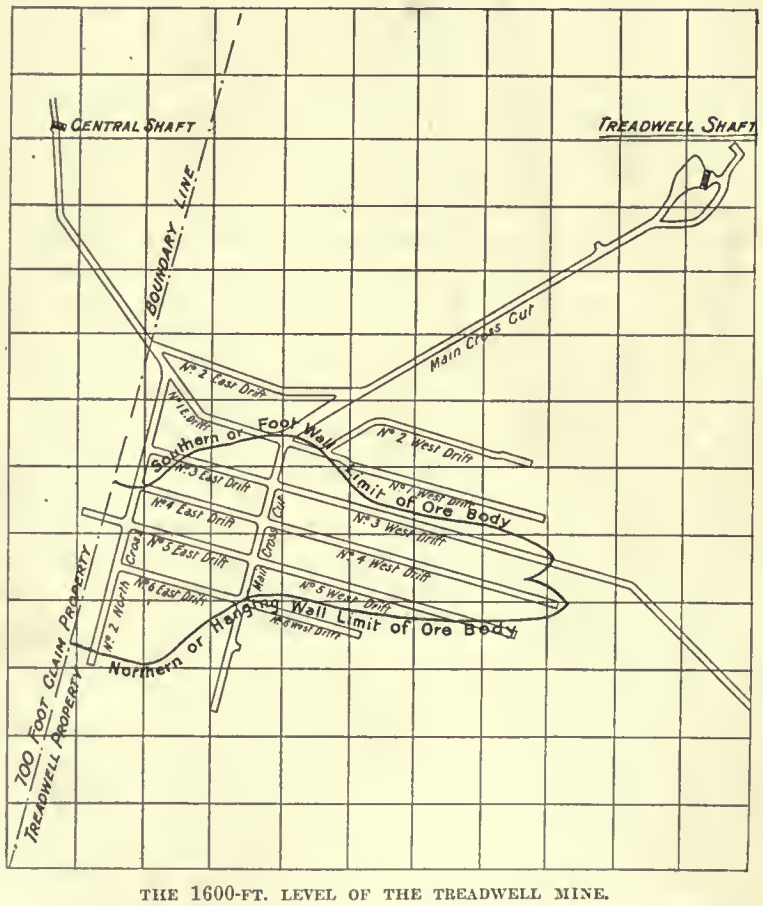
The annual reports of the Alaska Mexican, Alaska Treadwell, and Alaska United gold mining companies for the year 1912 are now at hand, and the following information has been compiled from the report of the general superintendent, Robert A. Kinzie. These reports are notable for their excellent summaries of the mine work, mine plans, detailed costs and general conclusions. The Alaska United company operates the Ready Bullion and the 700-Ft. claim, but the Treadwell company has also done considerable development in the latter. Exploration and development operations covered the following ground:

	Feet.
Alaska Mexican	3,530
Alaska Treadwell	11,016
Alaska United	2,489
700-Ft. claim, by Alaska Treadwell	1,562
700-Ft. claim, by Alaska United	4,538

Details of Development Work

On the 1320-ft. level of the Alaska Mexican, at a point in the main cross-cut branch, 75 ft. from the main cross-cut, a drift, called the main east drift, was started and driven 196 ft. The average assay value of 32 samples, taken from the above 196 ft., is $1.82 per ton. This work extended the stoping area on this level to a point 80 ft. farther east than had heretofore been worked. At a point in the main east drift, 10 ft. from its face, a cross-cut, called the main east drift cross-cut, was driven north a distance of 18 ft. The average assay value of three samples, taken from the above 18 ft., is 69c. On the 1460-ft. level, the main north cross-cut was continued 538 ft. through waste. At a point in the main north cross-cut, 60 ft. from its face, a drift, called the main west drift, was started and driven west a distance of 775 ft. The average assay value of 65 samples, taken from the first 384 ft. of the above drift, is 72c., and the average assay value of 61 samples, taken from the last 391 ft., is $1.80. At a point in the main west drift, immediately below the pillar at the east end of the No. 1 stope, 1320-ft. level, a raise, called the No. 1 manway raise, was started and driven a distance of 200 ft., connecting with the main east drift of the 1320-ft. level. The average assay value of 26 samples, taken from the above 200 ft., is $1.47. At a point in the main west drift, 544 ft. from the main north cross-cut, a cross-cut, called the No. 2 north, was driven north a distance of 115 ft. The average assay value of 21 samples, taken from the above 115 ft., is $1.02. On the 1570-ft. level, present bottom level, the station and ore-bin on the north side of the shaft, and on the south side of the shaft a pump-station and sump were cut out, and the pumps installed.

On the 750-ft. level of the Alaska Treadwell, a drift, called the No. 6 east, was started at the junction of the No. 1 north cross-cut with the No. 5 east drift, and driven a distance of 217 ft. The average assay value of 29 samples, taken from the above 217 ft., is 69c. per ton. This drift will be extended underneath the hanging wall of the No. 1, 2, 3, and 4 stopes. From this drift raises will be driven and 'bulldozing' chambers cut out similar to those already in use in the No. 2 stope. The caved ore will thus be drawn from this level. During the year, 129.895 tons of ore of an average assay value of $2.38 was drawn from the caved ore from the No. 2 stope of this level. At a point in the No. 1 west drift of the 1600-ft. level, 35 ft. from No. 1 north cross-cut, a drift, called the No. 2 west, was driven a distance of 365 ft. through waste. From this drift seven chute-raises were driven to the No. 4, 5, and 6 stopes to enable the ore to be drawn from the foot-wall side of these stopes, thus doing away with excessive shoveling. The No. 3 west drift was continued a distance of 1534 ft. The first 18 ft. was in



THE 1600-FT. LEVEL OF THE TREADWELL MINE.
(Blocks 100 ft. square.)

ore, and three samples taken had an average assay value of $5.18. The drift was then continued 1516 ft. through waste, the last 23 ft. of which was driven in ground belonging to the Bear's Nest Co. This work completes the contract under which the Treadwell has secured the 75% interest in the Bear's Nest property. Starting from the No. 4 west drift in the pillar between the No. 4 and 5 stopes, a raise, called No. 4 manway, was driven 276 ft., and connected

with the 1250-ft. level. The average assay value of 33 samples, taken from the above 276 ft., is $2.98. The development work on this level was distributed as follows: Driving, 2352 ft.; intermediates, 1857 ft.; manway-raises, 731 ft.; manway-drifts, 225 ft.; chute-raises, 1441 ft; chute-stations, 625 ft.; and stable-stations, 10 feet.

Development on the Bottom Level

On the 1750-ft. level the No. 1 east drift was continued 33 ft. through waste to the east end line. From this point, the drift was turned abruptly to the south, and continued 569 ft. in waste through ground of the Alaska United to the central shaft. At a point in the No. 1 east drift, 20 ft. east of the end line of the Treadwell property, a cross-cut, called the No. 2 north, was driven 60 ft. through waste, at which point it crossed over into the Treadwell ground. From this point the No. 2 north cross-cut was driven 136 ft. through waste. The cross-cut was then continued 177 ft. through ore, and the average assay value of 22 samples, taken from the above 177 ft., is $2.03. The main cross-cut was continued 385 ft., and the average assay value of 58 samples, taken from the above 385 ft., is 78c. The No. 3 east drift was continued 296 ft., and connected with the No. 2 north cross-cut. The average assay value of 34 samples, taken from the first 248 ft., is $2.09, and the average assay value of six samples, taken from the last 48 ft., is $1.21. At a point in the No. 1 north cross-cut, opposite the No. 4 west drift, a drift, called the No. 4 east, was driven a distance of 327 ft., connecting with No. 2 north cross-cut, and then to the east end line of the property. The average assay value of 50 samples, taken from the above 327 ft., is $1.38. The No. 4 east drift was then continued from the east end line of the Treadwell property 26 ft. into the ground of the 700-Ft. claim. The average assay value of three samples, taken from the above 26 ft., is $1.31. It is planned at the present time to continue the central shaft to the 2100-ft. level before cross-cutting to the orebody. The stopes will then be started and carried up to a point within 200 ft. of the 1750-ft. level, at which point they will be stopped, thus leaving a solid pillar of ground between the workings on the 2100-ft. level, and the older portions of the mine. The 1750-ft. level will then be used as a base-level for carrying on the work in depth. It is planned to move the blacksmith shop, repair shop, and manway hoists to this level. In other words, it practically means the starting of a new mine, the workings of which will be protected from caves, water, etc., by a solid pillar of ground 200 ft. thick. It will then be possible to cave a considerable portion of the pillars between the 1750-ft. level and the surface, thus recovering a large tonnage of ore.

On the 1350-ft. level of the Ready Bullion, at a point in the No. 1 west drift, 60 ft. from its face, a drift, called the No. 5 east, was driven a distance of 102 ft. The average assay value of 15 samples, taken from the above 102 ft., is $1.39. The No. 4 west drift was continued 141 ft. The average assay value of 19 samples, taken from the above 141 ft., is $2.41. This work has been done on what was known as the south orebody of the upper levels, but no work has been done on the south orebody below the 450-ft. level. Contracts have been let for driving the necessary raises for ventilation and intermediates preparatory to stoping this ore. On the 2000-ft. level, present bottom level, the station and ore-bin at this level were completed during the year. The main south cross-cut was started from the shaft station and driven in a southeasterly direction 627 ft. The first 392 ft. of the above cross-cut was in waste, and the average assay value of 38 samples, taken from the last 235 ft., is $2.64. During the year the main shaft was sunk a distance of 70 ft. through waste.

On the 1210-ft. level of the 700-Ft. claim, the foot-wall drift was connected with No. 3 west drift by a drift, called the No. 4 west, 129 ft. in length. The average assay value of 17 samples, taken from the above 129 ft., is $3.63. At a point in the foot-wall drift, 50 ft. from the main west drift, a station was cut, aggregating 150 ft. of driving. This station is to be used for transferring the ore from this level to the central shaft. At a point in the No. 3 west drift, a raise, called the No. 5 manway, was driven a distance of 124 ft. The average assay value of 19 samples, taken from the above 124 ft., is $3.49. On the 1320-ft. level, present bottom level, the foot-wall drift was continued 87 ft. through waste, and connected with the main west drift. This was continued 167 ft. to the west end line of the property. The average assay value of 30 samples, taken from the above 167 ft., is $5.39. At a point in the main west drift, 600 ft. from the east end line of the property, a drift, called the No. 3 west, was driven a distance of 207 ft., to the west end line of the property. The average assay value of 32 samples taken from the above 207 ft., is $4.04. At a point in the main west drift, 550 ft. from the east end line of the property, the foot-wall cross-cut was started and driven a distance of 218 ft. The average assay value of seven samples, taken from the first 50 ft. of the above drift is $3.96; the remaining 168 ft. was in waste. From this cross-cut a station was cut out in waste aggregating 133 ft. It is the present plan to open the bottom levels by driving east from the central shaft.

Ore Reserves and Sampling

Ore reserves in the mines are as follows:

	Ore in place, tons.	Ore in stopes, tons.	Av. value per ton.
Alaska Mexican	575,398	465,233	$3.18
Alaska Treadwell	5,702,696	1,275,262	2.72
Alaska United:			
Ready Bullion	1,405,394	316,127	2.62
700-Ft. claim	885,908	268,365	2.58
Total	8,569,396	2,324,987	....

The total quantity of ore available for milling is therefore 10,894,383 tons. Samples taken in the mines showed the following results:

	Levels sampled, feet.	No. of samples.	Av. value.
Alaska Mexican	680 to 1460	1533	$3.62
Alaska Treadwell	600 to 1750	4249	3.22
Alaska United:			
Ready Bullion	1025 to 2000	1283	4.05
700-Ft. claim	880 to 1320	2305	3.19
Total samples		9370	....

Stamp-Mill Operation

Results of the five stamp-mills may be summarized as under:

	Mexican.	Treadwell.		United.	
Stamps working..	120	240	300	120	120
Power used:					
Steam, days....	147.60	109.68	.....	149.16	175.78
Water, days....	213.76	239.60	207.39	210.31	183.87
Electric, days..	.....	.....	111.25	.....	.....
Concentrate, tons.	4956	6838	10,559	6128	4704
Ore crushed, tons.	233,299	371,308	520,884	216,454	234,339
Gold by amalgamation	$307,951	$1,159,401		$317,970	$282,180
Gold by cyanidation	371,169	1,046,487		300,188	294,951
Total output...	$679,120	$2,205,888		$618,158	$577,132
Yield per ton....	$2.91	$2.47		$2.85	$2.46

The salt-water system has been installed for the Treadwell mills, and is also connected with the fire system.

The Cyanide Plant

This plant, which is owned jointly by the Alaska Treadwell Gold Mining Co., the Alaska Mexican Gold Mining Co., and the Alaska United Gold Mining Co., was built to treat the concentrate made in their various mills and has proved an unqualified success. It has been operated continuously throughout the year and treated 33,185 tons of concentrate at an operating cost of $3.128 per ton with an extraction of 97%. In addition to the above, various additions and alterations were made to the plant at a total cost of $19,985, or 60c. per ton of concentrate treated. The principal items of the above construction charges consisted of the installation of a blast-furnace and acid-treatment unit in the refining room, and the installation of additional filter and precipitation presses in the mill. In connection with the operation of filling the underground stopes with tailing from the mills, an experimental plant was built and equipped, with the object of determining if it is possible to devise some method of extracting a proportion of the gold contained in the tailing at a profit. These experiments are now under way, but results cannot yet be announced.

Hydro-Electric Power Plant (Nugget Creek)

The first unit of this power plant has been completed and is now in use. The water for the use of the plant is diverted from the channel of Nugget creek at the lower end of the lower basin, at an elevation of about 500 ft. above the power-house. The water is then conveyed by means of a flume and pipe-line a distance of 6902 ft. to the power-house. From the present point of diversion, the water is conveyed a distance of 300 ft. through a temporary flume to the entrance of the drain-tunnel. This drain-tunnel is 650 ft. long and connects the lower basin of Nugget creek with the Mendenhall valley. The water is then conveyed through a continuous wood-stave pipe, 48 in. inside diameter, for a distance of 3912 ft. From the end of the wood-stave pipe to the power-house, a distance of 2040 ft., riveted-steel pipe, 36-in. diam., is used. The power-house at present contains one 1900-hp. maximum-capacity overhung Pelton water-wheel unit, with water-actuated water-nozzle regulated by a Lombard governor. The water-wheel is direct-connected to a 1175-kva., 3-phase, 60-cycle, 2300-volt, 300 r.p.m. General Electric Co. generator. The power-house also contains the necessary exciters, switchboard, and transformers. The voltage is transformed to 22,000 volts, and transmitted a distance of 14 miles to Treadwell, where it is again transformed to 2300 volts and distributed at this pressure. The second unit has been purchased and will be installed this summer. It consists of one 3800-hp. maximum-capacity Pelton-Doble double-overhung type water-wheel, direct-connected to a Westinghouse 2350-kva. generator of the same type as the generator at present installed. The work of preparing the foundation of the rock-fill dam to be constructed at the lower basin is now in progress.

Sociological Conditions of Employees

The Treadwell Committee of Safety has been organized for the object of minimizing accidents both on the surface and underground. The committee is made up of 15 members; eight are appointed by the Alaska Labor Union from its members, and seven are appointed by the general superintendent of the Treadwell group of mines. Every accident is immediately investigated by the sub-committee having charge of the department in which the accident occurs, and a full report is made to the committee, which in turn reports the findings of the sub-committee with such recommendations as it considers necessary to prevent a recurrence of the accident. The committee also appoints an inspector, whose sole duty is to report any dangerous condition that he may observe, either on the surface or underground, and, if he sees fit, has the authority to stop such operations until such changes are made as to render their continuance safe. The committee has also formulated a system of sick and accident benefits, which schedule has been adopted and put in force by the Treadwell group. All benefits are paid by the companies without any tax or reduction from the pay of its employees. As an addition to its various other attractions, there has been constructed in a separate building a thoroughly equipped hand-ball court with necessary lockers and change-room. The building also contains a meeting-room, smaller than the one in the main club building. This room is used for meetings of the fire companies, societies, etc. The Treadwell Club, as an institution, continues to be very popular with the employees, and Mr. Kinzie considers it an important adjunct to the plant.

Labor Conditions

There has been a satisfactory supply of labor for all departments during the past year. The following are the rates of wages paid different classes of labor employed here: Machine drillers, $3.50 per day; machine helpers, $3.25 per day; mine laborers, $3 per day; amalgamators, $120 per month; feeders, $100 per month; vannermen, $95 to $130 per month; machinists and helpers in machine-shop, $3 to $7 per day; blacksmiths, $5 to $6 per day; tool sharpeners, $4.50 per day; and blacksmiths' helpers, $3

per day. Employees who board at the company's boarding-house are charged $25 per month for meals, and $2 per month is added when they occupy a room in the lodging-houses. To show that the group of mines is not charging high rates for dwellings and boarding-houses, it may be mentioned that a total loss of $27,459 was made on their operation during the year.

Financial Statement

This may be condensed into the following table:

	Mexican.	Treadwell.	United.
Revenue from all sources	$681,635	$2,259,817	$1,195,290
Total expenditure	371,282	1,090,097	649,563
Net profit	$310,353	$1,169,720	$ 545,627
Dividends paid	225,000	650,000	324,369
Depreciation	100,759	621,069	222,522
Carried forward to 1913	40,000	225,000	70,000

Mining Costs

The following data are based on the tonnage milled:

			United.	
	Mexican.	Treadwell.	Ready Bullion.	700-Ft. Claim.
	Per ton.			
Development	$0.151	$0.126	$0.134	$0.156
Stoping	0.758	0.525	0.570	0.600
Tramming	0.132	0.105	0.118	0.129
Hoisting	0.080	0.088	0.171	0.122
Pumping	0.018	0.008	0.016	0.017
Total	$1.139	$0.852	$1.009	$1.024

Milling Costs

Crushing	$0.021	$0.025	$0.020	$0.017
Tramming	0.014	0.017	0.011	0.012
Stamping	0.138	0.120	0.153	0.140
Concentrating	0.058	0.045	0.069	0.048
Total	$0.231	$0.207	$0.253	$0.217

Summary of Results from Start of Operations

The Mexican mine has been operated since 1894, the Treadwell since 1882, the Ready Bullion since 1898, and the 700-Ft. Claim since 1899; and the total output is as follows:

	Mexican.	Treadwell.	United.
Ore crushed, tons	3,593,334	12,981,732	4,378,915
Concentrate produced, tons	69,082	245,283	84,923
Gold from amalgamation	$5,511,095	$18,567,448	$5,368,941
Gold from smelting and cyanidation of concentrate	4,437,921	13,638,753	3,708,736
Total yield	$9,949,016	$31,606,201	$9,077,677
Operating profits	3,656,126	14,387,760	1,998,097
Dividends paid	3,093,381	12,785,000	1,162,290

The total operations of the three companies for the year showed the following:

Ore milled, tons	1,576,284
Gold recovered from mill and cyanide plant	$4,080,298
Average per ton	2.59
Total expenditure	2,025,700
Average per ton	1.28
Total profit	2,054,598
Dividends paid	1,199,360

Coal imports into Peru in 1911 were valued at $1,098,509, of which $88,690 came from Australia, $786,214 from England, $159,081 from Germany, and $55,058 from the United States.

Volumetric Determination of Gold

By Victor Lenher

*Sulphurous acid is capable of reducing auric chloride to aurous in the presence of certain other salts. Through the use of this reagent it is possible to estimate gold volumetrically with ease and accuracy. In the following work, a sulphurous acid solution was prepared by evolving sulphur dioxide from sodium acid sulphite by means of hydrochloric acid and, after washing the gas, conducting it into repeatedly distilled water. The strength of the sulphurous acid necessarily varied from time to time, due to its gradual oxidation. Its strength varied from 0.005 gm. Au to 0.002 gm. Au per cubic centimetre. Sulphurous acid solution requires frequent standardization, owing to its ability to slowly oxidize, by absorbing oxygen from the air in the container, and pass over into sulphuric acid. After a large amount of experiment under widely differing conditions, the idea of using a permanganate solution as a convenient standardizing solution was abandoned. Working under the most favorable conditions, it has not been found possible to obtain results having an error lower than 1% between permanganate and sulphurous acid.

The most reliable method of standardizing sulphurous acid is through the ageney of iodine. It is entirely immaterial for the methods to be described whether the sulphurous acid solution is standardized on a known weight of iodine in potassium iodide or whether solid potassium iodide is dissolved in water acidulated with sulphuric or hydrochloric acid and a definite amount of standard permanganate introduced.

1. Auric chloride when treated with potassium iodide, liberates iodine according to the equation

$$AuCl_3 + 2KI = AuCl + 2KCl + I_2.$$

The iodine thus liberated can be titrated in presence of excess of potassium iodide by means of standard sulphurous acid. Starch can be used as the indicator.

2. Auric chloride can be treated with excess of a strong solution of magnesium chloride, then with potassium iodide, and the liberated iodine titrated with sulphurous acid.

3. Auric chloride when treated with potassium bromide yields bromine thus:

$$AuCl_3 + 2KBr = AuCl + 2KCl + Br_2.$$

The liberated bromine can be titrated with a solution of sulphurous acid.

4. Auric chloride treated with magnesium chloride and potassium bromide, similarly liberates bromine, which can be titrated with sulphurous acid.

5. Auric chloride when treated with magnesium chloride gives a yellow color, which can be decolorized by titration with sulphurous acid.

6. Auric chloride and sodium chloride give a yellow color which by sulphurous acid can be titrated to the colorless or aurous state.

In order to test the efficiency of these principles,

*Excerpt from the *Journal* of the American Chemical Society.

auric chloride solutions were prepared by solution of weighed amounts of metallic gold in hydrochloric acid and potassium chlorate and the excess of chlorine removed by the addition of ammonia until the formation of a permanent precipitate, which was then dissolved in hydrochloric acid. Unless precautions of this character are taken, the gold solution will either contain some free chlorine on the one hand, or some metallic gold will separate on the other when an attempt to remove the free chlorine by evaporation to dryness or nearly to dryness is made. Evaporation of a pure auric chloride solution, even on the water bath, causes the production of a small amount of aurous chloride, which on subsequent dilution gradually changes to metallic gold and auric chloride. By the treatment of metallic gold with hydrochloric acid and potassium chlorate followed by the ammonia and hydrochloric acid treatment, an auric solution can be obtained.

Series 1

Definite amounts of gold chloride prepared in the manner indicated and acidified with hydrochloric acid were treated in a dilution of 100 c.c. with about 3 gm. of potassium iodide, and the iodine liberated was titrated with a standard solution of sulphurous acid with the following results:

No.	Au taken, gm.	Au found, gm.	Error.
1	0.0395	0.0395	0.0000
2	0.0439	0.0438	−0.0001
3	0.0878	0.0876	−0.0002
4	0.1098	0.1092	−0.0006
5	0.1107	0.1108	+0.0001
6	0.2289	0.2289	0.0000
7	0.4395	0.4397	+0.0002
8	0.7301	0.7302	+0.0001

Series 2

Gold chloride solutions were treated with an excess of a saturated solution of magnesium chloride, potassium iodide was added, and the titration by means of sulphurous acid effected in a dilution of 100 cubic centimetres.

No.	Au taken, gm.	Au found, gm.	Error.
9	0.0439	0.0440	+0.0001
10	0.0878	0.0879	+0.0001
11	0.1061	0.1063	+0.0002
12	0.2653	0.2652	−0.0001
13	0.5305	0.5298	−0.0007

Series 3

Known amounts of gold chloride solution were treated with excess of a saturated solution of magnesium chloride. The yellow color of the auric chloride is considerably deepened by the addition of magnesium chloride. When sulphurous acid is added from the burette, the solution is bleached progressively until colorless. No other indicator is necessary.

No.	Au taken, gm.	Au found, gm.	Error.
14	0.0439	0.0438	−0.0001
15	0.0439	0.0440	+0.0001
16	0.2289	0.2289	0.0000
17	0.2289	0.2289	0.0000

In numbers 14, 15, and 16, 25-c.c. portions of auric chloride solution containing a small amount of hydrochloric acid were treated with sufficient excess of concentrated magnesium chloride to bring the volume to 100 c.c. and titrated. In No. 17 conditions were the same except that 20 c.c. of concentrated hydrochloric acid were present, showing that a considerable amount of free hydrochloric acid does not materially affect this titration of auric chloride in presence of magnesium chloride.

Series 4

Fifty cubic centimetres of the slightly acid solution of auric chloride was brought to a volume of 100 c.c. with a saturated solution of sodium chloride and titrated to a colorless state by means of sulphurous acid.

No.	Au taken, gm.	Au found, gm.	Error.
18	0.0439	0.0438	−0.0001
19	0.2289	0.2289	0.0000

In all of the above titrations a decided excess of alkaline salts was present, and at this point the reaction of sulphurous acid was studied on auric chloride solutions containing free hydrochloric acid but no salts. In such a gold solution sulphurous acid not only does not show a distinct bleaching effect, but metallic gold is thrown out of the solution with ease.

Series 5

Gold chloride containing a small quantity of hydrochloric acid was brought to a volume of 100 c.c., 3 to 5 gm. of potassium bromide was added, and the red color of the free bromine was titrated to colorless by means of sulphurous acid.

No.	Au taken, gm.	Au found, gm.	Error.
20	0.0439	0.0439	0.0000
21	0.0439	0.0440	+0.0001
22	0.0439	0.0438	−0.0001
23	0.0878	0.0876	−0.0002
24	0.2289	0.2289	0.0000

Series 6

Auric chloride solutions were treated with 3 to 5 gm. of potassium bromide and made up to 100 c.c. with a strong solution of magnesium chloride. The red color of the free bromine was titrated to colorless by sulphurous acid.

No.	Au taken, gm.	Au found, gm.	Error.
25	0.0439	0.0440	+0.0001
26	0.1061	0.1063	+0.0002
27	0.2653	0.2655	+0.0002

In the application of the above methods, the gold is originally usually in the metallic form. In order to dissolve the metal, either chlorine water or hydrochloric acid and potassium chlorate are convenient solvents. The excess of the oxidizing agent cannot be removed by evaporation on account of the production of some aurous chloride. The free chlorine can be advantageously removed by addition of ammonia until a permanent precipitate forms, acidulating with hydrochloric acid and heating to redissolve the precipitate formed by the ammonia. On cooling, 3 gm. of potassium iodide is added, and titration is effected by a standard solution of sulphurous acid, using, if desired, starch as the indicator; or, instead of using potassium iodide, the solution can be treated with potassium bromide or with excess of sodium chloride and titrated by sulphurous acid.

Examining A Peruvian Placer

By Pierre Bouery

The placers of the Nosciniscato and tributaries are in the province of Quiquipanchi, Department of Cuzco, Peru. They are reached by steamers from the United States to Molleno and from there by rail to Urcos, a station on the main line, 502 miles from the seaport. From Urcos, half of the way the trip is made by mules, and the balance on foot. The placers are on the eastern slope of the Eastern Cordilleras, of which the principal snow-covered peaks are the Alcumbrera, Callangate, and Musangate, with altitudes of over 20,000 feet.

Cuzco, the nearest important city and the seat of the government for the same department, is 32 miles distant from Urcos and is the distributing point for the surrounding country, including the mines. From Urcos, the distance of 120 miles, can be covered, with good luck and good weather, in a minimum of seven days continuous travel, discarding entirely the delays due to pack animals and carriers. A fairly good mountain trail, 60 miles long, separates Urcos and Marcapata, 30 miles of very bad trail follows it to Cadena, and for the last 30 miles to the mine there is practically no sign of a trail.

History of the Discovery

It is said that the placers were first discovered by a certain A. Hilfiker and sold to L. Gotuzzo of Lima, who, without any knowledge of mining, spent in expeditions, prospecting, and taxes some $60,000. Several expeditions were organized by him and his associates in the states, but none reached the mines, with the exception of one which went in 1909 and returned disgusted. The only work, up to the present time, has been by natives, who go there during the dry season and pick out the best spots and, after weeks of work, come back with a few ounces of gold.

It is my belief that during the Tertiary period the country was under water with several hundred feet of gravel over the bedrock, which is an argillaceous schist. When the upheaval of that country occurred, the present Sierras appeared and the topography of the country was changed; lines of weakness were formed, masses of new rocks were brought to the surface, and through the fault fissures the waters found their way to the lower strata, eroding the rocks and forming the rivers which carried away the rocks, making a natural classification of the

THE RAILROAD TO THE PLACERS.

MOLLENDO, THE GATEWAY TO SOUTHERN PERU.

material. It is hard to believe that the concentrated gold came from the cemented gravel; from appearance it would seem to come from the newly brought up rocks. I say that the cemented gravel is not gold-bearing, because it was impossible for me to find any color in it. If there is gold, it must be very fine and too small in quantity to be worked at a profit.

As a consequence, I am sure that the gold found in the Nosciniscato and tributaries came with the upheaval of the country, which brought to the surface the underlying bedrock full of small stringers that contain the gold. In weathering, which is very intense in the tropics, and because the rocks were distorted in every direction by pressure, they were easily eroded. The gold was thus freed from its matrix and deposited by the floods in the river below. Years have elapsed, erosion has been continuous, and new stringers have been exposed to the surface and later disintegrated and washed down with the other porphyritic rocks. The succession of these phenomena accounts for the present topography. During all this period and at the present time, the rivers are constantly changing their courses, and by this action concentrate the gold in places forming pockets.

Origin of the Placers

In short, I will say: First, that the actual placers were barren during the Tertiary period, although formed previously or at that time. Second, that the upheaval of the Cordilleras brought to the surface the schists and quartz carrying some gold-bearing stringers. Third, that the weathering-action on the fissures, faults, and dislocations, disintegrated the cemented gravel rocks, the latter carrying down to the plains the gold contained in them. Fourth, that the rivers flowing into the Amazon on a light grade were not flowing in a permanent bed, and, breaking through weak shores, left the soft bedrock exposed and deposited their gold in proportion to the extent of gold-bearing stringers crossed. The ridges of hard rock encountered acted as riffles in a sluice. Finally, I would say that the surface indications, on account of the dense vegetation, are very limited. My statements, however, are not entirely based upon surface exposures, but they are largely the result of study when passing through the country and cutting the prospect-trenches and trails. At first sight, and without any prejudice because of the difficulties of the travel, I saw that the chances for working were very limited, practically nil, unless the gold content

was very high, which could not be expected from a deposit of this nature.

The Bonanza placer is about a mile and a half from the mouth of the Huallumbe; it is over three miles long with a width varying from 500 to 2500 ft. The thickness is less than 1 ft. in places and with a maximum of not over 7 or 8 ft. It lies on a soft bedrock of argillaceous schist, red in some places and bluish-lead color in others.

The Huallumbe divides the gravel into two parts and exposes the bedrock or the thin layer of gravel above it. The grade of the river is about one per cent toward the Noseiniseato, while nearer the source of the Huallumbe it reaches five per cent. There the river has cut through the bedrock, making a deep canyon full of potholes. The bank cannot be worked by a hydraulic process, because there is no grade for the sluice and there is practically no bank. From 2 to 7 ft. of bank means a continuous change of the giants and elevators, and consequently the cleaning of all the uncovered bedrock, which would be a long and tedious operation. This could be partly overcome by washing at different places, but the equipment would then have to be more costly.

Seasons and Rainfall

The year is divided into two seasons, the dry season from April to October, and the rainy season from November to March. There is no record of the rainfall, but it is about the same as in similar tropical countries, with frequent cloudbursts, showers at regular hours, and repeated long and heavy rains. I would not be surprised to find a rainfall of over 250 in. per season. During the heavy rains it is difficult and almost impossible to work, on account of the high temperature and the dampness. A sanitary staff would have to be organized and maintained in order to fight tropical diseases, insects, etc. Although this is a secondary factor, I consider it important, as upon the health of the workers depends largely the success of the undertaking. As to labor, all the working force will have to be brought from abroad or from some other part of Peru, where it is available and more efficient. The Indians of Marcapata are entirely worthless except for their carrying capacity and endurance for long distance travel.

AT 1600 FT. IN THE PERUVIAN MOUNTAINS.

mining equipment, such as giants, elevators, and dredges, costing considerable and causing delays which can only be compensated by a very high percentage of gold. The digging of new sumps for elevators is prohibitive, as is also the moving of the giants and the building of a retaining dam for raising the water-level to float a dredge.

Abundance of Water

The only element available all the year around is the water, which could be brought from the adjoining rivers. The Quitari and the Yanaorco carry plenty of water all the year around, and with a ditch from 5 to 7 miles long will give a head of several hundred feet. Special care should be taken to handle the heavy floods during the rainy season, which would compel the use of expensive pipe-lines, buried in the ground, to avoid breaks and delays. I do not consider this difficulty insurmountable, if other conditions were favorable, and I am satisfied that the water is available and could be used. The size of the ditch should be sufficient to carry 3000 miners inches, in order to overcome the lack of grade in the carrying away of the boulders and tailing. This amount of water will wash enough gravel to oblige frequent

The first prospecting I did was near a small gulch. A dam was built between the banks and water was stored for rocking. Six pans were taken on each side of the bank and gave four fine colors. A second spot was selected along the river, and gave the same result in panning. We were searching for a rich place, as natives do, but could not find one. The crew of laborers was then divided into gangs headed by the foreman, one native miner, Vanoni, and myself, and for two days we hunted for a place where we could use the hose and water under pressure and wash in the sluice-box a payable amount of gold. Finally at the end of the third day, in what is called the River of the Frenchman, we placed the boxes and dammed the little stream to get some pressure, because pan indications were very good, and it was thought by

Vanoni that we were at last in the right place. The next morning we started to work, and after 2½ cu. yd. had been washed, I cleaned the boxes. The contents were put in a bottle and panned until the last sign of black sand disappeared. I found on the scale 2.33 grams. Taking the gold at $20 per ounce, on account of its excessive fineness of 997, its value was 59c. per cu. yd. It was a good prospect, but it could not be taken as an average of the deposit, because it was a concentrate on the border of the river, the bedrock showing about 5 ft. further and rising abruptly with less than one foot of gravel on it.

Unsatisfactory Result of Tests

Another spot was picked out in the same gulch, 250 ft. farther up, and after setting the sluices, the bank was attacked with picks and shovels. The contents of the boxes showed 11 fine colors, which were picked out and separated from the barren material. They were not weighed, but their value was estimated by comparison to be from 15 to 20c. for half a cubic yard. While the result of the local work was very convincing, I was ready to proceed farther, although Mr. Vanoni was satisfied that no profitable mining could be done in the pampas of the Nosiniscato and tributaries. He suggested that the only hope now was in the cemented gravel, because the quantity and the dump room were to be had there. I insisted on not breaking camp, and sent the best panner down the river, one mile below, instructing him to take 10 pans on the trail through the forest, where the bank and bedrock was exposed. He went, and as nothing of value was brought to me I decided to break camp and investigate the cemented gravel on my way back. This gravel lay between the pampas and the Sierras, and can be traced all along the Arasa with a thickness varying from 50 to 150 ft. Careful panningss taken from place to place, especially near Quince Mil Soles, proved it to be barren, but only systematic panning and washing would be conclusive. All the creeks emptying into the Huallumbe cut through the cemented gravel, so we picked out the one we were to use as a trail, and after going into camp in a new place, started panning. Panningss were taken under my direction from the bottom of the creek up to the surface every 5 ft. To our great disappointment, we could not find a color, but noticed that the cement was as hard as that of the ancient Romans. All hope was now gone and we decided to return, leaving the country to the native miners, who have time to spare for the finding of rich pockets.

Effect of Slave Labor

The Incas and Spaniards did not leave this country untouched, and work has evidently been done on the placers in the past, as proved by the finding of one of their tools. Whether they paid or not, I cannot say, for the conditions of the past and present are different. In the past, the mines were worked by slaves without pay, the only expenses incurred being for food, which was supplied by slave labor. When the gold extracted did not pay there were no losses, and some other place was sought for the rich metal. The fabulous wealth of the country is very much exaggerated; it was the result of hundreds of years of work by slaves and the consequent accumulation of the rich metal.

There is gold in the Nosiniscato, but as long as the country is unsettled, the trails and the roads unfinished, and the population as it is, there is no hope of seeing it dug out even with the most modern and economic methods. Natives, Cholos, and the like are the men who can make something of it; time and necessities make no difference for them.

Lake Copper Mines Valuation

The copper mines of Houghton county, Michigan, have recently been assessed for 1913 taxes by the board of equalization of the district. The assessments are interesting for comparison with stock values, and for comparing 1912 assessments with those of 1913. The list is given below. It will be noticed that the 1913 Calumet & Hecla valuation has been raised $4,000,000 over that for 1912; also that Isle Royale, Superior, Champion, Tamarack, Mayflower, and Old Colony have been substantially increased; while Wolverine, Copper Range, Franklin, Hancock, Quincy, Winona, Centennial, Osceola, Oneco, New Baltic, and New Arcadian have been reduced.

Mine.	Valuation 1913.	Valuation 1912.
Calumet & Hecla	$36,480,000	$32,340,000
Centennial	882,300	1,039,500
Copper Range	13,464,100	16,293,400
Franklin	669,800	1,372,300
Hancock	1,062,600	1,463,000
Houghton	135,600	139,900
Isle Royale	3,021,000	2,227,500
La Salle	728,100	782,300
Mayflower	455,400	300,000
New Arcadian	132,500	280,300
New Baltic	35,000	111,300
Old Colony	253,000	200,000
Osceola	6,649,200	7,361,000
Oneco	44,000	99,000
Quincy	5,852,000	6,243,600
Superior	2,008,100	1,807,900
Tamarack	1,195,000	990,000
Wolverine	2,804,400	4,435,200
Winona	263,100	629,800
Wyandot	50,600	110,000
Champion (¼)	4,921,000	3,055,800
Total for Houghton county mines	$81,107,200	$81,282,700

It is interesting to note in passing that several of the mines which J. R. Finlay called unprofitable and valued at zero in 1911 are here assessed at respectable figures. This is true of the Centennial, assessed at $882,300; Tamarack, assessed at $1,195,000; and the Franklin, assessed at $669,800. Hancock, assessed at $1,062,600, was given no value by Mr. Finlay in 1911, but had not then been developed as thoroughly as since.

Petroleum has been discovered within the precincts of Melo, Uruguay, by the Public Works Department, at a depth of 1150 feet.

Telluride of gold has been found in ore of the Victorious mine, Ora Banda, 40 miles from Kalgoorlie, Western Australia.

The Mineral Resources of Virginia—II

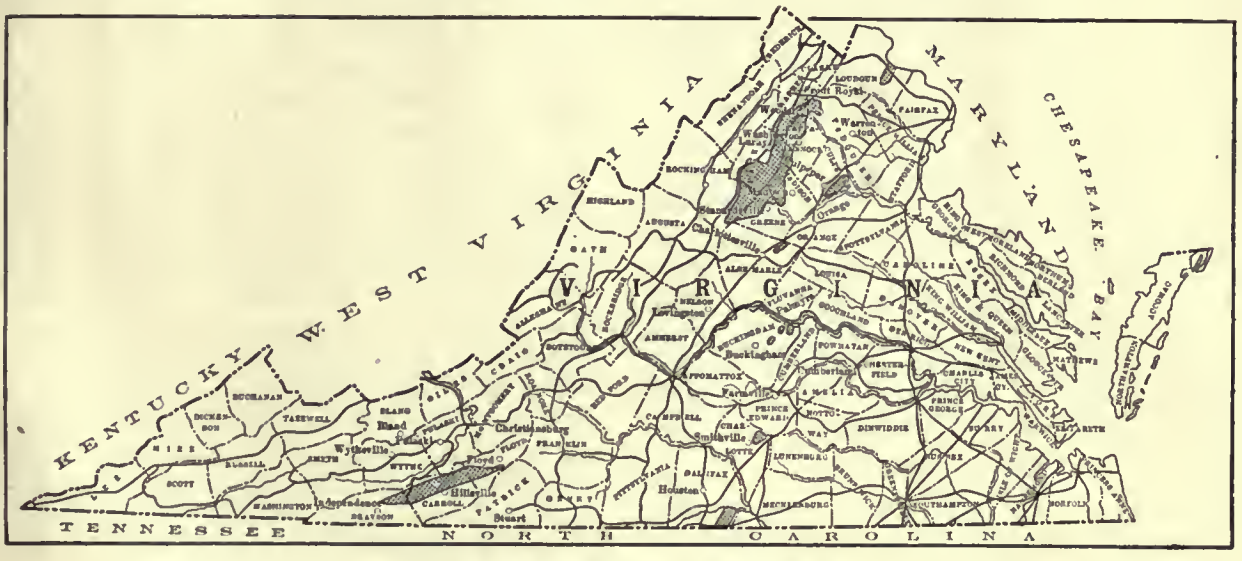
By Thomas Leonard Watson

Copper ores are found in many counties of Virginia, and in a variety of occurrences. They are confined to the crystalline rocks of the Piedmont plateau and the Blue Ridge mountains, and to the Triassic red beds which form numerous small areas in the Piedmont province. Of these occurrences, the principal areas, three in number, are (1) the Virgilina district, which includes parts of Halifax, Charlotte, and Mecklenburg counties; (2) the northern Blue Ridge region, which includes parts of Warren, Fauquier, Rappahannock, Madison, Page, and Greene counties; and (3) the southwest Virginia area, which includes Floyd, Carroll, and Grayson counties. The principal production has been from the first and third areas.

The Virgilina copper district, 47 miles east of Danville, and having an equal extent in Virginia and North Carolina, is the most important copper district in Virginia. The ores, comprising chiefly gray glance (chalcocite) and bornite, occur in quartz fissure veins which intersect or lie in altered andesite and andesite tuff. The inclosing rocks have been rendered thinly schistose from metamorphism, and they are more properly designated schists. Cuprite and malachite occur at shallow depths as alteration products of the original sulphides. A little native copper is sometimes noted. Chalcopyrite and pyrite are almost entirely absent. The ores are free from arsenic and antimony, and usually contain gold and silver, especially the latter. The gangue is chiefly quartz with calcite, feldspar, and epidote developed locally. Among the important developments in the district are several mines with shafts sunk to a depth of more than 300 ft. and a total of several thousand feet of levels. The mines of the two largest companies are equipped with concentrating mills, and both high-grade ores and concentrate have been shipped.

The northern Blue Ridge region, embracing parts of six counties, has been extensively prospected, but as yet with no production of copper. The ores consist chiefly of cuprite and native copper, small amounts of green and blue carbonates, and less of the sulphides, bornite and chalcopyrite. The ores occur along crevices and joints in small irregular-shaped lenses of quartz, and as disseminated grains through the more epidotized portions of the basalt. Its chief occurrence is where the rocks are fractured and epidotized.

The 'Great Gossan Lead' of Floyd, Carroll, and Grayson counties is a sulphide vein traceable for some 18 miles, composed chiefly of pyrrhotite with admixed quartz and schist, and carries streaks and patches of chalcopyrite and pyrite. The vein fills a fault-fracture in crystalline schists, and varies in width up to 100 ft. The copper content of the sulphide masses is too low (averaging less than 1% metallic copper) to work for copper alone, but the vein is mined on Chestnut Ridge and the ore treated at Pulaski for sulphur, so that the residue is available for copper.



DISTRIBUTION OF PRINCIPAL COPPER AREAS.

Lead and Zinc

Lead mining in Virginia dates back more than 150 years. The old lead mines at Austinville, on New river in Wythe county, were the first to be worked. For many years after the Virginia mines were operated, mining was confined exclusively to the lead ores. Zinc ores were first discovered at Bertha, near Austinville, in Wythe county, in 1876. Mining of zinc ores in Virginia dates from the opening of the mine at Bertha in 1879, when a small shipment of the ore was made to Providence, Rhode Island. The metal obtained from these ores proved to be of such rare purity that attention was directed at once to them, and a smelting plant was built at Pulaski, which was later remodeled and enlarged. The Pulaski plant is not operating at present. Commercial deposits of lead and zinc ores occur in a number of counties in southwest Virginia, and in

Albemarle and Spottsylvania counties east of the Blue Ridge.

The occurrence of lead and zinc ores in southwest Virginia is limited to the Shenandoah group of limestones of Cambro-Ordovician age. The ores include:

ZINC AND LEAD DEPOSITS OF SOUTHWESTERN VIRGINIA AND TENNESSEE.

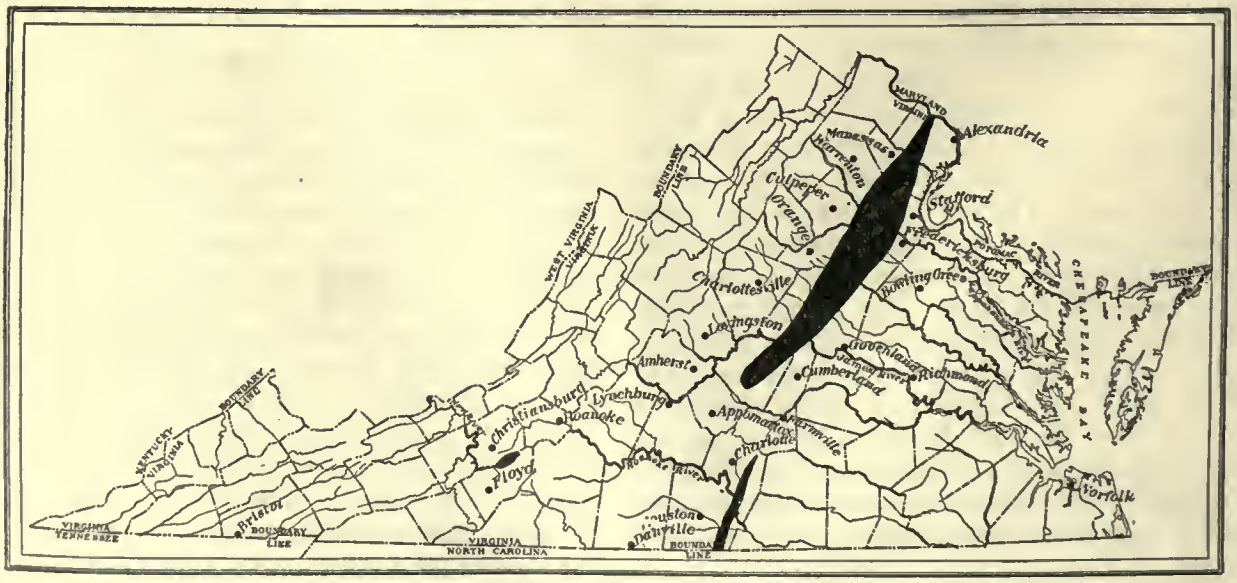
(1) the original sulphide forms, sphalerite and galenite, with some pyrite and less chalcopyrite; and (2) the secondary or oxidized forms derived from the original sulphides and occurring in the residual clays. Named in the order of their importance, dolomite, calcite, barite, fluorite, and quartz are the associated gangue minerals. The oxidized ores are usually concentrated at or near the bottom of the residual clays, closely hugging the irregular surface of the limestone. Until recently, only the oxidized ores have been mined. These are now believed to be practically exhausted, and attention at present is directed to mining the original sulphide ores in the hard and fresh limestone.

Gold and Silver

The Virginia Mining Co., of New York, operating in the Grasty tract of land in Orange county, between the years 1831 and 1834, was the first gold-mining company incorporated in Virginia. In 1836, there was considerable activity in gold mining in the state, and the production was reasonably steady from the re-discovery in 1831 to 1850, the annual value being given at between $50,000 and $100,000. Increased activity in gold mining was manifested in the early fifties, but the Civil War almost completely stopped mining operations in Virginia and the South generally. Activity was again manifested in the Virginia goldfields after the close of the Civil War, and milling and reduction plants were erected at various points. Many of these attempts met with only small success, and in most cases were abandoned, not because of the lack of ore, but largely because of bad management and inexperience, together with a change in the character of the ore from free milling above local ground-water level to sulphide ores below this level.

The principal gold belt in Virginia extends from Maryland in a southwestward direction to the North Carolina line. The belt varies in width from 15 to 25 miles and is 200 miles long, with its best developed portion in Fauquier, Stafford, Culpepper, Orange, Spottsylvania, Louisa, Fluvanna, Goochland, and Buckingham counties. Numerous mines have been operated within this area. At present the production is very small, but activity is again being manifested in the mines of this belt which should yield steady and profitable returns if properly managed.

The gold-bearing veins are chiefly quartz, which varies in texture from large crystalline masses to fine saccharoidal grains. The principal metallic content is auriferous pyrite, which at times is copper bearing and contains more or less admixed chalcopyrite. Within the weathered zone, extending from the surface down to local water level and accordingly of varying depth, the quartz is more or less porous and discolored or stained with iron oxide from the oxidation of the sulphide minerals, and the liberation of free or elementary gold. Below the local water level the veins are fresh, the sulphides are unaltered, and elementary gold is less frequent in occurrence. The early operations were confined largely to the oxidized portions of the veins which yielded a free-milling ore that was easy to treat. Since then, operations chiefly include the mining of the sulphide bodies, which require differ-



PRINCIPAL GOLD AREAS IN VIRGINIA.

ent metallurgical treatment and changes in plant.

The gold-bearing veins conform in the main to the structure, strike, and dip of the inclosing rocks, a fact which has caused various explanations to be advanced for their origin by different observers. Evidence is sufficient to establish the fact that the formation of the veins post-dates the schistose structure of the inclosing rocks. The vein structure is irregular, varying in width from a few inches to as many feet, and often the lenticular stringers are discontinuous. One stringer may dwindle to a thread or disappear and be replaced by another or by others. Some of the veins are remarkable for their persistence and continuity.

Excepting quartz and pyrite, the gangue minerals in the gold veins of Virginia comprise the following species: Chalcopyrite, native copper, galena, mispickel (arsenopyrite), pyromorphite, tetrahedrite, tourmaline, vanadinite, sphalerite, pyrrhotite, and siderite. So far as the gangue minerals are concerned, the Virginia gold ores are entirely typical in character. The ores are quartzose deposits in which pyrite is usually present, chalcopyrite common, mispickel, and sphalerite are not rare.

Air-Blasts and Shocks in the Mines of the Kolar Goldfields

By J. B. Woodworth

*The report of W. F. Smeeth, the chief inspector of mines for Mysore in India, for the year 1911-12, contains some interesting information concerning air-blasts and quakes and the records obtained from the seismograph. In his report for 1908-09, the same writer distinguished air-blasts due to some condition of internal strain in the rock independent of superincumbent pressure, while the term 'quake' was reserved for shocks occurring under circumstances which did not preclude the action of vertical pressure on pillars and portions of ground between stoped-out areas. It appears that in the Kolar goldfield certain mines often experience severe local shocks, which cause much damage and no small loss of life.

The most disastrous shock known in this field in regard to the loss of life occurred on July 18, 1911. Fifteen persons were killed underground, 6 died in the hospital, 3 were seriously injured, 7 were detained in the hospital, and 25 were slightly injured. The shock which caused this loss of life was strong enough to shake down plaster from buildings. Several levels were blocked in the mine by loosened rock and timber. In one level a tramcar was lifted bodily 3½ to 4 ft. from the floor of the level, indicating an epicentral vertical movement beneath the mine. In one stope three pieces of timber were twisted into an oblique position by a movement of the foot-wall in a northerly direction. As a further illustration of the violence of the shock, it is stated that a coolie climbing up Rowe's shaft had reached a point 35 ft. above the 26th level when the quake occurred. He was so stunned by the shock that he lost his hold of the ladder and fell to the plat below, and died later in the hospital. In the case of the so-called air-blasts, the period of vibration as recorded by the seismograph is said to be very short, the oscillations of the ground being extremely rapid and giving rise to sounds and shocks which are often clearly perceptible, and sometimes causing damage to buildings.

According to the account of Henry M. A. Cooke, in charge of the seismographs, there have been installed one 80-kg. Wiechert horizontal seismograph and one Wiechert vertical seismograph. Owing to the intensity of the local shocks, it has been necessary to reduce the period of the instruments. During the three months October to December, inclusive, of the year 1911, 5092 local shocks were recorded, or an average of 55.34 per day. A finer adjustment of the instruments has since shown that a higher average is recorded. Mr. Cooke remarks that the results seem to prove that the rocks in the locality are continually breaking, or snapping, a phenomenon which can be accounted for by the rocks being under a great lateral compression, and in a state of strain from which, by the underground excavations, they are being gradually relieved. If I understand him correctly, he supposes that the shocks arise from local relief of pressure afforded by the shafts and slopes. While it is probable that some movement may be thus accounted for, the intensity of the shocks and the description of the movements of the rocks make it quite beyond question that, as in another passage Mr. Cooke admits, the mine shaft and workings are excavated in a zone of faulting.

As remarked by C. L. Whittle, who called my attention to this interesting case, there seems to be here an unusual opportunity to implace special devised instruments to record the earth pressure or accumulation of strain: in other words, a seismometer which shall measure the seismic force in the zone of fracture: for it appears from the account that many of the shocks originate close to the workings. It is to be hoped that the opportunity will be embraced to conduct geological and seismological studies in the Kolar goldfield commensurate with the rare opportunity which appears to be here presented. With two rectangular components of a horizontal pendulum seismograph at a depth of invariable temperature in the mine, it appears possible to detect any tilting movement during the quiescent intervals between shocks by noting the displacement from the zero line if any takes place in a given direction. In fact, here seems to be a seismological laboratory of the first order, deserving a careful and extended series of observations upon the time of occurrence and intensity of the shocks. Such records for a sufficiently long term of years, should throw important light on the utility or futility of the scientific registration of earthquakes.

*From *Bull.* Seismological Society of America.

Continuous Agitation With Barren Cyanide Solution

By C. F. Spaulding

Reverting to my artiele on 'Continuous Agitation with Barren Cyanide Solution,' published in the *Mining and Scientific Press*, March 1, I have some further improvements to suggest.

On a recent visit to Reno, Nevada, G. J. Young, dean of the Maekay School of Mines, showed me drawings of a dewatering and slime-thickening vat, illustrated in Fig. 1. His idea is excellent, and if

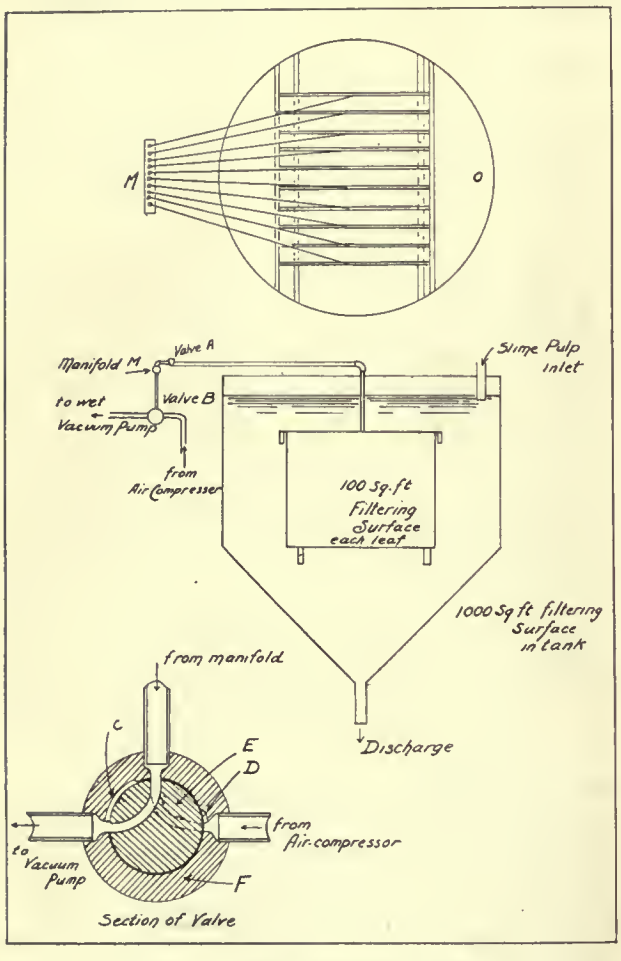


Fig. 1. Young's dewatering vat.

used with my process of agitation with barren cyanide solution should make a good and an extremely simple method of treating slime by continuous agitation and washing. It would obviate any trouble with colloidal matter and slime coming over with the decanted solution, as might be experieneed, in some eases, with my scheme of continuous decantation as outlined in the previous artiele. In Fig. 2, sketch 2. one of the 'Oregon' vats is shown fitted with Mr. Young's device. The details, such as area of leaves, time of forming cake, discharge, size of vacuum-pumps, etc., would have to be worked out to fit the conditions at each mill in whieh the vat is installed.

To use the Spaulding-Young process in a plant having Pachuca vats, the leaves had best be arranged as in sketeh 3. If desired, the central transfer pipe could be tilted to one side without interfering with the agitation. The addition to the top of the transfer pipe of an 'L' or 'T' would give a swirling motion to the pulp, which is a desirable feature, especially if the vats are used for continuous agitation, as the pulp is more intimately mixed and it prevents the vertical stratification and classification which is frequently observed in the vats. It will also prevent the pulp from forming cake on the side of the vat, which sometimes happens in the continuous process of agitation. I know of several cases where batteries of Pachueas, used continuously, have had cakes formed on the inside which gradually filled them. In one case the vat filled to within two feet of the transfer pipe, which was half way down. The tailing inereased from 45 to 50 grams in silver content before the trouble was found. The effective capacity of the vats was less than one-third of the capacity when clean. This naturally reduced the time of agitation to less than one-third of the neeessary time.

The thiekening leaves are for the purpose of having a clear solution pass through the zinc boxes. The gold and silver is then precipitated and the solution used to agitate and wash with. The size, shape, and number of leaves will depend upon the size of the agitation vats and the number of displacements desired per 24 hours.

The ports and the rocking device can be arranged and proportioned to give any desired cycle and any desired part of the cycle to forming and diseharging the cake. The valve can be operated on the principle of a Corliss valve, or given a straight rotary motion. A butterfly or plug-valve might be placed in the pipe-line from the pressure tank to the vaeuum-pump, just above and below the 'T' connecting with the manifold. These valves can be connected to the rocking device by levers or ehains, in this case everything could be made on the grounds, the rocking device opening and closing the valves.

As the leaves, being always submerged, are not exposed to the air at any time, the cake will be loose, permeable, and easily discharged. It seems to be a fact that exposure of the cake to the air for even a short time makes the filtering rate considerably slower. With a low vaeuum or pressure the cakes will be extremely permeable. With a thin porous cake, the passage of the solution will be rapid, and as it is the tonnage of solution and not of slime that is important, this is a desirable feature. The leaves being submerged in the inner vat, or in the outer part of the vat (see sketch 3), whieh is also acting as a settling vat, the pulp will be thin, which will also tend toward giving a large volume of solution.

A final discharge vat might well be arranged as in sketeh 1, to receive and wash the tailing from the last agitation vat. The addition of a slowly moving plow arrangement will facilitate the removal of the thickened pulp and keep it from accumulating on the bottom of the vat, whieh can be made either flat or eone shaped. A small Dorr thickening tank with the addition of leaves would have a large capacity.

A plant, sueh as this, can be made entirely automatic in action and will be simple and easy to operate. One man on a shift, outside of the repair gang, can easily handle auy reasonable tonnage. His duties would eonsist of watching the vats and the operation of the tank-agitators, testing the solution for eyanide, and taking samples.

Any manufacturer of mining machinery will be able to furnish the manifold three-way valve, rotating device, vacuum-pumps, etc., as outside of the valve and rocking device everything used is standard equipment. A 4 to 5-in. pipe surrounding the outside vat (sketch 3), or the inner vat (sketch 2), tapped with ⅜ or ½-in. connections to each leaf will make an excellent manifold. By using solution under a pressure of 12 to 15 lb. to discharge the cakes, the manifold and leaves will always be full of solution, giving no chance for the complications that happen when air is used to discharge the cake. This method is easier on the vacuum pump, which can be operated either on the dry or the wet system; the wet system is preferred. A common centrifugal pump will make an excellent vacuum-pump when operated under these conditions, that is, always having the suction pipe full and being placed below the source of supply. I would use a 1½-in. pump on the 15 by 15-ft. vats and a 2-in. on the 20 by 20-ft. vats; on other sized vats the pumps would be proportioned to the amount of solution to be drawn off.

In making the desired number of displacements there will be an excess of solution over what is required to use for agitation purposes. To use this excess solution to the best advantage, I am going to put a device in the bottom of each vat, something on the style of an automatic pulp distributer, by having this rotate with the movement of the pulp in the tank, and introducing all of the excess solution through it, it will keep the bottom of the vat swept clean.

Published data on the subject and experiments seem to point to the fact that it takes from 3 to 5 sq. ft. of filtering surface to pass one ton of solution per 24 hours. Assuming that it will take 5 sq. ft. per ton, the following table has been prepared:

	Vat, 15 by 15 ft., filled 14 ft.	Vat, 20 by 20 ft., filled 19 ft.
Pulp, 3 to 1, 26 cu. ft. per ton, tons..	95	230
Dry slime, tons	26	57.5
Solution, tons	69	172.5
Number of leaves, 1 by 5 ft. (sketch 3)	142	180
Area of leaves, sq. ft.....	1,420	1,800
Solution passed through leaves, 24 hours, tons	284	360
Number of replacements.....	4.1	2.1

The leaves in the 20 by 20-ft. vat should be made 18 in. wide by 6 to 7 ft. deep, in order to give a larger number of replacements. The size and number of leaves for any vat can be easily found by determining the number of replacements desired, and from that the tonnage of solution.

Sketch 4 illustrates a simple method of operating the valve. It is a modification of the old-fashioned sampling device, taking water, however, on one side only and being brought back quickly by a counterweight. The object of this is to give the passage leading to the vacuum-pump a longer opening than the passage to the pressure tank. The size of the discharge opening in the rocking device can be adjusted to discharge the water in any desired length of time, say 2 minutes, keeping the pressure on the inside of the leaves for this length of time.

Each method of installing the leaves has its own advantages, but I believe that the original scheme, as outlined in the March 1 issue of the *Mining and Scientific Press*, is the better.

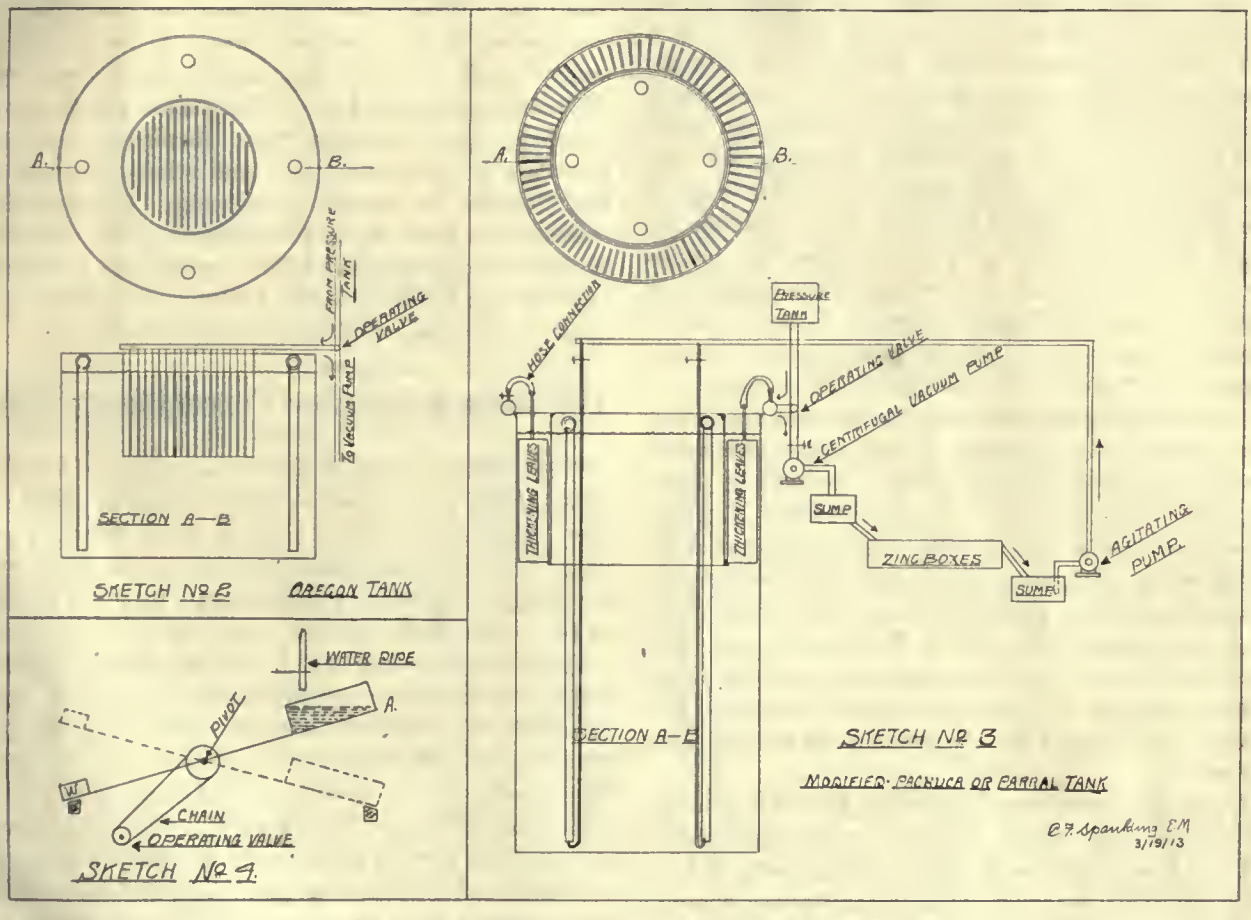


FIG. 2. YOUNG VAT ARRANGED TO SPAULDING SYSTEM.

Electric Power in Italy

The Societa Elettricita Alta Italia, of Turin, has nearly completed its plant at Viverone, 40 miles from this city, which will render 12,500 hp. available, utilizing the two morainic lakes of Bertignano and Viverone, situated one above the other at a distance of 512 ft. The water from the first lake flows to turbines situated near the second through pipes 6.9 ft. in diameter at a pressure of about 240 lb. The plant consists of a turbine constructed by the Milan firm, Ing. Riva & Co., one 4400-hp. alternator by the German firm of Siemens, and a centrifugal pump of 4400 hp. by the Swiss firm of Sulzer, forming one group; of one turbine, one 4400 hp. Siemens alternator, and two pumps constructed by Ing. Riva & Co., forming another group. The turbines, alternators, and pumps of each group are on the same shaft. During the day the centrifugal pump does not work and the turbine puts the alternator into action, furnishing the current at 50 cycles and 42,000 votes to the Societa Elettricita Alta Italia lines. During the night, when the need of power is less, the pumps are put into action so as to bring up the water from Lake Viverone to Lake Bertignano in order not to diminish the capacity of the latter, which is estimated at 450,000 cu. m. (588,600 cubic yards).

Work on a plant owned by the Societa Idro-Elettrica della Valle d'Aosta, at Montjovet, 60 miles from Turin, was actively pushed forward in 1912, and will be completed by the end of 1913. Current of 50 cycles and 42,000 volts will be generated by three groups of turbine alternators of 6000 hp. each. The turbines are constructed by the Escher Wiss Co.; the alternators by the A. E. G., of Berlin. The canal carrying the water to the power station is 2.5 miles long, 1.8 of which are through tunnels. The power will be used by the Societa Elettricita Alta Italia.

A station owned by the Societa Elettrica Riviera di Ponente Ing. Negri, of Milan, was completed in 1912 at San Dalmazzo di Tenda. It consists of four units of 10,000 hp. each, creating a 3-phase current at 50 cycles and 75,000 to 80,000 volts. The turbines were furnished by Ing. Riva & Co.; the tubes by the Balladier Co., of Cogoleto, province of Genoa; and the alternators by the A. E. G., of Berlin.

During 1912 the Manifattura Rossari & Varzi, of Gallarate, completed their plant in the valley of Lys, near Pont S. Martin, 55 miles from Turin. It consists of two stations of 2500 hp. each, developing a 50-cycle, 40,000-volt current. The Societa Elettricita Alta Italia bought 3000 hp., and the remainder is used for the small light and industrial plants in the valley.

The Societa Imprese Elettriche Conti, of Milan, will probably open an important power-station at Baceno in 1913. The electric plant owned by the Turin municipality was brought during 1912 to 7300 kw., not including 3500 kw. ceded to the state railways for the electrification of the Bussoleno-Modane line.

The line between Bussoleno and the French frontier is now open to traffic, and work on the electrification of the line between Bussoleno and Turin is proceeding actively. As the 3-phase current ceded to the state railways was at 50,000 volts and 50 cycles, it had to be transformed to create a 3-phase current at the potentiality and frequence of the motors applied to the locomotives, 3500 volts at 16 cycles. The transforming plant, built at Bardonecchia, was erected by the Brown Boeri Company.

A special device was adopted in connection with the Bussoleno-Modane electric railway, as in the case of the Giovi railway, for recuperating the current during the descent of the trains, by means of which the traction engines act as brakes and at the same time as electric asynchronous generators, the grade of the ascent reaching in places 30 in 1000. The state railways used Mannesmann posts for the suspension of the electric wires. These posts are conical and perfectly smooth. In the curves and when heavy strains have to be sustained, they are coupled. The insulators were furnished, some in porcelain by an Italian firm, and others in glass, at half the cost, by French glass-works. The only line transformed from steam to electric in 1912 was that of San Giuseppe-Savona. The current was furnished at 16 cycles by the Societa Elettrica Riviera di Ponente Ing. Negri, of Milan.—*Consular Report.*

The Butte & Superior Concentrating Plant

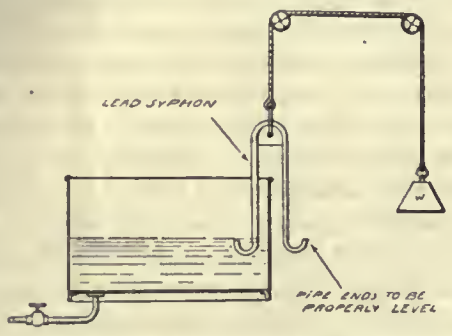
*The mill is designed in two sections, each being independently operated by electric power and having a maximum capacity each of about 600 tons per day. The rock-crushers are placed at the shaft, the ore being discharged automatically to them by the skips in the shaft. A belt conveyor transports the coarsely-crushed ore to a coarse-crushing plant which reduces it to approximately ¾-in. size, and from this department it is again conveyed to storage bins over the fine-crushing department of the mill. The crushing and grinding machinery consists of rolls, tube-mills, and pebble-mills. The concentrating facilities for the recovery of the coarser minerals consist of tables, classifiers, and jigs, and from these are produced from 33 to 50% of the total metals recovered. The tailing resulting from the ordinary methods of wet concentration are reground and treated by so-called flotation methods. At the end of April 1913, the flotation plant had not been completed to a capacity commensurate with that of the other portions of the mill, and it is accordingly impossible to economically handle all of the finer products. When operating at a capacity proportionate to the existing facilities, recoveries of above 80% are made regularly, and under favorable conditions, recoveries of 90% of the zinc contents are readily obtained. Sufficiently continuous results have been obtained to warrant the assurance that when the remodeling of the mill is completed, and its various departments balanced, the regular recoveries on a normal grade of ore and at full mill capacity will approximate 90% with probable higher results. The products derived from the concentration of these ores contain a high percentage of zinc as compared

*Abstract from annual report.

to those of other similar enterprises, a high value in silver, and a low percentage of iron, thus constituting an unusually desirable and profitable product for this class of material.

Siphon for Cyanide Vats

In reply to the discussion on a paper entitled 'Minor Improvements in Cyanide Practice,' read before the Chemical, Metallurgical and Mining Society of South Africa, P. T .Morrisby describes a very interesting little contrivance, which he calls an "ever-ready primed siphon." It is suitable for siphoning the clear solution from a zinc acid-treatment vat,



in which it is desirable to have as few connections as possible, and other similar purposes. The siphon can be made from a piece of either iron or lead pipe, preferably the latter. A suitable size for this purpose is 1¼-in. diameter and of sufficient length that when bent in the middle it will reach from the inside bottom of the vat to the outside bottom, with each end of the pipe turned up like a hook for about six inches, as shown in the illustration. The siphon is suspended over a semi-circular piece of wood, with a radius of about nine inches, and this is attached to a rope and counter-weight, by which means the siphon may be raised or lowered at will. When making the first adjustment, it is essential that both of the ends be perfectly level, one with the other. The siphon is primed with a hose under pressure, and once primed is always primed, provided the ends, as stated above, are kept level.

Cyanide Plant at the Quartette Mine, Nevada

This mine is situated at Searchlight, Clark county, and the plant was erected to treat accumulated tailing from the 40-stamp mill. It has a capacity of 75 tons per day, averaging $5 per ton, mainly in gold, and about 0.75% of copper. A description of the plant is as follows: After being delivered at the storage bins by means of wheelers, the product is carried by a belt conveyor to an Akin mixer, where it is mixed, 6 of cyanide solution to 1 of tailing. Three pounds of lime is added per ton treated. The pulp flows by gravity from the mixer to an Akin classifier, the sand, about 40%, goes to the leaching vats, where it receives the usual treatment. All rich solutions pass by gravity to the zinc-boxes. The sand, after treatment, is discharged by means of a belt conveyor. The recovery by leaching averages 86%, cyanide consumption being 2 lb. per ton treated. Slime leaving the classifier flows through a launder to an Akin classifier and thickener. The overflow of the classifier takes out 45% of the solution which is returned by means of a 2-in. centrifugal pump to the mixer. Thirty per cent of the metals in the slime is dissolved in the circuit up to, and in the overflow of the classifier. Whenever the solution is worth $2 per ton, which is a standard, it is by-passed to the zinc-boxes, barren solution being added in its place. The underflow of the classifier is lifted 25 ft. by means of an air-lift to an Akin agitator, which is 22 ft. in height, and 10 ft. in diam. The inflow of the agitator is balanced by a float to equal the discharge which is going continuously to the 'Portland' filter. This filters a large amount of low-grade pulp at nominal cost. The filter residue is taken away by a belt conveyor. The average recovery in the slime treatment is 94.6%, the consumption of cyanide being 2.75 lb. per ton treated. The power for this entire plant is furnished by a 22-hp. Fairbanks-Morse engine. It is noticeable that, in addition to the consumption of water and power being low, the recovery is high and the copper content is not such as to necessitate any expensive special process.

Antarctic Minerals

By Our Melbourne Correspondent

T. W. Edgeworth David, professor of the Sydney University, who was a member of the Shackleton South Polar Expedition, has given to the press a résumé of the mineral discoveries of the Mawson expedition in Antarctia. It is an abridgment of the report of three geologists who acted under Mr. Mawson, himself a geologist. From this résumé the following facts may be culled:

A bluff near Commonwealth bay, terminating seaward in a 1000-ft. cliff, carried in its lower 400 ft. bands of black coaly shale and is held to form a part of the great coalfield which stretches south almost to the Pole, a distance of not less than 1500 miles. The thickness of the seams varies from 3 to 7 ft. Lumps tested were found of workable quality, but whether the field is or is not of economic value cannot yet be said with any certainty. Three other discoveries of possible importance were made. The pebbles of the glacial moraine were found to be partly coated in places with green and blue carbonates of copper, and these were traced to an outcrop of rock, where they occurred in quartz veins. In a loose block of quartz in the moraine were also found streaks of stibnite (antimony sulphide). Many small metallic plates of molybdenite were also found in quartz rock, occurring in lenticular veins. Of non-metallic minerals, many discoveries were made. Red garnet was very common, and some lumps measured 6 inches in diameter. Large black crystals of tourmaline were also found frequently. Crystals of beryl, from ½-in. diameter and about 2 in. long, and of a bluish green tint (some of them green enough and translucent enough to be styled 'emeralds') were found in quartz veins. Yet, somehow, it is difficult to imagine an Antaretie gem-field.

Discussion

Readers of the MINING AND SCIENTIFIC PRESS are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

Slime Settlement

The Editor:

Sir—During an inspection of the chief mining districts of the world, I, being much interested in the subject of slime settlement, made a point of visiting mills where anything new in this direction was being tried or used. For several years considerable attention has been centred on assisting the rate of settlement of fine particles suspended in liquids by means of baffles in the containing vessel. This system has been brought before the public by a number of writers. R. H. Richards, in his book on 'Ore Dressing,' speaks of it as being in use in Mexico.

The underlying prineiple is that currents are set up between adjacent baffles, the downward current, which is along the upper side of the baffles, causes the slime that settles to slide downward, whereas the upward current, which travels against the underneath side of the baffles, is not strong enough to disturb the settlement. In the United States, one company has designed machines, claiming greatly increased settling capacity per square foot of area, which is theoretically brought about by the use of a large number of baffle-plates set at an angle of 60° across the flow of pulp in the tank. These are said to retard the flow of the light solids and to provide a settling spaee free from disturbing eurrents. In the case of these machines, however, it has been clearly demonstrated that no advantage is gained, and I, knowing this, was anxious to study a number of instances of which I had heard and read, where considerable benefit was claimed by the use of baffles set in tanks of different kinds.

About 18 months ago a detailed article by B. L. Gardiner, dealing with the subject, appeared in the *Chamber of Mines Journal*, Kalgoorlie, Western Australia, giving the advantages derived from the use of corrugated iron baffles, called accelerators, set in a nest of spitzkasten. Extra efficiency was elaimed for the corrugated iron as against ordinary smooth baffles, as the eorrugations were said to deflect the flow into narrow streams. This article was copied by a number of the leading technical journals, as the anthor stated that the method as adopted at the Sons of Gwalia mine was not only a complete success, but that an improvement in the density of the thickened pulp was obtained, varying from 26 to 41 per cent.

I closely investigated this matter when in Western Australia, and was surprised to find that the inclined baffle idea had been completely discarded, owing, so I was informed, to the impossibility of preventing the slime building up on the baffles, and then sliding off in cakes when sufficient had accumulated. This action caused disturbances in the spitzkasten, which naturally retarded settlement. In South Africa, two attempts to use this system of accelerated settlement eame under my notice. Both, however, had been discarded. In one case, after months of experimenting, the reason was given, that no benefit eould be found, and that, if there was any, it was counteracted by the building up and sliding off of cakes of slime, as in the case in Western Australia. The trial in South Afriea was made in the following manner: Sheet-iron plates inclined at an angle of 45° were set in a 50-ft. slime-collecting tank, with vertical sides, so that the baffles extended from near the centre to the side. As no success was met with, practically all the plates had been discarded at the time of my visit. Another attempt to work out this problem led to the fitting up of a large number of cone tanks with 45° curved baffles, inclined parallel to the side of the cones. These, however, gave no apparent benefit, and today the slime plant is shut down. In my opinion, the principle involved of assisting settlement of fine particles suspended in liquid, by the use of baffles, has given no praetical results, notwithstanding the fact that increased rate of settlement can be demonstrated where a glass cylinder containing slime and water is placed at an angle of 45°, as against one standing vertically.

H. N. SPICER.

Denver, June 7.

Vendor's Valuation of Mining Property

The Editor:

Sir—A discussion of the vendor's valuation of mining property might appropriately appear in a lay publication, as it usually happens that the mine-owner who has the least eonception of mine valuation is not a subscriber to technical papers and does not take interest in technical matters. Notwithstanding this fact, he is perfectly satisfied that he knows exactly what his mine is worth, and that the ore "can be treated." Also that it can be "mined for $1 per ton" and "milled for $1 per ton." Why the almighty dollar should be abused in this manner is a mystery. However, these instructive data are usually backed up by a "report" from the man "who was last in charge of the mine." Among other interesting data therein contained, it is not unusual to find statements that "a coneentrating plant ean be erected on this property at a cost of $5000 to $10,000"; "a cyanide addition can be attached to this mill for $1200." Or, on a trackless desert without a watershed in sight, "water can undoubtedly be developed for mining and milling purposes by drilling in the bottom of the gulch." These statements are all given belief by the vendor and are used by him in valuing his mine.

It is to be regretted that the conditions above referred to are the rule rather than the exception. While every engineer knows this to be the case, and the situation has often been discussed, it is reopened periodically, presumably, because some one has had a particularly characteristic experience, or a series of minor ones, and feels that he must utter a howl of protest, rather to relieve himself than to enlighten his fellows.

A disconcerting feature which is encountered is the owner's valuation of improvements, inadequate metallurgical plants, useless mine workings, uncalled-for railroads and grades, poorly constructed flumes and bridges, unsanitary bunkhouses, boarding-houses, and the like. Instances are known of expected return from dams that have failed, bullion which has been stolen, stopes that have caved, and development funds which were used to buy wine and automobiles. The engineer cannot protest because these encumbrances have been placed on the property. It is the owner's reward for not having secured proper advice at the beginning of his operations, and constitute his sole recompense. It is, therefore, surprising that an owner expects to get returns for indiscreetly spent funds.

In the average run of mining properties, which are for sale at the present time, the amount of ore reserves varies inversely with the amount of money expended on the surface. This simply shows that money has been used for decorating the landscape with equipment before proper development work was completed. This carries with it a long train of consequences, such as: a change in the character of the ore developed after completion of mill, and a lack of ore reserves, with its sequence of poor mining in a heroic attempt to 'keep things going at any price.'

The argument cannot be too strongly presented that the individual or association which is in mining as a business will give no value to that which he cannot use, either underground or on the surface. He is probably figuring on tearing down your mill and erecting a larger one, after developing more ore, and your mill is probably an actual detriment, as it probably occupies the site he wants to use. Working tunnels and shafts, or any other workings in the mine, which are of actual benefit to the mine and which would have to be carried through in any case, are not included in the above. Neither is a useful tramway or a road or bridge or building, or anything that would be of benefit. It must be added, at this point, that associations or individuals who do not regard mining as a business are getting scarcer every minute. If fond hopes are held that 'live ones' will appear on the scene who will 'take a chance,' it is to be noted that most of those who have taken a chance have been so badly disappointed that they have quit themselves and have told all their friends, and have thus spoiled the market for the mine. This latter statement is more general and far-reaching than is commonly believed, and is a cause of growing satisfaction among mining men, as it tends to place the industry on the high plane where it belongs.

It is only fair to state, however, that the legitimate mining man is always willing to take a *reasonable* chance. He does not want to gamble, as properly conducted mining is not a gamble; and he does not regard it as such. He reasons that he is taking no more of a chance in spending his money to open up ore, which he knows is on the surface, than there is in buying a piece of real estate in the expectation that a young town will become a city, or that a city will grow to a metropolis.

Give him a chance, Mr. Owner. If your property is a prospect, do not insist on a heavy first payment, or on any payment at all, unless you have to have the cash to pay off debts. Consider that, if your mine is what you claim it is, the money which your prospective purchaser will expend in development will make it possible for him to pay you its worth. If your property has ore reserves, consider carefully just what these ore reserves are worth in *net profit*, and what it will cost in modern equipment to make these profits possible. Your prospective purchaser will in most cases be willing to give you his own figures as to profit per ton and cost of equipment. Try and believe that he is sincere, and that he at least thinks he is right, and that he will quickly alter his views or his figures if you can show that he is not right. You will find it easier to do this if you will consider the indefinite manner in which you have arrived at the valuation of your mine, and compare it with the systematic investigation of your purchaser. Some mines are valued the same day they are found, and the figure descends unto the third and fourth generation, until nobody knows how it was deduced, but which everybody believes to be correct.

In conclusion, it is sincerely hoped that our vendor, who is not a mining man, will come to regard a deal of this nature as a strictly business transaction, and as a business transaction which differs in no respect whatever from those which occur in his own daily experience. Good mining property is in great demand at the present time, and it may confidently be stated that many payable mines, now idle, would be operating if the above considerations were realized by the non-technical owner.

W. F. Disbrow.

Denver, Colorado, May 26.

The Intermittent System of Cyanidation

The Editor:

Sir—L. P. Hills, in discussion under the above head in the *Mining and Scientific Press* of May 3, states "each ton of solution carries $2.66 plus $1 giving $3.66. Decanting to 40% moisture leaves $1.46 per ton dry pulp." This is incorrect. With $3.66 solution in a 40% moisture pulp dissolved value per ton dry is $2.44. Quoting from same discussion: "when plant is operating under normal conditions, the pulp leaving the agitator must give the same screen analysis as that of the inflowing pulp, so how can this 'concentration' be brought into play in the continuous system?" Naturally, inflow and outflow will have same screen test, but if before normal conditions have been established there has been a concentration of heavier particles the average heavier particle will receive a longer treatment. Hours agitation equals tonnage divided by feed per hour. I am aware that pulp treated in a Dorr agitator can be kept homogeneous by using sufficient air, but by reducing the amount of air a less violent agitation is produced suitable for preferential treatment of heavier particles.

Noel Cunningham.

Timmins, Ontario, May 30.

Special Correspondence

LONDON

Scientific Prospecting Proposed.—Failure of Present Methods.—Extra Lectures at Technical Schools.

Much discussion has been taking place recently in London among the rank and file of the profession with regard to the necessity for scientific prospecting. The feeling is that it is particularly desirable to give attention to this subject at the present time, when promoters and intelligent investors are bewailing the scarcity of new fields of activity. As has been pointed out by several acknowledged authorities, the chance of accidentally finding surface bonanzas is rapidly diminishing. That there are rich hidden orebodies has been proved by experience, and, generally speaking, it is to these that the miner and the users of metals must respectively look for future work and future supplies. The average prospector has in the past been well aware of the desirability of following surface indications, and has not confined his attention to a search for a ready-made fortune. He has received the assistance of local capitalists, either on the grubstake plan or by the advance, in exchange for a share in the property, of the small amount of money required to explore underground, the money being spent entirely on manual labor, tools, and dynamite. It is suggested that London companies should broaden the scope of their business and help the prospector and small owner on these lines. It is true that two or three of the London groups have on occasions embarked on prospecting work, and sometimes with excellent results, as at Mysore and Ashanti, but each venture has generally been conducted at a greater expense than is usually associated with the development of prospects.

Most of the active promoting houses, however, apply their capital solely to proved propositions in connection with which the mining risk is confined to the chance of large orebodies continuing to persist. Most of these houses are, to put it mildly, out of touch with the spirit of enterprise required for speculating on a surface indication, and the engineers associated with them, being chary of risking a failure, do not care to recommend a scheme unless it amounts to providing the necessary working capital required for extracting known ore. The parent companies may have names that involve the idea of exploring and developing, but the controllers are not always enamoured of the business expressed by these words. The same caution is usually displayed by companies that have made fortunes out of mines and wish to continue their organization after the exhaustion of their properties, even though those mines when first acquired gave no promise of the eminent riches eventually extracted. Two recent examples will suffice. In the first case, an exploration company recently formed in America reports that several hundred proposals have been examined, either at first or second hand, and that not one proved to be suitable. The second case, a company owning what was once a great gold mine, has paid attention to sixty proposals with no better luck. It stands to reason that if a commercial undertaking is conducted on lines that do not lead to business, inquiry should be made into the soundness of those lines, and into their application to current conditions. Many engineers in this country would like to see an innovation made in connection with the methods adopted for acquiring properties by the big firms, a change whereby closer contact could be made with the actual worker and owner. It is claimed that a hundred thousand pounds divided into sums of five thousand, and spent on twenty properties by the intelligent engineer belonging to the rank and file, is more likely to bring wealth to the owner than the same amount spent on one property and on the examination of rejected properties by the staff of consulting and examining engineers. But all these propositions bristle with difficulties, and generally speaking they are not suitable for joint-stock companies, however much they are suitable and profitable to the individual capitalist who knows his country.

The extra lecture-courses given by well known authorities have been popular for some time at the American colleges, and it is only of recent years that the interesting innovation has been made in this country. I have in previous issues referred to the monthly lectures at the Royal School of Mines, and your readers will fully appreciate the sample reprinted in your columns relating to the shaft-sinking practice at the Brakpan. Another school, one of not so great renown, has followed this policy lately. I refer to the Sir John Cass Technical Institute, which is situated in the City of London, in the centre of commerce, and close to the Tower of London, and in a street off such celebrated thoughfares as Eastcheap, Mark Lane, and Fenchurch street. The benefactor, Sir John Cass, died in 1718, and a large amount of his money was applied to the education of the poor in the eastern division of the city. The revenues began to increase tremendously about thirty years ago, and by consent of the government an enlarged scheme of education was established. The principal is Charles A. Keane, well known as the translator of George Lunge's recent works, and C. O. Bannister is the head of the metallurgical department. Your readers are probably acquainted with Mr. Bannister's researches in connection with blast-roasting. Extra lectures recently given to students at this institute were by Charles S. Herzig, C. W. Purington, and T. A. Rickard, all of them dealing with the valuation, sampling, and development of mines. The lectures were open to others than students, and a large number of city men such as secretaries and directors of mining companies, availed themselves of the privilege and opportunity. I understand that Mr. Herzig's lectures are to be reprinted in book form.

RHODESIA

Gold Production Increasing Slowly.—Lack of Development.—Cam & Motor Building.

In so far as production is concerned, the mineral industry of Southern Rhodesia has progressed but little during the last year or two. In 1911 the gold output was valued at £2,647,895, and the production of other minerals at £242,864, or a total of £2,890,759. For 1912 the gold output was £2,707,367, and of other minerals £257,230, or a total of £2,964,597. The results clearly show that the great promises held out at the time of the boom in Charterland in 1909 and the early part of 1910 have not been realized. Neither has there been any marked advance in regard to profits and dividends. The grade of ore milled has not improved, and so far as can be judged from the statistics available, working costs have not been reduced to any appreciable degree. The two Chambers of Mines in Southern Rhodesia, at Bulawayo and Salisbury, do not, like the Transvaal Chamber of Mines, record the profits and operating expenses of the different mines, and it is impossible to say just what the aggregate profit earnings of the industry amount to each month. In Matabeleland and Mashonaland there are large numbers of small mines scattered all over the country, generally operated by tributary syndicates or parties of practical miners possessed of some capital—a very different state of affairs from that prevailing on the Witwatersrand. It is out of the question to collect data as to working expenses and profit for all or even the majority of these ventures. Any advance in the aggregate profit must be attributed to the operation of a larger number of stamps and tube-mills and the raising of the stamp duty. On the face of the foregoing, it would seem that that there has been no improvement whatsoever in regard to mining in Southern Rhodesia in the past three years. This view is in error, inasmuch as the development position of the mines, taken as a whole, has been rendered much more sound and businesslike. Previous to 1909 there were not half a dozen mines in the whole of the country possessed of any really appreciable ore reserves, and the best had only a few months'

supply for the mills. The greater number of properties recovering gold were content to run on hand-to-mouth lines. The failure of so many Rhodesian mines is largely attributable to this lack of development; but much wiser counsels now prevail. The mine in the most advanced state of development today is unquestionably the Shamva, which is based upon a huge low-grade conglomerate in the Abercorn district of Mashonaland and which was floated by the Consolidated Gold Fields of South Africa with a capital of £500,000. At this property between 2,000,000 and 3,000,000 tons of ore has been blocked out. Next to the Shamva, the Cam & Motor, in the Gatooma district, can point to the largest reserves, the tonnage developed being substantially over 1,000,000.

The gold output for the first three months of the current year, amounting as it does to £687,317, shows a substantial increase over the same period of last year. The 1912 and 1913 productions for January, February, and March may be contrasted as below:

	1912.	1913.
January	£214,918	£220,776
February	209,743	208,744
March	215,102	257,797

The March output constituted a record, the previous highest production being £243,712 in August 1911. The increase

ZINC PRECIPITATION HOUSE AT SMALL RHODESIAN MINE.

is attributable to the declaration of an output of 4764 oz. of 'reserve gold', valued at over £20,000, by the Globe & Phoenix. In addition to this declaration, the company returned £35,214 from the mill, £2817 from concentrate, £2652 from tailing, and £2505 from slime. That the country will be able to maintain a gold output of over a quarter of a million per month in value throughout the year seems unlikely, but toward the end of the current year a number of new mines will enter the producing list. Now that the railway is through to the Shamva mine from Salisbury, that property should be enabled to continue construction. At the Cam & Motor the production stage should shortly be reached. Mr. McDermott, the new manager for this company, has arrived from Western Australia, and it is reported that a construction engineer of repute is to be imported from England to expedite erection of equipment. A new siding has been laid to expedite the forwarding of machinery to the Bell mine, while at both the Antelope and Falcon construction work is being pushed. In Rhodesia, as in the Transvaal, industrial activity is largely determined and influenced by the number of native laborers available. In this regard, there has been a gratifying improvement of recent months. About two years ago the old Rhodesian Native Labor Bureau was reorganized, and, despite the cessation of recruiting in Southern Rhodesia and the hostile attitude of the Nyasaland Protectorate authorities toward the Bureau, the results secured have been most satisfactory. H. W. Kempster, a couple of years ago, was appointed to reorganize the Bureau. His term of office has just recently expired, and Wolfe Murray has been appointed to succeed him.

BUTTE, MONTANA

RETURNS FOR ASSESSMENT.—ANACONDA SHOWS MARKED INCREASE.—NORTH BUTTE SHOWING ALSO GOOD.

The Anaconda Copper Mining Co.'s gross income for the year ended June 1, 1913, was $43,130,733.61, and the net profits $11,446,901.34, against $38,277,753.14 gross in 1912 and $10,525,729.82 net, an increase in the net proceeds of $921,171.52. The annual report filed with the Montana tax authorities give these interesting figures. Following are some comparisons of yields and operating expenses:

	1913.	1912.
Tons of ore mined	4,531,640	4,319,994
Yield per ton	$9.517	$8.860
Cost of mining, per ton	$4.035	$3.709
Cost of smelting, per ton	$1.875	$1.673
Gross proceeds	$43,130,734	$38,277,753
Cost of mining	18,285,445	16,022,791
Cost of reduction	8,496,851	7,227,774
Freight on ore	1,359,843	1,332,465
Marketing, etc.	3,531,692	3,168,993
Total costs	31,683,831	27,752,023
Net proceeds	11,446,901	10,525,730

The North Butte Mining Co., closely affiliated with the Anaconda, made its annual report at the same time, showing a gross income of $5,219,151 and net earnings of $1,613,046, against gross earnings of $4,186,737 and net of $986,213 last year. Some North Butte comparisons follow:

	1913.	1912.
Tons mined	451,298	411,908
Yield per ton	$11.565	$10.164
Cost of mining, per ton	$4.202	$4.190
Cost of smelting, per ton	$3.600	$3.426
Gross proceeds	$ 5,219,152	$ 4,186,737
Cost of mining	1,896,541	1,725,909
Cost of reduction	1,624,817	1,411,834
Cost of construction	31,007	13,421
Freight on ore	53,741	49,360
Total costs	3,606,106	3,200,524
Net proceeds	1,613,046	986,213

The East Butte has not yet made its report, but is expected to make a good showing of net profits and a reduction in the cost of production. The Butte & Superior will show another big loss in operations on the year, and probably the only other profit-earning company will be the Elm Orlu, a Clark company, although the Butte-Alex Scott is also expected to make a good showing of profits. Heavy losses will be shown by the Butte Central, Raven, Butte-Ballaklava, and others.

BRITISH COLUMBIA

GENERAL REVIEW OF PRODUCTION.—WATER SUPPLY FOR PLACER MINING IS GOOD.—LODE MINING ACTIVE.

Generally there is activity in the more important mining districts of the province, the chief exception being that labor troubles at some of the coal mines on Vancouver Island have caused a stoppage of work in the Nanaimo district, though not at the Cumberland or Extension collieries.

Much snow having fallen last winter, the outlook for a plentiful water supply is good. Much will depend on weather conditions; if the weather be hot throughout late spring and early summer the snow will melt quickly and the gravel-washing season be shortened proportionately, unless rain falls in the autumn. In Cariboo district preparations are well forward for hydraulicking on the John Hopp properties near Barkerville, namely, the Forest Rose, Stout's gulch, Lowhee creek, and Mosquito creek. Several other placer gold mines in Cariboo division will also be worked this season. In Quesnel division of Cariboo district, the Quesnelle Hydraulic Gold Mining Co. will operate at full capacity, while several smaller properties in the same division will also be worked. In Atlin district, the North Columbia Gold Mining Co., on Pine creek, may be expected to again be the largest producer. Other placer

operators include the Pittsburg-British Gold Co. on McKee creek, the Placer Gold Mines Co. on Ruby creek, the Otto Creek Development Co. and the Maluin Syndicate on Otto creek, and the Société Minière de la Colombie Britannique on Boulder creek. Spruce, Birch, and several other creeks are also being worked, while O'Donnell river will have increased attention on account of good prospects having been found on the benches last season. Notwithstanding that unfavorable accounts have been published regarding Silver creek and neighboring streams south of Teslin lake, so little actual mining has yet been done that it is yet too early to take it for granted that the new field is a failure. Now that it is practicable to do mining work there, that part of the district will doubtless be fairly tested before being abandoned by all who have gone there. Placer mining in other parts of the province not mentioned above is unimportant.

The greater part of the lode-gold produced in the province comes from Rossland and Boundary districts. Of a total of approximately 257,000 oz. recovered in 1912, Rossland mines contributed 132,000 oz., Boundary district (including 35,700 oz. from Hedley camp, Similkameen) 105,000 oz., Nelson division 17,500 oz., and Coast district mines 2500 oz. The current year's output should be larger in all these districts, if no interruption to mining operations shall occur.

Slocan district mines, which produced 1,657,000 oz. silver of the 1912 total of 3,132,000 oz. for the whole province, bid fair to make a larger output this year, for the Standard and Hewitt mines, near Silverton, and the Slocan Star and Rambler-Cariboo, in Central Slocan are all in shape for an increased production with half a dozen smaller mines also promising proportionate increases. Ainsworth division mines—Bluebell, No. 1, Silver Hoard, Utica, and Retallack & Co.'s group—are expected together to show a substantial increase over last year's total of 302,000 oz. There is no present indication of East Kootenay adding much to its 1912 production of 384,000 oz., nearly all from the Sullivan Group mines, which, however, have thus far this year well maintained their average output of lead-silver ore. Boundary district mines have to their credit for 1912 a little more than 389,000 oz. of silver obtained chiefly from copper-bearing ores. Other producing districts that added to last year's total were the Coast with about 104,000 oz., Rossland with 87,500 oz., and Lardeau with 43,500 oz., and all three are now producing silver at a rate that will give at least as large an amount this year.

Of nearly 45,000,000 lb. of lead produced in 1912, East Kootenay mines yielded 20,500,000 lb. in the proportion of about nine-tenths from the Sullivan group and one-tenth from the Monarch, and both these are continuing to produce this year. Of the Ainsworth division production of 4,864,000 lb., the greater part by far was from the Bluebell, which mine is keeping up its output of lead ore. In Slocan, Rambler-Cariboo, Van-Roi, and Standard mines together contributed nearly all of this district's 1912 output of 16,945,000 lb., and this year their combined output promises to be larger, while the Slocan Star, Hewitt, and others are expected to swell the total appreciably. The only other present lead-producing district is Nelson, with the H. B. and Emerald mines, both continuing to ship ore. In the Skeena country several silver-lead mines are being opened, but their output is not likely to be considerable this year.

The larger copper mines of the province are those of the Granby and British Columbia Copper Co.'s, in Boundary district. Of last year's total output of 51,500,000 lb., they contributed rather more than 33,300,000 lb. Coast mines—in greatest degree the Britannia and in far less the Marble Bay mine—added nearly 15,500,000 lb. to the total, while Rossland mines produced about 2,540,000. A small production from the Red Cliff, in Portland Canal division, made up the remainder. Except that the Britannia may make a larger output this year, and the Silver King, in Nelson division resume production, there are no indications of changes of any importance.

It is expected that there will not be any production of iron ore in 1913. Beyond development work done on Vancouver Island properties, there has not been substantial advance made, for there has not been any iron ore mined for shipment for several years. There is reported to be a prospect of the Texada Island iron properties being sold shortly.

The chief producers of zinc are Slocan mines—the Lucky Jim of crude zinc ore and the Standard and Van-Roi of silver-zinc concentrate. Zinc occurs in the ores of the Bluebell and Retallack & Co.'s Whitewater group, both in Ainsworth division, but neither shipped any last year. Some good zinc ore has been developed in the Noble Five group, Slocan and the Monarch. Near Field, on the Canadian Pacific main line of railway is a lead-zinc mine which also shipped last year. The Hewitt, in Slocan Lake district, will likely ship zinc concentrate this year, and there is talk of production in Lynn Creek camp, near Vancouver city.

BOSTON

Blue Sky Laws.—Lake Superior Mines and Laboa Troubles.—Miami and Other Copper Companies.

'Blue sky' legislation in this Commonwealth is taking on a modified form. A substitute bill is now before the House providing that the Commissioner of Corporations shall keep in his office for public inspection full information regarding securities offered for sale in this Commonwealth. Dealers shall be licensed, the fee being $25 per year. In case a dealer has a grievance, he may appeal to a board consisting of the Bank Commissioner, State Treasurer, and the Director of the Bureau of Statistics, whose authority is final. Violation of provisions of the act entail a fine of not more than $1000, and if intent to defraud can be shown, a maximum imprisonment of two years is provided. Government and municipal bonds and notes, and commercial paper running not more than 12 months, are exempted. The act, which will probably pass, goes into effect the first of next year.

At the annual meeting of the Calumet & Hecla subsidiary companies, Superior, Ahmeek, and Laurium, held here on June 10, the retiring directors were reëlected. R. M. Edwards has gone to the Lake district on a visit to the properties in the South Range over which he presides. He is having work on the Gambrinus claim of the Corbin Copper Co. prosecuted rapidly, it being his intention to sink the shaft to a depth of about 2000 ft. without stopping, although mining men familiar with Butte claim that good ore will be opened at half that distance. The Corbin management has great confidence in its new properties at Butte, and is urging stockholders to meet assessments.

Reports from the Lake district are that the labor situation there is showing much improvement. Strange to say, there has been no trouble getting skilled miners, but unskilled labor for tramming has been scarce. In order to encourage an ample supply, the mine managers are considering the proposal to make the pay of trammers equal to that of miners, balancing the mental ability of the former against the physical ability of the latter. It is said that the difference in pay has resulted in an oversupply of miners at times because the average trammer or timberman will work for a few months and then apply at some other property for a miner's job. The mainstay of the Lake labor situation in regard to miners has been the Cornishmen. The unskilled labor has been recruited from the southeastern countries of Europe. Owing to the Balkan war and the efforts of the Italian government to turn immigration to Tripoli, the labor market last winter from that quarter was cut off, but in the past few months there has been a renewal of supply.

The directors of the Miami Copper Co. will meet next month to take dividend action, and the regular 50c. quarterly dividend is being discounted here. Neither the cave-in nor the interference with shipments to the Greene-Cananea smelters has enforced curtailment enough to cause a change in the dividend rate. The policy of all the porphyries has been to establish a dividend rate which could be maintained in good times and bad, and Miami has planned to do the same. Chino and Ray, in commencing dividends, have probably taken into mature consideration

their ability to pay them without passing or reduction for an indefinite period. The Iron Cap Copper Co. management expects its June output of high-grade ore to amount to 500 tons. May expectations of 300 tons were exceeded by actual shipments. The company was troubled some in May by car shortage, but is having no trouble about rolling stock this month. It is announced here that the First National Copper Co. is going into the production of sulphur as a by-product for the purpose of taking care of its fume troubles. The expenditure of a substantial amount of money has been authorized for experimental work on a desulphurizing process which the experts have recommended. The Balaklala plant is being put in readiness for operation at once, and it is expected that one furnace will be in commission by the first of next month, when the new process will be tried. East Butte in May, notwithstanding shaft-sinking and changes going on in the smelter, turned out about 1,400,000 lb. of copper and earned about $100,000, which is very close to normal. The management is opening up considerable ore resources below the 1200-ft. level, the lowest of which ore is being taken at this time.

The holders of 'stock receipts' of Alaska Gold Mines Co. have been notified that the final payment of $5 per share must be made on or before July 1. The terms are such that the company may, at its option, forfeit all right to all shares on which the additional $5 per share is not made before that date.

NEW YORK

SECURITY MARKET SMASHED.—COPPER SITUATION BETTER THAN AT FIRST THOUGHT.—DIVIDENDS AND PRODUCTION AT HEDLEY, CANANEA, AND BUTTE.—FIRST NATIONAL HOPES TO RESUME.

The trouble that has been brewing in the security market broke last week in a decline which sent leading share issues to a price anywhere from 12 points below their high level of last year, to 215 points lower in the case of Calumet & Hecla. There can be no doubt that credits have become so extended as to produce a high money market, and the nervousness of the present moment was increased by the appointment of a receiver for the 'Frisco' road and the visit of Prince Poniatowski, chairman of the board of directors of a French bank that is a large holder of the securities of that road, who said frankly that the French market for American securities has been seriously hurt by a succession of similar unfortunate occurrences. Then on Monday, June 9, the Supreme Court of the United States handed down its long-expected decision in the Minnesota rate case. That day the market seemed bewildered, since no one clearly understood what the decision meant, but on Tuesday it broke with a crash, carrying 200 issues to the lowest level of the year. Two days later the market opened strong and continued upward to the end of the week. This is the first real activity in the markets for some time. Many of the leading copper shares still continue at low levels. However, Mr. McAdoo, secretary of the treasury, interjected himself into the situation by offering to issue $500,000,000 of the emergency currency authorized by the Aldrich-Vreeland act. But instead of being greeted with cheers, he met with jeers, since it is rather obvious that a situation arising from too extended credits, municipal, state, and national, as well as private, is scarcely to be helped by the issue of notes. Financial journals rejoice at the fact that this act expires next year, believing that the issuing of emergency currency would merely have the effect of drawing gold out of this country. The general opinion is that conditions here are improving. The weakness of the money market in London and on the Continent having reacted on New York as well, there is every reason to believe that bankers have seen the signals and have put on the brakes, and that the season of moving the crops next fall may be approached without excessive trepidation. Meanwhile, an attempt is being made at Washington to block Mr. Wilson's plan of currency legislation during this session of Congress. R. T. Henry, of Texas, has introduced a bill which will pave the way for a renewal of the 'money trust' investigation by giving to congressional committees the same power of inquisition over national banks as is now possessed by the courts and the Comptroller of the Currency. Doubtless, Samuel Untermyer's hand will be seen in the difficulties which seem to be threatening President Wilson's plans.

The Copper Producers' statement on June 9 showed a decrease of over 8,000,000 lb. in stocks, but was without effect on the metal market. Domestic deliveries for May were the same as in April, allowing for the 30-day month, but exports showed a decrease of about 15,000,000 lb. Joseph Clendenin, who handles the copper sales for the American Smelting & Refining Co., has just returned from Europe and reports that consumption of copper abroad is at top notch. He doubted also that any considerable amounts of copper abroad have gone into invisible supplies, since there is little doubt that consumers allowed their stocks to run down on account of the Balkan war, and have been replenishing them with the return of normal conditions. Though exports to Europe this year have been 15% larger than in the same period of last year, the European statistics have shown a constant decline in visible stocks. At the end of the week, transactions in small lots of second-hand copper showed a strengthening and afforded ground for the belief that when big buying is resumed it will be on a basis of 15c., though earlier in the week a lower level had been feared. The Nichols refinery at Laurel Hill, on Long Island, was shut down by a strike on June 13. This is one of the largest refineries in the world, having a capacity of 30,000,000 to 35,000,000 lb. of refined copper per month, and if the strike should last long it will have a correspondingly marked effect on the output of refined copper. The Nichols refinery handles all the Phelps-Dodge copper as well as that of the Old Dominion, Calumet & Arizona, Shannon, East Butte, Granby, and Ducktown companies.

The Hedley Gold Mining Co. has declared a quarterly dividend of 3% and an additional one of 2% payable June 30. The Batopilas Mining Co. reports the arrival in Chihuahua of its April and May bullion, amounting to 100,000 oz. fine. May production of the Greene-Cananea is given as 2,272,000 lb. copper, 78,182 oz. silver, and 428 oz. gold, almost exactly one-half of the production during last January. At the Braden the old mill treated 7570 tons of 2.42% ore during May, showing a recovery of 67.25%. The new mill treated 45,526 tons of 2.32% copper ore, making a recovery of 56.9%. The Minerals Separation plant showed a recovery of 71.50%, but as soon as the Hardinge mills are in full operation this should be materially increased. The advance in the Fortuna No. 2 adit during the month was 22 miles, of which the last 15 metres was in ore averaging 1.96% copper. This is below the average of the Braden, but the ore is a long distance beyond the bodies developed in the No. 3 and No. 4 adits, and may develop into something better. From indications above, it was expected to find ore at this place, but it is not the less reassuring to find expectations justified.

At the Butte & Superior an average of 700 tons per day has been milled recently on ore averaging 20.35% zinc. The recovery made was over 88%, and the concentrate ran better than 50% zinc. The situation of the company is thus much improved. Another company which has had troubles is the First National, perhaps better known as the Balaklala, of Shasta county, California. After a long series of difficulties over smelter-fume litigation, it was finally shut down. The management has been hopeful of eventually being able to resume operations, and sees a possible way out in a new process for smelter-fume control, which does away with one-half of the sulphur present and cuts down the sulphur content of the escaping gases correspondingly. An extensive series of experiments is now under way, and if expectations are realized there is a good chance of First National resuming place in the list of producing companies.

The Goldfield Con. M. Co. was ousted from the New York Stock Exchange, June 16, for refusal to comply with the rules in regard to registering stock transfers through a separate company.

General Mining News

ALASKA

The senate territories committee at Washington, D. C., on June 16 agreed on a bill for government construction of railroads in Alaska. It was to have been reported to the senate on the following day by G. E. Chamberlain, and will provide for $40,000,000 in bonds to finance the undertaking and leave the entire control to the President. The committee decided against the plan of W. L. Jones for a commission of five members to supervise the construction.

Cordova

Rich gold-bearing ore has been opened nine miles north of Camp 140 on the Copper River railway, on a tributary of the Kotsina river. It is stated that the rich ore is only 2 in. wide on the foot-wall for 50 ft., but the vein is 2½ ft. wide over a length of 600 ft. Sixty claims have been staked up to June 3.

Fairbanks

The Little Giant stamp-mill, on 17 Above Discovery, is working full time. The mortar is fitted with 40-mesh screens, and gold is caught on copper plates. It is planned to crush ore from the Teddy R. mine all summer. A lease on 200 ft. of the Wild Rose claim, to a depth of 100 ft. has been let till January 1915, on a royalty basis of 20% of the gross output. Spalding and associates are mining rich ore from the Soo claim, nearby.

Juneau

Gold worth $780,000 and consigned to the San Francisco mint through the Seattle assay office, left Juneau on June 14 on the steamship *Humboldt*. This is the first large gold shipment of the year.

Nome

During the season there will be six new dredges shipped to Nome, two of which will be erected in the Kougarok, and one at Candle, while the others will be sent to different parts of the Seward peninsula.

Valdez

According to the *Valdez Weekly Miner*, a hydraulic plant is being installed on Valdez creek, for the Valdez Creek Placer Mines Co. of Boston, which has the Tammany Bench ground. An adit has been driven through the gravel on bedrock about 1200 ft., and the width of the channel is about 100 ft., containing $11.20 to $23 per cu. yd. The water supply for sluicing consists of a ditch 1.75 miles long to a reservoir, from which it will be taken 3000 ft. through pipe, the total head being 280 ft. The sluice-boxes will be 1500 to 2000 ft. long, using 30-lb. rails. It is expected that 2000 yd. of gravel will be sluiced daily, yielding $2 per yard. Work should be started during the current month. William T. Soule is manager.

The Latouche mine is shipping 125 tons of copper ore daily to the Tacoma smelter. W. E. Dunkle is in charge. The Midas mine, in Solomon basin, 3 miles from Valdez, is under the same management, and is under bond to the Guggenheims. About $40,000 has been spent on development, and if acquired by them, the owners will be paid $180,000. Four adits have been driven over 1500 ft. in all, and a diamond-drill is in operation, also three machine-drills. The Port Wells district comprises a large gold-bearing area on the northwest arm of Prince William sound. It is easily reached, there is water and timber, and it is quite active at present. The Sweepstakes group of nine claims has opened 18 to 84 in. of ore over 145 ft. in length, and shipments to the Valdez custom stamp-mill have returned $100 per ton. The Cameron-Johnson Gold Mining Co. has a valuable property on the right side of Shoup glacier. Both the Treasury Note and Montezuma claims have opened good ore. A Risdon Iron Works 5-stamp mill is being erected, and should be working by July 15. The Little Cliff mine, seven miles west of Valdez, has been opened to the 500-ft. level. Sixty men are employed. Since May 1910 production totals $676,556. The Hubbard-Elliott company has shipped 80,000 lb. of supplies for the season's work.

ARIZONA

Gila County

(Special Correspondence.)—At the Inspiration Consolidated, the suspension of work in the main transportation tunnel due to the Keystone suit has had no effect upon any other portion of the workings. The usual rate of work is being maintained in blocking out the Colorado orebody, which will be worked by the caving system being employed at the Ray Consolidated, which differs from that used at the Miami. At the Live Oak section of the mine, an Aldrich vertical-triplex electric pump is being installed. It will have a lift of 1700 ft. Work at the millsite, and on the railroad grade, between the mine and millsite, is proceeding rapidly, and grading for the crushers at the main east and west shafts is almost complete. At the Miami Copper Co.'s property, the mine force is rapidly overcoming the check imposed upon ore extraction by the cave-in of April 17. Investigation, subsequent to the cave-in, has resulted in the conclusion that the settling of the capping was largely due to the presence of a fault, which was not apparent upon the surface, and revealed only after the capping came in. The Miami Copper Co. figures on an output of 90,000 tons of ore and 3,000,000 lb. of copper in June. The new furnace of the Calumet & Arizona is doing good work. At the old smelter two furnaces have been shut down. The Maverick Mining Co. is being formed by Los Angeles people to develop property 20 miles north of Florence, and 10 miles southwest of Superior. Shafts will be sunk and churn-drills operated.

Miami, June 12.

Maricopa County

A carload of copper-silver ore from the Red Rover mine, 50 miles north of Phoenix, was sent to the Douglas smelter, and averaged $200 per ton. This ore comes from a 6-ft. streak in a 16-ft. vein. The new mill of the Illizona Mining Co., 40 miles northwest of Phoenix, was destroyed by fire. Damages are figured at $10,000, and the plant will be rebuilt.

Mohave County

The fifth annual report of the Tom Reed Mining Co. shows that 43,478 tons of ore and 12,185 tons of tailing yielded $1,149,181. Dividends amounted to $563,924. The May clean-up was valued at $93,000. S. S. Jones is superintendent. The Gold Road output for the first week in June was valued at $31,000.

Pinal County

(Special Correspondence.)—V. D. Williamson has taken a bond and lease on 120 claims. Development on a large scale will be commenced at once. Mr. Williamson is financially well equipped. The auto-truck service between Superior and other parts of the Pioneer district, and the Southern Pacific railroad at Florence, has been temporarily discontinued; but will be resumed soon upon the arrival of trucks ordered by the Magma Copper Co. to take the place of those of the private line formerly used here.

Superior, June 12.

Santa Cruz County

(Special Correspondence.)—A new 50-hp. hoist is being installed at the Three R. mine. During the progress of the installation the shipments of ore are reduced to 50 tons per day, but by the first of the ensuing month, at least 100 tons of ore per day will be shipped. The ore has been sent to El Paso, but during the strike of Mexican laborers at the smelter only a part of the ore was shipped there, the rest going to Hayden. The ore being shipped averages about 10% copper. George F. Wieland has sold his group of four claims to August Jaeger, F. E. Thayer, and T. P. Quinn. The ore carries gold, silver, lead, and zinc. A shipment of the ore will be made shortly.

Patagonia, June 12.

Rich silver ore has been opened in the World's Fair mine at Patagonia.

CALIFORNIA

Calaveras County

(Special Correspondence.)—The Lightner Mining Co. has resumed operations after several months of idleness. Alex. Chalmers, the former superintendent, started a few men repairing the 60-stamp mill, preparatory to resuming operations on a larger scale. The Utica Mining Co., which has had a large force of men reconstructing and enlarging the flumes, has completed the work and returned to work on the mine. The new flume has a 500-in. daily capacity, and it is hoped this will obviate any future shortage of water. On May 31, during an electrical storm, the two transformers at the North Star mine were burned out, and two employees working on the drill at the Waterman mine, received severe shocks while handling the steel cables and machinery. The Reiner mine recently tested its hoisting machinery, which has been rebuilt to operate by electricity. At a recent meeting of the State Railroad Commission in Sonora, some light was thrown on the current freight rates in this community. F. J. Martin, superintendent of the Utica Mining Co., and Mr. Randall, superintendent of the Angels Camp, testified to paying from $45 to $63 per ton for concentrate shipped to the Selby smelter. Marte Verde, manager of the Angels foundry, and a number of other citizens, testified to equally exorbitant rates. There is hope in this community that the commission will take some action for its relief.

Angels Camp, June 9.

A new corporation has been formed to exploit the numerous gravel deposits in the Mokelumne Hill section, and active work will start within a few weeks. The claims are traversed by several ancient channels, and many of the properties yielded excellent profits years ago, although only worked in a small way. The new interests, known as the Corral Flat Mining Co., is incorporated for $300,000, and it is planned to drive adits to cut the deposits at a fair depth and thoroughly explore the old channels. The directors are J. H. Reardon, W. H. Kearney, J. L. Green, E. Johnson, and A. F. Friedberger. W. H. Kearney is president and treasurer, and J. L. Green, secretary.

Kern County

At a depth of 2300 ft., No. 6 well of the Honolulu Oil Co., five miles from Taft, 'came in' during the past week with a roar, and the flow of gas is estimated at over 40,000,000 cu. ft. per day at 700-lb. pressure. Should the flow keep up, the well will be developed as a 'gasser'; while if it subsides, it will be 'mudded,' and drilling continued.

Lake County

The Abbott Quicksilver M. Co. is preparing to reopen the Abbott mines, and build a new furnace of 15 or 20-ton capacity. The new work will be on a smaller deposit east of the famous old mines which have yielded $1,700,000 and much litigation. It is hoped to have the furnace running by fall.

Nevada County

The North Star Mines Co. has paid the first quarterly dividend for 1913, of 30c. per share, amounting to $75,000. This makes a total of $3,861,989 to date. The new Brunswick shaft will soon be down to 1450 ft., and the lower levels are to be developed. A Dow pump is handling 1200 gal. of water per minute. It is planned to add 20 stamps to the mill. C. H. Mallen is manager.

Placer County

The Yukon Gold Co. will install a 7½-cu. ft. Bucyrus dredge on the recently acquired ground on the American river. The adjoining property is being examined and tested by drills.

Plumas County

Ore is being shipped to the smelter from the Independence mine on Winters creek, and the option holders are pleased with general developments.

Shasta County

The charcoal used at the Heroult smelter is produced in the wood by-product plant, situated near the smelter. The 20 retorts handle about 45 tons of wood, and the company has arranged for the steady delivery of large quantities of wood for the purpose. Creosote, wood alcohol, acetic acid, tar, and other by-products are also produced by this plant. In its iron mines along the Pit river, the company has opened large reserves of high-grade iron ore. The ore smelted averages 70% iron and is mined at low cost.

Sierra County

High-grade ore has been opened on the Uncle Sam vein, in the North Fork mine at Forest. The vein is 3 ft. wide, carrying free gold and arsenical pyrite. Where cut, the ore is 1800 ft. in from the mouth of the incline adit. This was driven through andesitic lava, clay, and a gravel channel. The work occupied three years and cost $60,000. G. F. Stone is manager. San Francisco people are mostly interested in the property.

COLORADO

Eagle County

Another discovery of silver has been made on Horse mountain, about 1000 ft. from the Lady Bell mine. The Liberty claim, owned by Charles Zartman, was leased about two weeks ago to Marion Henry, sheriff, and it is on this claim that ore has just been discovered which carries 510 oz. of silver per ton. This is, by far, the most important find in the Eagle mining district since the discovery of the Lady Bell.

Gunnison County

The Tin Cup district is active. A gold dredge costing about $130,000 is being placed in Bertha gulch, near Abbeyville. A California company is doing this work.

Huerfano County

(Special Correspondence.)—The Colorado Mining Corporation is engaged in developing its group of claims, 9 miles from Russell Siding, on which promising deposits of uranium and vanadium ores occur. The ore occurs in a greenish black sandstone, the vanadium in the form of roscoelite forming incrustations along the cleavage planes of the ore. The uranium oxide occurs as a yellow stain or in small disseminations. The ore apparently occurs as a series of lenses, varying from 1 ft. to over 7 ft. in width, and has been exposed on the surface in a series of shallow shafts for a distance of 4500 ft. Assays upon the ore range from 2.63 to 6.25% V_2O_3, and an assay upon a large sample showed 2.51% V. There is an abundance of water and timber on the claims. Near La Veta, Frank Meyer has a group of claims on which occurs ore showing similar characteristics.

Russell Siding, June 12.

The San Juan

The Mountain Top adit is in 2000 ft., which leaves about 100 ft. to be driven to cut the vein. Shipments of ore and concentrate from Silverton during May were 350 and 2625 tons, respectively. Those from Ouray to Salida, Pueblo, and the Brown Mountain smelters were 1881 tons in all, of which the Camp Bird sent 866, Atlas 300, and Wanakah 511 tons.

IDAHO

Bonner County

The stockholders of the Idaho-Continental Mining Co., at a special meeting on June 9, ratified the contract agreement entered into by the management with the International Smelting & Refining Co., and the Idaho-Continental mine, near Porthill, is now in control of the Ryan interests, a majority of the stock having been transferred to the International company as security for the $325,000 advanced to finance development work and equip the mine. This loan has been made as an advance on ore shipments, which will be sent to the Tooele smelter for 10 years. The equipment, including a 200-ton concentrator, power-plant, transmission line, and all other auxiliaries, will be completed by the fall. There is not less than two years' run of ore already blocked out, and it is expected to repay the funds borrowed by the time this material is exhausted.

To assure the supervision of the property by the International company until the loan is repaid, three of its representatives are on the directorate, and G. I. Goodell has been made vice-president and general manager, a position created for the purpose.

IDAHO COUNTY

Work has been started again at the Mineral Zone group. The mine is in poor condition on account of caving, but this has exposed some good ore. An adit is being driven to cut a shoot in the Last Chance mine. The mill is not working yet. The Last Chance has three veins on its ground, and the large one, on which the mill is built, is so base that but a small percentage of the gold can be saved by amalgamation. The lower adit of the South Fork mine is in 500 ft., and the lost vein should be cut within 20 ft. of driving.

SHOSHONE COUNTY

It is proposed to amalgamate the Reindeer Copper Mining & Milling Co. and the Copper Queen Mining & Milling Co., operating adjoining properties in the Mullan district.

HELENA AND FRISCO MINES, NEAR WALLACE.

The new company will have 2,000,000 shares. One of the biggest leases taken out in this section in several years was closed on June 9, when D. W. Price, of Kellogg, secured the lower workings of the Yankee Boy property, on Big creek, for five years on the usual royalty basis. The Yankee Boy is owned by Dennis Blake and Mrs. Hattie Blake. Under the terms of the lease, Price will drive a 1500-ft. adit from the level of the creek to cut the vein 500 ft. below the present lowest workings. Four men will be put to work at once, and more as the work continues. The mine is rich in silver, and a 22-ton shipment returned $3500. The Federal Mining & Smelting Co. has acquired adjoining property for $240,000. The Bunker Hill & Sullivan company is reopening the old Monarch mine, which has been developed in the past, producing good ore.

MONTANA

FLATHEAD COUNTY

Excitement is increasing at Kalispell since the rich discovery in the South Fork copperfields several weeks ago. Scores of prospectors are thronging into the territory. Twenty-four parties outfitted here and left for the fields during the first week in June, and nine others are preparing to depart. Some of the outfits have taken the Swan trail, while others go in by way of Coram. The copperfields are situated about 30 miles from Kalispell.

LINCOLN COUNTY

(Special Corrtspondence.)—The Montana Placer Mining Co. has a force of men at work on its Big Cherry creek placer mine, 15 miles south of Libby, getting the plant ready for operation. Repairs are being made to the flume, constructed by a former company at a cost of approximately $25,000. A hydraulic elevator will be installed, the water in the old pit pumped out, and the sluice-boxes will be repaired. J. H. Hottendorf, who recently came to Libby from California, is in charge of the work. The stock in the company is owned principally by Libby and Spokane people. A large area of placer ground is owned by the company.

Libby, June 8.

SILVERBOW COUNTY

(Special Correspondence.)—The Pilot Butte company, which commenced cross-cutting on the 1800 and 2000-ft. levels nearly two weeks ago, has cut the vein on the 2000-ft. level, and driving is now in progress. A sample of the ore is reported to assay 21% copper and 160 oz. of silver per ton, and Mr. Sheehan, the superintendent, says there is no question but that ore shipments will commence in July. The air is not very good on the 2000-ft. level, and a new compressor is to be installed at once, and as soon as it is in working order, driving on the two lower levels will be started. The Butte, Anaconda & Pacific Railroad Co., which has contracted to build a spur from the mine to connect with the main line of the company, will commence work at once and in July the connection will be made. The Tuolumne Copper Co. is continuing shipments of about 125 tons per day, although there is every prospect that these will be increased considerably within the next six weeks. The drift on the 2000-ft. level is opening well for a distance of over 300 ft., and in view of this fact there is every reason to believe that the development work now being done on the 2200-ft. level will open some rich ore. The 2200-ft. level is equal to the 2400-ft. level of the North Butte workings on the Adirondack vein, from which the North Butte is shipping a large quantity of 5% ore.

Butte, June 14.

NEVADA

ESMERALDA COUNTY

Salt Lake people have organized the Silverfields Mines Co., with a capital of 500,000 shares of $2.50 each, to operate at Goldfield. At a meeting of the Goldfield Consolidated it was decided to pass the dividend. Dealings in the company's stock on the New York Stock Exchange has been stopped, this now being done by the Curb. Goldfield mining men have organized the Nevada Potash Co. to develop 1600 acres of Clayton lake, or Silver Peak salt marsh, 20 miles west of Goldfield. The ground will be tested by drilling, and good results are anticipated.

HUMBOLDT COUNTY

At National, the Wheeler adit is in Charleston hill over 2000 ft., in andesite, and on June 12 cut rhyolite, in which the National vein occurs. The adit is now being driven across this formation, and hopes are entertained that the vein will be cut in from 40 to 60 ft., that being the thickness of the rhyolite on the hanging wall of the vein where it has been opened in the Charleston Hill National Syndicate ground farther south. Many of the prominent mining men who have knowledge of conditions and developments in the National Mines Co. and Syndicate properties, have contended that the bonanza vein passed from the sideline of the West Virginia claim, belonging to the National Mines Co., and entered the Birthday group, owned by the First National Mining Co., and upon which Messrs. Campbell, Berry, and associates have their lease. The finding of the rhyolite hanging wall of the vein in the Birthday ground supports the opinion above referred to, and tends to disprove the contention of the National Mines Co. in its apex suit last year against the Syndicate, which was decided by Judge Farrington of the federal court in favor of the plaintiff.

NYE COUNTY

The West End Mining Co., Tonopah, has placed an order with the Wellman-Seaver-Morgan Co. for a new electric hoist fitted with Wuest type of herringbone gears.

OREGON

BAKER COUNTY

The Main of Oregon Mining Co. has 10 men employed on its property, situated at the junction of Ruby and Clear creeks. The upper vein contains 8 ft. of free-milling ore, and a 10-stamp mill should be working in a few days.

JACKSON COUNTY

(Special Correspondence.)—The annual clean-up of the placer mines in this and Josephine county is now in progress, there being not sufficient water for further hydraulic work. There has been a good supply, and the season's production should be equal to the usual quantity of gold. A satisfactory clean-up was brought in from the Golden West mine, of upper Slate Creek district, western Josephine county, by W. H. Ramsey, the manager, this week. Mr. Ramsey states that there has been more mining activity in the Slate Creek region this season than ever before. As this district will be touched by the Pacific-Interior railroad from Grants Pass, the mine-owners of the district are rushing development on their properties to be ready for the new line. Several hydraulic mines are also being developed, among these being the Buster Brown, owned and operated by L. P. Brown.

Philomath, June 13.

UTAH

SUMMIT COUNTY

It was reported from Park City on June 9 that the engineers who have been making the survey of the Silver King Coalition workings, under the recent case filed by the Silver King Consolidated Co., have completed underground work, and that the task of compiling and platting the work remains to be done, which will take some little time. On the 2000-ft. level the Lower Mammoth company has cut the vein, which was 8 ft. wide of low-grade ore on the 1800-ft. level.

CANADA

BRITISH COLUMBIA

A new copper furnace of 450-ton daily capacity was blown in at the Consolidated Mining & Smelting Co.'s plant at Trail on June 9. The 'centre feed' system has been installed for the new furnace, and it is proposed to remodel the other furnaces. The Rambler-Cariboo mine, in the Kaiso district, is shipping an increased quantity of ore to the Trail smelter. The new plant is producing 300 tons of concentrate per week. The Jewel mill has been enlarged, and the mine and mill are in full working order. The vein cut in a raise 60 ft. from the surface, at the Slocan Star, at Sandon, assays 198 to 215 oz. of silver per ton.

ONTARIO

Work is preceeding actively in draining Kerr lake, and the water to be drained is approximately 400,000,000 gal. During May the Nipissing high-grade mill treated 129 tons, and the low-grade mill 6544 tons of ore. Bullion produced totaled 460,353 oz., 162,381 oz. coming from the latter mill, the whole valued at $276,748. The hydraulic prospecting system uncovered two veins, one assaying 68 oz. silver, and shows 2 in. of cobalt. Development generally was satisfactory. La Rose produced 209,758 oz. of silver, valued at $115,855 during May. Net profits were $84,407. On July 20, a dividend amounting to $187,500 will be paid. The surplus is $1,752,150. At Porcupine an employee was arrested with $1500 of gold in his grip, which was stolen from the McIntyre mill.

YUKON

Telegraph advices from Dawson state that the first river steamboat from White Horse this year arrived on June 15, with passengers from the United States and southern Canada. Two other boats, owned by the White Pass & Yukon railway, were expected on June 16, bringing passengers, freight, and 2000 sacks of delayed mail from Dawson, Fairbanks, and other points on the lower Yukon. D. D. Cairnes, Canadian geologist, with a party of 10 men, equipped with 14 horses, is at Dawson preparing to leave for an extensive examination at the head of the White river.

MEXICO

BAJA CALIFORNIA

The Boleo copper mines suffered from an influx of water last autumn, but the extraction totaled 364,850 tons of ore, compared with 355,100 in 1911 and 366,000 in 1910. The reserves have been maintained and correspond to six years, working at the present rate. The smelter handled 360,000 tons of ore yielding 12,650 tons of copper, an increase of 290 tons on the preceding year. The average content of the ores was 3.51%. The railway transported 652,312 tons, as against 605,661 in 1911. The gross profit amounted to $1,750,000. After allowing for amortization, a dividend of $7.20 per share was paid, as compared with $4.85 for the previous year.

JALISCO

Fifty bandits, under the leadership of Julian Medina, former municipal president of Hostotipaquillo, entered the Cinco Minas Co.'s camp toward the end of May. They demanded money, arms, and ammunition. They got only ₱200 in money, a little ammunition, and canned goods valued at ₱150, due to the firmness of the acting manager, J. W. Crowdus. Nobody was molested.

A fourth tube-mill is in operation at the plant of the Amparo Mining Co., in the Etzatlan district of this state, and the daily average of ore now treated is 290 tons. A third Oliver filter is in place and soon will be in operation, and with this filter working it is expected to increase the tonnage of ore handled to over 300 tons per day. A big orebody has been opened to the south of the Amparo main workings, averaging 1 kg. silver and 10 to 20 gm. gold per ton. A new 2-compartment shaft will be sunk.

SONORA

(Special Correspondence.)—Mining and milling operations at the Cerro de Plata Mining Co. in the Noria district, have been progressing steadily regardless of the revolution that exists in that state. This company, which has been in the development stage for some time past, is reported as having developed a good body of silver ore which averages 46.5 oz. per ton. Thomas A. Wetzel, mining engineer of Los Angeles, recently made a report on the property and estimates the ore in sight at 57,600 tons. E. B. Holt, president of the company, is at present in San Francisco, making preparations to conduct milling operations on a greatly increased scale in the future. The plans include the erection of a new 100-ton mill and cyanide plant, and it is expected that this work will be commenced within the next four months. Bullion shipments since the mill started in November 1912 have averaged 25,000 oz. per month.

NICARAGUA

(Special Correspondence.)—The Babilonia Gold Mines, Ltd., of London, owning the Babilonia mine at La Libertad, has taken an option on the adjoining mines to the west and east. The property on the east is the Esmeralda, belonging to Alfonso Hurtado, while of the other, one-third is owned by the company and the balance by Hurtado and J. M. Jiminez. The option also includes the Magava power-site of these two men. The total price is $250,000 to Hurtado for the Esmeralda, one-third of the Santa Elena, and one-half of the power-site. On December 1, 1913, $100,000 is to be paid, and $150,000 within one year, interest bearing at 6%. The payment to Jiminez is $20,000 on December 1, 1913, for one-third of the Santa Elena, and one-half of the Niagona site. With this additional property, the Babilonia company controls the western end of the district, having over three miles along the 'formation.' The deal was completed by George Fairbairn, the manager, and required considerable tact, as Sr. Hurtado asked $550,000 for the property.

Santo Domingo, May 8.

Schools and Societies

Los Angeles members of the AMERICAN INSTITUTE OF MINING ENGINEERS will meet in the committee-room, Chamber of Commerce, on June 20, at 3 p.m., to complete organization of the local section recently authorized by the board of directors of the Institute. At present 60 members have indicated a desire to join the section.

THE BUREAU OF MINES AND GEOLOGY COMMISSION of Oregon announces the opening of offices at No. 526 Yeon building, Portland. A statistician will be at work collecting data concerning the production and importation of mineral products in Oregon. At present there is great risk accompanying the investment of capital in many branches of the mining industry, due to the absence of accurate information pertaining to market requirements and conditions. The bureau has five parties in the field headed by the most capable and well known geologists. It is hoped to have their published reports for distribution by the spring of 1914. Coöperative work with the U. S. Geological Survey has been undertaken, which contemplates the early completion of the geological research of the Sumpter quadrangle and the John Day basin.

The fifty-eighth general meeting of THE INSTITUTION OF MINING ENGINEERS was held in London on June 5. The following papers were read: 'Recent Methods of the Application of Stone-dust in Mines,' by W. E. Garforth; 'The Reopening of Norton Colliery with Self-contained Breathing Apparatus after an Explosion,' by J. R. L. Allott; 'The Heat Produced in the Slow Oxidation of Coal at Ordinary Temperatures,' by F. E. E. Lamplough and Miss M. Hill, of Cambridge University; and 'Insulated and Bare Copper and Aluminum Cables for the Transmission of Electrical Energy, with Special Reference to Mining Work,' by B. Welbourn. The following papers were discussed: 'Recent Legislation in Relation to Land and Mines,' by Alexander Smith; 'The Bellevue Explosion, Alberta, Canada: An Account of, and subsequent Investigation concerning, three Explosions produced by Sparks from Falls of Roof,' by John T. Stirling and Professor John Cadman. Arrangements were made for visits to the Chingford reservoir of the Metropolitan Water Board Co., and the Beckton works of the Gas Light & Coke Co. on June 6. The Institution dinner was held at the Waldorf hotel on the evening of June 5 at 7:30 o'clock.

The board of directors of the AMERICAN INSTITUTE OF MINING ENGINEERS has authorized the holding of a meeting under the auspices of the iron and steel committee in New York City, October 16 and 17. Gratifying responses have been received to the request of the committee for contributions, the following papers being assured: H. M. Howe, 'Discussion of the Existing Data as to the Position of Ae_3.' H. M. Howe, 'Equilibrium Temperature for A_1 in Carbon Steel.' H. M. Howe, 'The Divorcing of the Eutectoid in Meteorites.' H. M. Howe and A. G. Levy, 'Determination of the Position of Ae_1 in Carbon-Iron Alloys.' J. W. S. Crowe and H. S. Rawdon, 'Thermal and Microscopical Examinations of Professor Howe's Standard Steels.' J. H. Hall, 'Shock Tests of Cast Steel.' H. F. Miller, Jr., title not yet decided. E. Stültz, paper on the 'Scoria Process.' Albert Sauveur, 'Mayari Steel.' Felix A. Vogel, 'Briquetting.' J. E. Johnson, Jr., paper on 'Cast Iron.' R. R. Abbott, 'Influence of Alloying Elements on the Carburizations of Steel.'

As far as possible, these papers will be published in the *Bulletin* before the October meeting, and will also be mailed in pamphlet form to any member requesting it, as well as to all persons designated by the authors. The committee has good reasons to expect additional papers by several eminent steel manufacturers. Members intending to present papers should notify the secretary as early as possible, giving the title of the paper and the probable date at which the manuscript may be expected. It is essential that the manuscripts be received at the latest by September 1, and preferably by August 1, in order that the papers may be printed and distributed before the meeting.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

T. F. COLE has been at Butte.

R. R. BOYD is at Los Angeles.

CHARLES L. PARSONS is at Denver.

R. B. MCGINNIS has gone to Idaho.

THEODORE GROSS has sailed for Europe.

FRANKLIN B. REECE has gone to Arizona.

J. A. HOLMES was in New York recently.

F. G. COTTRELL was in New York last week.

FREDERICK H. MORLEY is at Colorado Springs.

D. W. SHANKS was in San Francisco this week.

J. PARKE CHANNING is expected in San Francisco.

H. G. F. SPURRELL is at Buenaventura, Colombia.

GRANT H. TOD has left for Juneau and other Alaska points.

E. A. CAPPELEN SMITH has gone to Europe for the summer.

SUMNER S. SMITH is leaving Juneau for the Susitna valley.

FOREST B. CALDWELL will return to Candelaria, Mexico, next week.

PHILIP N. MOORE was in New York last week, but has returned to St. Louis.

L. D. RICKETTS has gone to Arizona, expecting to return to New York in July.

W. W. WISHON recently examined the Octo group for Redlands, California, clients.

LEWIS F. JOHNSON is in San Francisco and will go to Los Angeles the last of the week.

HARRY J. WOLF has been appointed professor of mining in the Colorado School of Mines.

S. E. BRETHERTON has returned from Shasta county and gone East on professional business.

LOUIS A. WRIGHT and J. PARKE CHANNING have been at the Transvaal mine, Cumpas, Sonora.

D. H. BANKS is at Yerington investigating the possibility of leaching the copper ores of that district.

J. R. ROOKE-COWELL has left for Chile, to enter the chemical laboratory of the Braden Copper Company.

G. R. BRYGS and O. P. POSEY, of Los Angeles, have leased the Desert mine and mill at Vicksburg, Arizona.

F. C. SCHRADER, who has been studying Rochester for the U. S. Geological Survey, was in San Francisco last week.

J. C. RUTHERFORD, W. W. WISHON, and R. R. MACDONALD have leased the Socorro mine and mill at Wenden, Arizona.

E. B. HOLT, president of the Cerro de Plata Mining Co. has transferred his office from Magdalena, Sonora, to Nogales, Arizona.

HOWLAND BANCROFT has returned to Denver after an absence of a month in New York, Boston, Washington, and other Eastern cities.

S. J. GORMLY is studying the treatment of Ray ores at Hayden to determine a proper basis for a contract between the two companies concerned.

W. S. THYNG has concluded his services as secretary of the Northwest Bureau of Mines, Columbia building, Spokane, and has opened an office for the general practice of mining engineering.

CHARLES T. KIRK has been appointed professor of geology in the University of New Mexico, his duties to begin this month. The state law of 1909, establishing a Natural Resources Survey, combined the above-mentioned office with that of state geologist.

The Metal Markets

LOCAL METAL PRICES

San Francisco, June 19.

Antimony	12—12¾c	Quicksilver *(flask)	$41
Electrolytic Copper	16¼—16¾c	Tin	50—51¼c
Pig Lead	4.60—5.55c	Spelter	7—7¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL PRICES

(By wire from New York.)

NEW YORK, June 19.—Metal prices are now steady again. Copper averages a shade under 15c. and spelter a trifle below 5c., as shown by detailed quotations below. Lead remains at 4.33. Little business is being transacted. Amalgamated is reported to have reduced the selling price in Europe to 15c., and it is said that dealers are offering 14¾c. On June 18, cables from London reported copper easy, spot, £64 15s., off 2s. 6d.; futures, £64 17s. 6d., off 2s. 6d. Tin firm, spot, £204 5s., up 10s.; futures, £204 5s., up 7s. 6d. Lead, up 12s. 6d.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
June 12	59.25	May 7	60.98
" 13	59.12	" 14	60.25
" 14	59.12	" 21	60.66
" 15 Sunday		" 28	60.08
" 16	59.25	June 4	59.99
" 17	59.12	" 11	59.75
" 18	58.62	" 18	59.08

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.96	....
Apr.	59.20	59.25	Oct.	63.16	....
May	60.88	60.21	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
June 12	4.33	May 7	4.40
" 13	4.33	" 14	4.33
" 14	4.33	" 21	4.33
" 15 Sunday		" 28	4.33
" 16	4.33	June 4	4.33
" 17	4.33	" 11	4.33
" 18	4.33	" 18	4.33

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.64	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	4.34	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
June 12	4.90	May 7	5.31
" 13	4.90	" 14	5.28
" 14	4.90	" 21	5.28
" 15 Sunday		" 28	5.19
" 16	4.90	June 4	5.11
" 17	4.90	" 11	4.94
" 18	4.90	" 18	4.90

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	5.23	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
June 12	14.75	May 7	15.30
" 13	14.70	" 14	15.54
" 14	14.70	" 21	15.50
" 15 Sunday		" 28	15.43
" 16	14.70	June 4	15.18
" 17	14.70	" 11	14.79
" 18	14.70	" 18	14.70

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	15.42	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
July	1912	44,335,004	107,817,920
August	"	60,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720
April	"	104,269,270	106,565,760
May	"	75,549,108	102,654,720
June	"	67,474,225	90,025,600

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
May	1912	126,737,836	72,702,237	69,485,945
June	"	122,316,240	66,146,229	61,449,650
July	"	137,161,920	71,093,120	60,121,600
August	"	145,628,521	78,722,418	70,485,150
September	"	140,089,819	63,460,810	60,264,796
October	"	145,405,453	84,104,734	47,621,342
November	"	134,695,440	69,369,795	65,906,550
December	"	143,353,280	68,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February	"	130,948,881	59,676,402	72,168,623
March	"	136,251,849	76,585,471	77,699,306
April	"	135,333,402	78,158,837	85,894,727
May	"	141,319,416	81,158,800	68,286,097

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
May 22	40	June 5	41
" 29	41	" 12	41
		" 19	41

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	40.25	Nov.	41.50	....
June	41.30	....	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisco quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.06	49.10	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

ESTIMATED STEEL EARNINGS

Despite the recent industrial slowing down, it is estimated that the earnings of the U. S. Steel Corporation for the second quarter of the year will amount to $39,000,000, an increase of $4,500,000 as compared with the March quarter, and $14,000,000 as compared with a year ago. It is also probable that as a whole the production will be larger than for any quarter in the history of the Corporation. While the furnaces are running at about one-half capacity, the output for May constituted a record, and it is to be remembered that, owing to stoppages for repairs, renewals, and the fact that all furnaces become obsolete in time, an 80% capacity output represents nearly the practicable maximum.

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, June 18.
Associated Oil 5s	97½
E. I. du Pont 4½s	83½
Natomas Con. 6s	90
Unlisted.	
Associated Oil 1st ref	80
General Petroleum 6s	56¾

Unlisted.	Closing prices, June 18.
Natomas Dev. 6s	100
Pacific Port. Cement 6s	99
Riverside Cement 6s	77
Standard Cement 6s	91⅝
Santa Cruz Cement 6s	81½
So. Cal. Cement	70

STOCKS.

Listed.	Closing prices, June 18.
Associated Oil	38½
Amalgamated Oil	82
E. I. du Pont Powder pfd	88
Pacific Coast Borax, pfd	100½
do com	80
Pacific Crude Oil	35c
Sterling O. & D	1.10
Union Oil of Cal	80
West Coast Oil, pfd	90

Unlisted.	Closing prices, June 18.
Mascot Copper	1½
Noble Electric Steel	9
Natomas Consolidated	11½
Pacific Coast Borax, old	206
Pacific Portland Cement	59
Riverside Cement	45
Standard Cement	17
Standard Oil of Cal	187
Santa Cruz Cement	87½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 19.

Atlanta	$ .14	Mizpah Extension	$ .52
Belmont	6.32	Montana-Tonopah	1.20
Big Four	.45	Nevada Hills	.93
Buckhorn	1.30	North Star	.90
Con. Virginia	.04	Ophir	.11
Florence	.38	Pittsburg Silver Peak	.55
Goldfield Con	1.80	Round Mountain	.43
Goldfield Oro	.13	Sierra Nevada	.03
Halifax	1.25	Tonopah Extension	1.95
Jim Butler	.71	Tonopah Merger	.68
Jumbo Extension	.22	Tonopah of Nevada	6.00
MacNamara	.16	Union	.07
Mexican	.69	West End	1.37
Midway	.39	Yellow Jacket	.23

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.)

	June 19. Bid	Ask
Adventure	$ 1⅛	1⅜
Allouez	30½	31
Calumet & Arizona	60½	60½
Calumet & Hecla	415	420
Centennial	10¾	11½
Copper Range	40	40½
East Butte	10½	10¾
Franklin	5½	5¾
Granby	55	56
Greene Cananea	6	6⅛
Hancock	14½	15
Isle-Royale	18¾	19
Mass Copper	2½	3

	June 19. Bid	Ask
Mohawk	$ 45½	46
North Butte	25½	25½
Old Dominion	43½	44
Osceola	77	79
Quincy	57	58
Shannon	7½	8
Superior & Boston	2½	2½
Tamarack	23	23½
U. S. Smelting	35½	36
Utah Con	7½	7¾
Victoria	93c	1
Winona	1½	1¾
Wolverine	45	47

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

June 19.

	Bid.	Ask.
Alaska Mexican	8¼	8¾
Alaska Tread	36	38½
Alaska United	17½	18
Alaska G. M.	9¾	10¼
Braden Cop. 6s	128	135
B. C. Copper	2	2¼
Davis-Daly	1⅞	2⅛
Dolores	2	4
El Rayo	1	2
Ely Con.	6	8
First Nat.	1⅝	1⅞
Giroux	1½	1⅝
Greene Can.	6	6⅛
Hollinger	14¾	15¾
Kerr Lake	3⅛	3¼
La Rose	2¼	2½

	Bid.	Ask.
Mason Valley	5½	6
McKinley-Dar.	1⅝	1⅞
Miami 6s	168	173
Mines Co. Am.	2½	2¾
Nipissing	8½	8¾
Ohio Copper	⅝	¾
San Toy	18	20
Sioux Con.	2	5
S. W. Miami	5	7
So. Utah	¼	⅜
S. O. Calif.	169	171
Tri Bullion	⅛	¼
Tuolumne	2	2⅛
United Copper	⅜	¾
Wettlaufer	10	12
Yukon Gold	2¼	2½

AT THE RECENT MEETING of the Tanganyika Concessions, Limited, it was stated by the managing director, that the present production of the company is at the rate of between 5000 and 6000 tons of copper yearly, and that with the duplication of the plant this rate of production will be doubled before the end of June. It is intended to commence the erection of further furnaces within the next two or three months, which will bring up the output of copper from about 12,000 tons per annum to about three times that amount when they are completed.

GOLD PRODUCTION of the Rand in May was 794,306 fine ounces.

JAMES LEWIS & SON'S REPORT of June 2 gives the following quotations: gold, 77s. 9d. per ounce standard; silver, 2s. 3.75d.; quicksilver, £7 10s. per flask; sulphate of copper, £22 10s. per ton; lead, £19 to £19 15s. per ton; antimony, £32 to £34 per ton. Tin declined from £232 to £212 10s.

AT THE ANNUAL MEETING of the stockholders of the Greene Cananea Copper Co., on June 16, the retiring directors were reëlected. The proposition to increase the par value of the company's stock from $20 to $100 per share by the exchange of five shares of present stock for each one share of new stock, was authorized.

INCOME TAX paid by the Golden Horse-Shoe company, Kalgoorlie, during 1912 was $12,000 on a profit of $50,4000, or nearly 25%. This heavy percentage is due to an alteration of the law in England, where the company is registered, which does not now, as formerly, admit of adjustment in the case of falling profits.

MAY COPPER PRODUCTION

Miami, 1,948,900 lb. Old Dominion, 2,749,000 lb. Utah, estimated, 10,148,000. Greene Cananea, 2,272,000. East Butte, 1,400,000.

MINERAL OUTPUT OF JAPAN

During March 1913, according to figures collected by the Department of Agriculture and Commerce, the production was as given below. For comparison, the percentage of increase over production for March 1912 is also given.

		Per cent.
Gold, ounces	11,960	5.4
Silver, ounces	382,740	3.1
Copper, pounds	10,912,140	7.2
Iron, short tons	6,450	24.9
Coal, long tons	1,649,965	6.5
Petroleum, barrels	121,310	9.4
Sulphur, short tons	3,160	15.5

MINT RECEIPTS FOR MAY

The San Francisco Mint received the following bullion during May:

	Ounces.
Alaska (Cape Nome, 391 oz.; Fairbanks, 1221; Douglas Island, 8089; balance, 232 oz.)	9,934
Arizona	9,569
California	16,216
Idaho	27
Nevada	3,609
New Mexico	333
Oregon	478
Philippine Islands	2,833
Washington	4
Refineries, government offices, etc.	128,867
Mutilated United States coin	24
Foreign coin	33,751
Jewelry	1,052
Mexico	2,249
Total receipts	208,947

Value of gold, $4,319,322.

MINERAL OUTPUT OF THE NORTHERN TERRITORY, AUSTRALIA

This part of Australia, situated in the north-central part, has an area of 523,620 sqnare miles, and a population of only several thousand, of whom most are Chinese, Australian 'blacks', and others. The territory, formerly controlled by the state of South Australia, is now under the federal government. Access to the country is difficult, and takes some time to reach Port Darwin from the Eastern states. This place is connected with other parts of Australia by telegraph, and cable from England. At present a commission is investigating the advisability of constructing a railway to connect the existing lines. The federal government will do this work. Mining is in a languishing condition, due to want of communication, transport, and population. During 1912, production was as follows: gold, $97,000; tin ore, 271 tons, worth $129,000; lead ore, 108 tons, worth $3900; and wolfram, 39 tons, worth $15,800.

South Dakota Gold, Silver, and Lead

The total value of the production of gold, silver, and lead in South Dakota for 1912, as reported from 40 productive mines, 19 of which were placers, amounted to $8,019,370, according to Charles W. Henderson, of the United States Geological Survey. This production is the largest ever produced in any one year, the output being $229,182 above the previous maximum mine yield of $7,790,188, in 1908, and $468,612 larger than that of 1911. The gold output was 381,745 fine ounces, valued at $7,891,370, over 98% of the total value. The increase in gold for the year was 21,841 fine ounces in quantity and $451,496 in value. The yield of silver also increased, from 203,755 to 206,459 fine ounces. Smelting ore from South Dakota in 1912 carried 22,845 lb. of lead, against 64,311 lb. in 1911. The output of placer gold increased from 584 fine ounces in 1911 to 664 ounces in 1912.

A total of 1,901,726 short tons of ore was mined and treated in 1912, compared with 1,946,127 tons in 1911. Of this total, 1,893,836 tons was treated in the mills, yielding as bullion $7,734,806 in gold and 179,334 fine ounces of silver, valued at $110,290, with an average recovery per ton of $4.08 in gold and $0.058 in silver. Smelting ore. 7890 tons, averaged 0.8758 oz. of gold and 3.43 oz. of silver per ton.

The Homestake mine was operated continuously with a small increase in tonnage but an appreciable increase in average value per ton. The published report of this company shows a production of 1,528,923 tons, with an average value of $4.31+ per ton and a total value of $6,600,953. The tonnage of milling ore from the Golden Reward group, on Bald mountain, was equal to the 1911 yield, but an increased tonnage of crude ore was shipped to smelters. A 75-ton roaster is to be installed for the preliminary treatment of the sulphide ores before cyanidation. The Trojan mill was operated continuously in 1912, against five months in 1911, with a resultant increase in tonnage treated. The tonnage from the Wasp No. 2 mine, where steam-shovels are used for extracting the ore, showed a small increase. Because of the burning of the Mogul mill in March, the output of the property decreased. After the fire the Mogul ore was treated at the Lundberg, Dorr & Wilson custom plant, which was also operated on ore from the Buxton & Bonanza, Midget, and Dakota mines. The New Reliance, Victoria, and Black Hills-Standard mills were operated during a part of the year.

Placer mines in Custer, Lawrence, and Pennington counties yielded a slightly increased output. The most important production of placer gold came from the dredge at Mystic, Pennington county, with a small increase over the 1911 output.

Metals in Wyoming in 1912

The mine output of gold, silver, and copper in Wyoming in 1912, according to Charles W. Henderson, of the United States Geological Survey, showed a decrease, compared with the yield in 1911, of $7460. The output of gold, which represents 83% of the state yield, was $22,235, an increase of $3035. The yield of copper (formerly the most important metal product of Wyoming) was only 27,570 lb. in 1912, compared with 118,584 lb. in 1911. The silver production was 265 fine ounces, against 725 oz. in 1911. Almost all the gold output and over half the silver output was from the Atlantic City district, Fremont county, where there was a revival of the old Sweetwater district of 1867-1877. At the Duncan mine the ore was both amalgamated and cyanided. A small shipment of very high-grade ore was made from the Hidden Hand mine. Small quantities of placer gold were recovered at Encampment, Carbon county; in the Hurricane district, Crook county; and in the Atlantic City, Wind River, and Willow Creek districts, Fremont county.

Several cars of copper ore, containing platinum and palladium as well as small quantities of gold and silver, were shipped from the Rambler mine, at Holmes, Carbon county. The mill on this property was not operated. Several cars of copper ore, containing small quantities of silver, were shipped from the Hartville district, Laramie county. There was some development work and two small amalgamation and cyanide mills were under construction in the Bear Lodge district, near Sundance, Crook county, but no output was made.

Washington Metal Output

The value of the mine production of gold, silver, copper, and lead in Washington in 1912, according to C. N. Gerry, of the United States Geological Survey, was $1,120,214, compared with $1,056,017 in 1911 and $968,249 in 1910. The increase was due principally to the marketing of copper ore from Stevens county.

The gold production was valued at $680,964, nearly the same as was given in the preliminary press bulletin in January, or $166,713 less than the output of 1911. The decrease was due to the fact that less ore was shipped from Republic, where material was stored awaiting the completion of two new cyanide mills.

The silver output increased from 243,781 fine ounces in 1911 to 413,538 fine ounces in 1912, an increase of over 69%, largely from the Chewelah district in Stevens county. Ore from this district also increased the copper output from 318,207 lb. in 1911 to 1,086,010 lb. in 1912. Better prices were received for both copper and silver.

There was a decrease of 721,197 lb. in lead output, making the total 127,387 lb. in 1912, and no zinc ore was marketed.

The total ore sold or treated aggregated 94,981 tons in 1912, an increase of 12,676 tons. In 1911 most of the ore was shipped directly to smelters, but in 1912 gold and silver mills treated 21,312 tons, concentration mills 7680 tons, and the remainder, or 65,989 tons, was shipped to various smelters. Of the productive mines, 34 were deep and 12 were placers. The Republic district, in Ferry county, had an output of gold and silver valued at $686,971, and from the Chewelah district, in Stevens county, ore was shipped valued at $300,474.

Chilean Mineral Industry

A *Consular Report* gives the following figures in connection with trade in this country during 1912: Generally the commercial and industrial year was fairly prosperous, exports exceeding imports by $15,567,159, a good harvest, and labor was fully employed at advanced wages. Mineral exports were valued at $122,664,742, of which $24,425,951 went to the United States, $48,360,235 to England, $24,264,299 to Germany, and $6,223,415 to France. There was a large increase in nitrates and copper bars and ore. Mineral machinery, coal and oil imports from the United States totaled $10,600,503; from England, $20,050,109; from Germany, $16,378,928: from Belgium, $3,122,649; and from Australia, $3,019,747. During the year little was done toward developing the steel plant at Corral, while the imports of iron and steel increased. Coal imports totaled 1,577,221 tons coming from England and Australia.

Tin Market in Holland

The following table shows the arrivals, deliveries, and stock of tin in The Netherlands in 1911 and 1912, according to consular reports, the figures being for slabs of about 75 lb. each:

	Arrivals.	Deliveries.	Stocks.
Banka	459,947	473,347	21,000
Billiton	4,800	5,100	.....
Straits	71,340	71,730	360
Total slabs	536,087	550,177	21,360
Total tons	17,870	18,339	712

Company Reports

OROYA LINKS, LIMITED

This company owns 417 acres situated at the northeast end of the 'Golden Mile,' Kalgoorlie, Western Australia, and the report is for 1912. Development distributed over the Oroya North, Brownhill, Block 45, and Eclipse sections, covered 5799 ft., of which 2745 ft. was done in the first, and 2561 ft. in the last-named properties. This work cost $60,000. The tonnage mined during the year was 60,555 tons from the Eclipse, 44,223 from the Oroya North, 22,887 from the Brownhill, 2119 from the Oroya South, and 2096 from Block 45, a total of 131,880 tons. Ore reserves in the Eclipse section, above No. 7 level, are estimated as 114,537 tons averaging $6.12 per ton. At the lowest level, No. 7, development work carried out during the year has disclosed a wide body of good-grade ore, which has been further proved by raises and winzes from that level. At a depth of 814 ft. from the surface, the lode showed a width of 24 ft., of an average value of $9.60 per ton. A considerable number of lessees were working on 10 of the company's claims, they producing 5802 tons of ore yielding gold worth about $128,900, the best being on the Oroya North, where 1792 tons yielded $74,600. The shoot being worked here has dipped into the New North Boulder company's ground, and an option has been taken on it for $100,000. Royalty from lessees amounted to $28,000. The mill crushed 131,880 tons of ore yielding, with royalties, a total of $768,000. The net profit in Western Australia was $172,800. Dividends amounting to $135,000 were paid.

ROUND MOUNTAIN MINING COMPANY

This company operates at Round Mountain, north of Tonopah, Nye county, Nevada, and the report covers the year ended March 31, 1913. The company's holdings consist of 222 acres of patented and 121 acres of unpatented ground. The report of the general superintendent, R. H. Ernest, contains the following information:

Development work covered, feet	4716
Cost per foot	$7.13
Ore reserves, tons	155,500
Average value per ton	$5.56
Ore treated, tons	57,360
Total to date, tons	226,028
Gold production in 1912	$282,335
Recovery, per cent	88.50
Total to date	$1,975,918
Net realization in 1912 after charging depreciation, equipment, etc.	$29,151
Dividends to date	666,939
Cash on hand at March 31, 1913	146,148
Supplies	19,187

A new vein was cut on the 70-ft. level by a raise from the 501 cross-cut. This ore averages $7.64 per ton. On the 700-ft. level, 1174 ft. of development was done in opening the Keane or 751 vein, while stoping produced 3004 tons of $8.01 ore. The vertical veins in the Stebbins Hill section were actively prospected, yielding $6 to $6.25 ore. La Gazabo vein yielded 8966 tons of $6.37 to $7 ore. In March 1913, 201 cross-cut was started to open the Hydraulic vein, which was exposed by placer operations in 1911. It was cut at a depth of 60 ft., and is 21 ft. wide in the cross-cut, car samples averaging $7 per ton. The 501 ore-zone is about 90 ft. wide, worth between $2 and $3 per ton, and it is intended to develop it extensively. If a recovery of $2 per ton is made, a profit of 50 to 60c. per ton can be made by increasing the mill capacity to 500 tons per day.

INTERNATIONAL NICKEL COMPANY

This company was incorporated in New Jersey in 1912, and has large interests in mines in Canada, the United States, and New Caledonia, besides a large plant at Sudbury, Ontario. The authorized capital is $62,000,000, in 120,000 6% cumulative preference, and 500,000 ordinary shares of $100 each, 89,126 and 380,315, respectively, being issued.

During the year that ended March 31, 1913, the business of the Company has shown a substantial and satisfactory growth. The improved conditions in the steel industry resulted in a greatly increased demand for nickel, and in all other industries where the company's products are used, the demand has been the best in the history of the company. All indications point to satisfactory business for the coming year. During the year the busines in 'Monel' metal in its various forms continued the development and expansion noted last year, and this metal may now be said to have established itself in certain lines. The policy of keeping the plant up to date in every respect, and of enlarging its capacity is being continued. The consolidated income account compares as follows:

	1913.	1912.
Earnings of constituent companies	$6,802,886	$5,019,703
Other income	126,220	69,263
Total income	$6,929,107	$5,088,966
Export tax, etc.	542,308	222,553
Net income	$6,386,799	$4,866,413
Interest, etc.	1,366,494	1,284,453
Surplus	$5,020,305	$3,581,960
Preferred dividends	534,755	534,749
Balance for common	*$4,485,550	$3,047,211
Common dividends	3,491,049	2,143,412
Surplus	$ 994,501	$ 903,799

*Equal to 11.79% earned on $38,031,500 common stock.

At the stockholders' annual meeting of the company, the number of directors was increased from 12 to 15. Three new directors are Seward Prosser, W. A. Bostwick, and James L. Ashley. Other directors were reëlected. During the year the entire outstanding bonded indebtedness of the company has been retired. The company offered to the bondholders to pay these bonds at the redemption price, 110 and interest, and all bonds that were not tendered in response to this offer were called for payment on April 1, 1913. All of the bonds have been actually turned in and canceled, except bonds aggregating $812,858 of principal, for which the redemption price and interest is on deposit with the trustee of the mortgage, after the mortgage has been canceled. The general balance-sheet of the International Nickel Co. and its constituent companies in America as of March 31, 1912, compares as follows:

Assets:	1913.	1912.
Property account and constituent companies	$44,485,044	$26,197,764
Advanced Nickel Corporation, Ltd.	3,999	175,571
To Société Minière Caledonia	.....	11,109
Deferred charges	255,033	23,277
Stocks sundry companies	65,430	19,710
Inventories	2,364,969	3,263,108
Accounts receivable	1,485,941	1,354,733
Bills receivable	.....	50,000
Interest, insurance, and taxes	37,627	49,915
Cash	4,442,664	3,854,177
Total	$54,140,707	$34,999,355
Liabilities:		
Common stock	$38,031,500	$11,582,626
Preferred stock	8,912,600	8,912,626
Miscellaneous funds	.....	41,079
Bonds	.....	8,162,154
Accounts payable	752,874	744,798
Accrued taxes	102,652	76,373
Common dividends due	1,140,945	810,767
Accrued interest	5,434	226,146
Preferred dividends due	133,689	133,687
Profit and loss surplus	4,921,409	3,938,093
Total	$54,140,707	$34,999,355

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

WATER used by the 61,000 locomotives in the United States amounts to 672,853,774,720 gal. per year.

IRONWORK in the North Lyell copper mine, Tasmania, was found to be badly corroded by the action of the mine water, during the period the mine was flooded after the recent disastrous fire.

COINAGE executed at all United States Mints in May amounted to 11,044,940 U. S. pieces worth $4,879,198.20, and 2,243,820 pieces for the Philippine Islands, valued at $208,738.

PROPERTY owned by the Western Federation of Miners in the United States is valued at $505,860. This includes from a $3000 hall at Nome, Alaska, to a $75,000 building at Lead, South Dakota.

COST OF SUPPLIES at the Alaska Mexican 120-stamp mill during 1912 was as follows: shoes, 1.4c. per ton; dies, 0.4c.; cams, 0.2c.; mortar extras, 0.1c.; screens, 0.2c.; quicksilver, 0.2c.; lubricants, 0.2c.; vanner belts, 0.5c.; belting, 0.1c.; and miscellaneous, 0.9c.; a total of 4.2c. per ton.

COSTS at the Round Mountain Mining Co.'s property during 1912-13 were as follows: Stoping, $2.26 per ton; development, 59c.; milling, including 20c. per ton depreciation, $1; bullion tax, freight, 5c.; offices, interest, insurance, and miscellaneous expenses, 33c.; mine plant depreciation, 29c.; and litigation, 3c.; making a total of $4.55 per ton.

THE FOUNDRY at the Alaska Treadwell mine produced 1,146,823 lb. of iron, and 7049 lb. of brass castings in 1912. In the 240-stamp mill, the wear of dies was 1 lb. of iron for 5.12 tons of ore crushed, and in the 300-stamp mill, 4.24 tons. In the United mill, wear of the shoes was 1 lb. of chrome steel for 2.76 tons of ore, and of the dies 1 lb. of Treadwell iron for 4.94 tons.

COST of traveling and living in Central and South America is increasing. A traveler who left New York on September 11, 1912, went to Ecuador, returned to Cartegena and Barranquilla, Colombia, and thence to Bogota, Colombia, at the following cost: September 11 to October 11, $430; October 11 to November 11, $433; and November 11 to December 11, $435. No engineer should be expected to travel in these countries under $15 per day.

ELECTRIC unloaders operating at lower lake docks have a record of moving 10,636 tons of iron ore from a ship in 2.5 hours. In 1912, the greatest amount of freight carried by one single steamer on the lakes was 874,000 tons, and the greatest number of miles run by one steamer was 46,835. The average speed is 11 miles per hour, of a ship 600 ft. long, 58 ft. wide, and 32 ft. deep, with triple-expansion engines of 2000 horse-power.

AN amended employers' liability act came into force in Western Australia in February of the current year. It provides for additional compensation to be paid to workmen in cases of accident; and to meet these, the insurance companies have increased premiums from $7.02 to $9.18 per $480. The Golden Horse-Shoe company has a payroll amounting to $921,600 per year, the additional premium being increased by $4140 per year. It is proposed by this and other large companies to take their own risk and establish an insurance fund.

THE SWISS CHEMICAL INDUSTRY, which includes the manufacture of aniline and other dyes, and which centres in Basle, was fairly profitable during 1912. The exports amounted to $9,114,153, an increase of $802,920 over the figures for the previous 12 months. Of the total, $1,504,807 is credited to the United States, an increase of $310,948 as compared with 1911. Aniline and other dyestuffs represent $4,970,474 of the exports. On account of the political disturbances in China, there was a decrease in the demand in the Far East, which is a profitable market for Swiss chemicals.

ADHESION IN AMALGAMATION, according to Allan J. Clark and W. J. Sharwood, occurs when the surface of a plate, wiped or scraped as clean as possible by a rubber squeegee or cloth, still remains 'wetted' with amalgam, that is, coated with a thin film, removable only by scraping the surface with a tool which removes an actual layer of copper. The amalgam in this condition is in the form of a surface layer, perhaps of infinitesimal thickness, which adheres in just the same way as a film of grease. Possibly the phenomenon known as adsorption is involved. Repeated sprinkling with mercury, followed by wiping with a cloth or rubber removes nearly all of the precious metal thus adhering.

THE 50-stamp mill of the Oroya Links, Kalgoorlie, ran 8417 hours, in 1912, equal to 95.82% of the total possible time. The average stamp-duty was 7.52 tons per stamp per 24 hours, and the percentage of extraction for the year averaged 92.6%. Treatment consists of stamping, concentration, classifying, tube-milling, agitation, and vacuum-filter treatment. The cost was $2.18 per ton, and the residue averaged 44c. per ton. During the year extensive repairs were made to the concentrate roasting plant, which contains three Merton furnaces. Additions are being made to the plant by the installation of a new filter vat for the vacuum plant, and a mechanical pulp-thickener. This latter proved a success, and it is proposed to install two more.

AN Akins classifier and Hardinge conical mill will replace the 5-ft. Huntington mill for regrinding the tailing from the stamps at the Los Gazabo mill, Nevada. The Huntington mill has been found unsatisfactory for this purpose, because of difficulty in regulating the feed, and also its limited grinding capacity. The installation of the Hardinge mill is expected to increase the capacity of the mill to 190 tons per day, and will insure a higher extraction of gold values from the low-grade ore crushed by the stamps. The necessary extensions to the mill building have been made, and the installation will be completed early in June. The total cost will be approximately $6000. A further decrease in milling costs will result from this installation.

PLUMBOJAROSITE occurs in 18 different parts of Utah, especially in Beaver county. As seen in different hand samples, according to B. S. Butler in *Economic Geology*, it varies considerably in appearance. In color it ranges from a light, nearly ocher yellow, to a dark brown. When relatively coarsely crystalline, it has a distinctly micaceous appearance, but in the fine crystalline material it appears earthy, except on close examination. Where massive, it frequently has a distinctly schistose structure. The mineral has apparently been commonly mistaken for hydrated iron oxides, and it has been assumed that the metal contents were present as carbonates or chlorides, mixed with the hydrated iron oxide. It is usually not difficult to distinguish between the hydrated iron oxides and the basic sulphates, since the oxides have a harsh gritty feel when rubbed between the fingers, while the basic sulphates, due to their micaceous character, have a smooth oily feel. The lustre of the two is also usually distinctive, the sulphate having a silky lustre, while the oxide is earthy. In the fine material this character is less distinctive. Analyses of Utah and New Mexican plumbojarosite are respectively as follows: Fe_2O_3, 42.11 and 42.37%; PbO, 18.32 and 19.84%; K_2O and Na_2O, 0.13 and 0.38%; SO_3, 27.59 and 27.06%; H_2O, 9.16 and 9.56%; CuO, 0.27%; CaO, 0.05%; insoluble, 2.64 and 0.51%; and ZnO, 0.30%. The chemical formula may be stated as $PbO.3Fe_2O_3.4SO_3.6H_2O$.

Motor Trucks in Foreign Military Service

In Europe, governmental sanction of a motor truck is considered the highest possible testimonial of its merit. The motor truck industry in Europe was well established some years before even the pleasure-car branch of the industry had its inception in the United States. With characteristic thoroughness in designing and manufacturing, Europeans got the start. The United States government owns hardly 100 motor trucks for service in its war department, whereas abroad there are said to be in France alone nearly 2000 subsidized motor trucks subject to governmental requisition. These subsidized trucks have to undergo a kind of test which in the United States is almost unknown. Not only must they travel a hard and fast distance on a given quantity of fuel and lubricant, but they must use several kinds of fuel, such as denatured alcohol, benzine, or gasoline, with equally good results. When the European powers (France, Germany, and Russia) conduct their tests for the subsidies, a slight misalignment of the frames, or the loosening of a bolt, disqualifies that truck official sanction which carries with it a very substantial bounty annually for three years, amounting in France to $200 per year. In this connection it is interesting to note that Russia has started buying motor trucks in large quantities. All of these trucks were of Saurer make. In the trials there were 54 makes of the best that Europe could produce competing. Adolph Saurer says that, together with the trucks ordered by the Russian government in the fall of 1912, he now has more than 100 motor trucks to build for it. They include the repair truck, store-room truck, trucks with trailers for aeroplane transportation, and other types. The giving of this large order is the best proof of the high opinion which the persons of authority in the Russian war department have of the car. No less flattering than the above is an order for twenty omnibuses sent to the Bavarian post. The Bavarian post established several years ago an excellent automobile omnibus service in the Bavarian Alps. This is probably one of the biggest automobile undertakings in existence, and is paying good dividends. Besides the number of auto-trucks, this post department uses regularly 22 Saurer omnibuses of the 2-ton type, which besides their favorable results in service, are famous for their quiet running.

Cold Drawn Steel Unions

The Mark Manufacturing Co. of Chicago is putting on the market a new pipe union made of cold drawn steel throughout. These unions are made from flat strip steel by the cold-drawing process, making a fitting that is seamless and free from sand holes, pin holes, or similar structural defects. The successive drawing operations are performed in a series of punch presses, ranging in weight up to over 100 tons. These presses are all individually driven by motors, ranging from 5 to 150 hp. The Mark union consists of the usual three main parts, male and female ends, joined by a coupling nut. All of these parts, as well as the brass seat ring, are drawn cold from flat stock. The manufacture starts with long steel strips, from which disks or blanks are cut. These discs are then drawn into a deep cup, from which the bottoms are punched, forming a cylinder. One end of this tube is then folded or rolled back upon itself to form a reinforcement, which the succeeding operations press into final shape. The lower end is upset to form the bead, and the part is ready for threading. The Mark union is threaded to Briggs Standard for pipe threads and so carries the same taper as the pipe. In this respect it is different from most unions on the market, which are tapped straight through.

An advantage claimed for the Mark union is that it is made of the same material used in wrought steel pipe, and this overcomes a defect inherent in cast iron, malleable, and brass unions. The expansion of steel unions under heat is the same as the expansion of the pipe. The contraction when cooled is also the same. Another novelty is the densified, hardened steel seat, which is opposed to a soft brass ring in the female end. This densified seat is formed by applying the die with a tremendous pressure. Both the steel seat and brass ring are formed in dies without machining or grinding, and the fit of one face against the other is exact. Rust and corrosion are provided against by putting every union through the Sherardizing process, which forms a zinc alloy, integral with the boy of the metal over every part of the surface. This Sherardizing is done after the threads are cut, and protects them fully from corrosion, without altering in the slightest degree their sharpness and fit.

Catalogues Received

Joseph Dixon Crucible Co., Jersey City, N. J. Booklet, 'Dixon Graphite Brushes.' 16 pages. Illustrated. 3½ by 6¼ inches.

A. Leschen & Sons Rope Co., St. Louis, Missouri. June issue of 'Leschen's Hercules.' 12 pages. Illustrated. 8 by 10 inches.

Goldschmidt Thermit Co., 90 West St., New York. Pamphlet No. 34, 'Thermit Marine Repairs.' 32 pages. Illustrated. 8½ by 11 inches.

Power and Mining Machinery Co., Cudahy, Wisconsin. Bulletin No. 43, 'Wet Grinding Tube Mills.' 21 pages. Illustrated. 6 by 9 inches.

Blake and Knowles Steam Pump Works, 115 Broadway, New York. Catalogue BK-876, 'Blake-Knowles Single Pumps.' 84 pages. Illustrated. 6 by 9 inches.

International Steam Pump Works, 115 Broadway, New York. Bulletin No. C-210-S, in Spanish, 'Clayton Air Compressors.' 32 pages. Illustrated. 6 by 9 inches.

Watt Mining Car Wheel Co., Barnesville, Ohio. Catalogue B, 'Steel Ore Cars,' and Catalogue F, 'Steel Mine Cars.' Each 20 pages. Illustrated. 5½ by 8 inches.

Denver Fire Clay Co., Denver, Colorado. Catalogue, 'Case Gasoline Furnaces,' 16 pages. Bulletin No. 115, 'Case Oil Muffle Type Furnaces,' 12 pages. Folder, 'Case Low Pressure Oil Forge,' 4 pages. All illustrated. 6 by 9 inches.

Chicago Pneumatic Tool Co., Fisher Bdg., Chicago. Bulletin No. 128, 'Miscellaneous Equipment for Pneumatic Drills,' 12 pages. Bulletin No. 132, 'Pneumatic Motors and Pneumatic Geared Hoists,' 20 pages. Bulletin No. 133, 'Cylinder Air Hoists and Jacks,' 12 pages. All illustrated. 6 by 9 inches.

Special Sale of Geologic Folios

As a result of a recent fire in the Geological Survey building, the entire basement, in which the geologic folios were stored, was filled with dense smoke and many of the folios were burned, others scorched, and all more or less damaged by water. The entire remaining stock of some 150,000 folios, four-fifths of which are probably as near perfect as goods usually offered in a smoke or fire sale, will be sold at the nominal price of 5c. each. The regular retail price of the standard folios is 25c., but a few unusually large folios have sold for 50c., and the regular price of the 'field edition' of the later folios, a more convenient form for use in the field, is 50c. All these are now to be had at 5c. each, but no wholesale rate applies to this sale. Folio 185 (Murphysboro-Herrin, Illinois) has been published since the fire. This rate does not apply to it. These folios fully describe the geology of some 175,000 square miles of the United States. Lists will be sent on application.

The Dodge Manufacturing Co., Mishawaka, Indiana, reports that the Alaska Treadwell Gold Mining Co., Treadwell, Alaska, has purchased additional transmission machinery of the Dodge make.

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EDITORIAL STAFF:

San Francisco

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EUGENE H. LESLIE, M. W. von BERNEWITZ - - - - Assistant Editors

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T. A. RICKARD - - - - Editorial Contributor
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EDITORIAL

CALIFORNIA petroleum production in May, according to figures collected by the *California Oil World*, amounted to 7,639,144 barrels net, a slight decrease from the April figures. The total amount in storage is now 47,905,506 barrels, a figure that has remained nearly constant for some months.

MINING COMPANIES must impound tailing and are not to allow it to pollute any stream, according to the decision of the United States Supreme Court in the case of the farmers against the Arizona Copper Company, Ltd. While there has been much litigation upon the subject, we believe this is the first time the matter has been passed upon by the Supreme Court. Fuller comment will be made when the text of the decision is at hand.

IT IS announced at Butte that the zinc concentrate from the Elm Orlu mine is to go to the smelters of the National Zinc Company, which recently leased the plants of the United Zinc & Chemical Company, and accordingly has works at Bartelsville, Oklahoma; Kansas City, Kansas; and Springfield, Illinois. As evidence of the care that Mr. W. A. Clark takes in planning an enterprise, it may be mentioned that before contracting with the National company he had a thorough investigation made of the feasibility of establishing independent works, using Wyoming gas or coal for fuel.

GEOLOGY has been of great service to miners, of very great service indeed; but geology to be serviceable must be accurate, and we hope we are not over-skeptical when we doubt the value of much that is labeled geology in reports and prospectuses. For example, in a sample recently sent us there is a reference to "the slightly igneous and sedimentary rocks of the Tertiary." This does not inspire confidence in the conclusion that the fissures "having been seamed by the graduations of other rocks of the basaltic flow, and a sort of blue quartzite" produce "good conditions for the formation of many mineral veins." All this is said to especially characterize a certain "great mineral region."

TRANSFER of the real estate of the Colorado Fuel & Iron Company to the Colorado Industrial Company at the stockholders' meeting last week is explained as a mere simplification of accounts. The Industrial company was organized to furnish money needed for expansion of the business when it came under control of the Gould-Hawley combination. Owing to agreements with holders of debentures of the older company, no additional obligations could be incurred directly. The Industrial company there-

fore took the controling securities and advanced money on secondary security. By retirement of the original debentures, the way is cleared to a first lien. The Colorado Fuel & Iron Company is one of the pioneer manufacturing concerns of the West that has frequently found its needs to outrun its own accumulations of capital, but it is fundamentally a sound enterprise.

YUKON GOLD made a bad start with heavy capitalization and flamboyant publicity, but the excellent technical work of the engineering staff is enabling the company to recover lost ground. We present this week a summary of the report for the year, made by Mr. O. B. Perry. It is a pleasure to note that in addition to satisfactory returns at Dawson, the Iditarod venture, announced last year, is turning out excellently. In April we printed the news that the Company had taken options upon the Alta Bert and adjacent placer properties in Trinity county, California, and more recently it has been made public that ground has been drilled and a dredge is to be placed on the American river. These new ventures are being financed out of earnings and the position of the Company is, accordingly, being steadily bettered.

WALL STREET was treated to a dose of the switch by the New York state legislature in its session recently concluded. The laws regulating the sale of securities and making the manipulation of the price of stocks and bonds a felony were discussed at some length in our issue of May 10. Laws since enacted and signed by the Governor provide that a broker who, knowing himself to be insolvent, accepts collateral securities from a customer ignorant of his insolvency, thereby causing the customer to lose all or part of his security, is guilty of a felony, punishable by a fine of not more than $5000, or by not more than two years' imprisonment. Hypothecation of a customer's securities without his consent is similarly made a felony punishable to the same degree. Trading against the customer's order is similarly punishable, and every member of a firm is liable for the acts of one. This legislation has raised little protest in 'the street', however, for reputable firms have never engaged in such practices, and elimination of the unfit is to the obvious advantage of the fit.

DEVELOPMENT of hydro-electric power has been so rapid of recent years that it is difficult to keep account of the many new enterprises. Water power and the mountains of the West are natural mental associates, and it is somewhat surprising to learn that a recent census of hydro-electric enterprises in the southeastern United States shows a total of 64 plants, completed or under construction, to develop 1,186,000 horse-power. Among the more important plants are those of the Aluminum Company of America, on the Little Tennessee river; the Southern Aluminum Company, on the Yadkin river; the Alabama Traction, Light & Power Company, on the Coosa; the Virginia Power Company, on the New; the West Penn Traction & Water Power Company, on the Cheat; the Ozark Power & Water Company, on the White; and the Tennessee Railway, Light & Power Company, on the Ocoee. In the central states the Gold Fields American Development Company, Ltd., has practically completed a plant on the Mississippi river at Keokuk, Iowa, and will begin to deliver 60,000 horse-power to St. Louis in the course of the summer, and is ultimately to furnish 300,000 horse-power. It is especially interesting to find a large mining corporation investing its surplus capital in the development of electric power for industrial purposes. Mines may come and mines may go, but streams go on forever.

CONFERRING by Harvard University of the degree of Doctor of Science upon Mr. Charles D. Walcott adds but another to the honors that have come worthily to the distinguished secretary of the Smithsonian Institution. Incidentally, it calls renewed attention to the fact that in American life devotion to science is one of the open paths to a career of honor, dignity, and usefulness. Mr. Walcott did not have the advantages of a college education, and when he joined the Geological Survey he began at the bottom with the modest salary of $50 per month. By virtue of ability of high order and no less noteworthy industry, he rose to the position of Director of that organization, and Mr. Roosevelt also turned to him when the organization of the United States Reclamation Service was to be undertaken. In 1907 he became secretary of the Smithsonian Institution, perhaps the highest official position among American men of science. Western men know him best as a great administrator of public engineering work, but to the world at large he is most famous for his studies of Cambrian and pre-Cambrian fossils. To young men everywhere, his career stands as an inspiration.

MAKING of sulphuric acid was, a few years since, hailed as a solution of the smelter-fume problem, but disillusionment soon followed, since it did not require long to compute that one or two large smelting plants would be able to swamp the market with acid. Only in Tennessee and in California has the making of acid as an adjunct to smelting operations proved a source of profit. The situation in Tennessee is unusually favorable, in that there is a good local market for fertilizer, and the other raw materials for its manufacture are fortunately also available. But in industrial manufacture a variety of trade conditions have to be considered, and the announcement that the Virginia-Carolina Chemical Company will build a large fertilizer factory at Carteret, New Jersey, presages a keener competition. The International Agricultural Corporation, which buys the acid made by the Tennessee Copper Company, utilizing a part and selling the remainder in the open market, is reported to find its acid contract burdensome and to be seeking its dissolution, to which the Tennessee company will probably agree. Transport of acid is difficult and costly, and though the escape of SO_2 in smelting may appear useless waste, it is likely to prove in most cases more profitable than any possible method of its recovery.

MINING MEN may well read with interest the open letter in this issue, written by the energetic chief of the department of Mines and Metallurgy for the Panama-Pacific exposition. As he well says, the great fair affords an excellent opportunity for the miners to impress the public with the necessity and stability of the industry they represent. Far too many erroneous impressions are current because uncontradicted. In the interest of the profession let all get together and educate the public to the facts of the situation.

DIFFICULTIES of many sorts are met when any new industry is established. What some of them have been in the case of electric smelting of iron ore in California is told by Mr. Crawford on another page. It is announced this week that work at Heroult has been suspended until funds become available from the recent levy of $2 per share made on the stock of the Noble Electric Steel Company. To raise additional capital is a frequent but always annoying process, but a concern that by persistent work has overcome so many difficulties may be confidently expected to complete its task.

ANOTHER record in tunnel-driving has been made, this time at the Mt. Royal tunnel being driven for the Canadian Northern railroad at Montreal by the engineers of the Mackenzie & Mann Company, Limited. This tunnel, which is 8 by 12 feet in cross-section, is being driven from four portals. The new record, 810 feet in 31 days, was made at the Dorchester-street heading, which is now in 3750 feet from the face. The rock is a medium hard limestone interseeted by trap dikes. The work is being done with the new Sullivan water drills, and was described in the *Mining and Scientific Press* of February 8, 1913. The footage is neither so high for hard rock as in the Loetschberg record of 1013 feet, nor is it the American record. The latter, 1061.6 feet, was made in soft sandstone at 17 M. of the Los Angeles aqueduct and described in the *Mining and Scientific Press*, October 30, 1909. The Montreal performance, however, constitutes the American record for hard-rock work. The best previous records were those made in the Elizabeth tunnel of the Los Angeles aqueduct, 466 feet; at the Laramie tunnel in Colorado, 653 feet; and in an 8 by 8-foot heading driven by the Arizona Copper Company, 799 feet. While conditions are never quite the same at any two pieces of work, and while, in large measure, speed is a function of cost, these comparisons are interesting. In gaining speed, the bonus system of payment is a powerful incentive, as is also competition between rival crews. At Mt. Royal the average depth of hole is but 5½ feet, and this marks a considerable reaction against the American tendency toward deep holes, of a dozen years ago. As manufacturers lighten their drills so that set-ups come to occupy a smaller portion of the total time, it becomes profitable to blast more frequently, and hence to approach the European system of short rounds and many of them. At the same time, the lighter drills necessitate shorter holes in order to maintain an economic balance between weight of machine and weight of drill steel. There is no good reason why European records should not be equaled in North America, and in time we expect to see them surpassed.

A Geological Survey for China

Among the new departures initiated by the recently organized Republic of China, one of the most commendable is the proposed organization of a bureau for systematic study of the mineral resources of the country. One of the most critical problems of the new republic is that of national finance, which is closely bound up with national prosperity, which in turn rests upon the development of natural resources, agricultural and mineral. Much has already been done in unsystematic fashion, and the general features of the geography, geology, and mineral resources of China are fairly well known through the studies of a succession of explorers and students, beginning with Marco Polo and extending down to the present. The most important work was done by Baron F. von Richthofen and the geologists attached to the 'Mission' of the Lyons Chamber of Commerce. The United States bore honorable part in this pioneer work through the explorations of Messrs. R. Pumpelly, Bailey Willis, and others. The need for systematic and continuous study as an aid to right development is obvious, and the new government is to be commended for the promptitude with which it has taken up this matter.

The method of organizing as so far announced, seems less commendable. It is proposed to found, under the Ministry of Industry and Commerce, a Mining Academy to be situated in Peking and to consist of a president and four professors, two of whom are to be foreigners and two Chinese, and it is interesting to note that, following the plan suggested by Mr. T. A. Rickard some years ago, the professors are alternately to teach one-half of the time and to spend the other half in the field. The graduates of the Academy are to be organized into a Prospecting Corps which will study the mineral deposits of the various provinces and map them in order to determine which are most worthy of immediate development. It is apparently taken for granted that government aid will be asked in the development of mineral deposits, and one of the functions of the new bureau will be to pass upon the validity of such requests as well as to prevent the organization of swindles. The conjunction of teaching and geological surveying presents various disadvantages, and is evidently proposed in order to build up a corps which has been trained under the supervision of the heads of the organization. Little is to be gained by such a method, and much is sacrificed. The number of Chinese young men who have already been trained in geological and mining work, chiefly in foreign countries, is ample to furnish the personnel of such an organization, and the training of raw recruits only leads to unnecessary delay in bringing the institution to a stage where it can do effective work. In addition, all previous experience goes to show that educa-

tional institutions in Peking are unpleasantly accessible to official interference, to the great detriment of their work. The director of the new bureau is to be Mr. Esous Chang, and the mining professor Mr. C. Y. Liu, a graduate in 1911 of the School of Mines of Columbia University. Both of these gentlemen are guilty of "the crime of being young" and are accordingly lacking in the previous experience which the organization of a survey of a country larger than the United States would seem to demand. On the other hand, it must be remembered that Clarence King was also a very young man when he led the way in similar work in this country, and we hope Messrs. Chang and Liu may meet with a corresponding degree of success. A further proposal, which is excellent, is the organization of a National Mining Association, which is to combine the functions of the Institute of Mining Engineers and the Mining and Metallurgical Society in this country, and is to coöperate with the Academy and Prospecting Corps. Any work which these organizations are able to do will be for the advantage of the newest of republics, and we wish them Godspeed.

Armor Plate Manufacture

Much stir was created at Washington not long since over the purchase of armor plate to be used in the construction of battleships for the navy. The Secretary of the Navy worked up a fine frenzy over the fact that only three companies, the Carnegie Steel, the Bethlehem Steel, and the Midvale Steel, bid on government contracts, the prices named being substantially uniform, ranging from $420 per ton for ordinary armor plate to $500 per ton for special grades. This price is known to represent a large profit on the apparent manufacturing cost; probably as much as $250 to $350 per ton. As a result, Mr. Henry F. Ashhurst, senator from Arizona, has introduced a bill providing for the appropriation of $1,600,000 for the construction of a government-owned and operated plant. A government commission is to be charged with the selection of a proper site, and construction is to be started immediately, if Congress votes the funds necessary. This is evidently the psychological moment for introducing such legislation, following the Krupp scandals in Germany, but before the Government embarks in the somewhat stormy pool of steel manufacture, it will be well to give the matter careful consideration. As the matter is of national importance and hinges on the mineral industry, some analysis of the situation will be of interest.

As everyone knows, the manufacture of armor plate has been brought to its highest development by the Krupp works at Essen in Germany. Plate manufactured in this country is produced by methods covered by the Krupp patents, under which the Carnegie and Bethlehem companies operate; while the Midvale company, though using essentially the same methods, has recently successfully defended an infringement suit. The amount of armor plate made each year is small compared to the total output of steel, and the demand is exceedingly irregular: the Japanese war scare being effective to secure appropriations for battleships during some sessions of Congress and failing to work at others. Armor plate is a special product requiring special treatment and a very heavy investment of capital in special plant for its manufacture, and the product has to pass exceedingly rigid inspection. During the periods when no contracts are available, or are being filled by rival plants, this equipment lies idle, deteriorating, while the capital which it represents is earning no interest. It is not remarkable, therefore, to find that business of this character is not sought by the steel companies except at a price which yields an apparently large manufacturing profit. This is greatly reduced by the necessity of covering overhead charges during periods of inactivity. It would be easy to compute a lower cost of manufacture in a government-owned plant if interest upon the capital cost of construction and upkeep during periods of inactivity were not charged against manufacturing cost, but the total cost to the Government would, in all probability, be greater. At the government-owned plant in France, armor plate is produced at a cost of $250 to $300 per ton, but overhead charges are not included in this figure; at the Japanese government plant at Wakamatsu the cost is $400 per ton. Other governments average a higher rate than ours. Germany paid, in 1912, $490 per ton for armor plate; France, $490 to $510; Italy, $459 to $617; Russia, $320 to $385; and England, $438 to $535 per ton. It is not remarkable that the companies are willing to share the business, for it is obviously to the advantage of each to secure one-third of the business all the time, rather than all the business one-third of the time. The appropriation of $1,600,000 will, of course, only suffice to start the work, and the total sum involved before operations were in full sway would unquestionably be much greater, probably $12,000,000 or $15,000,000. That conditions bordering on competition, at least, prevail in this country is shown by the recent successful irruption of the Midvale company into the armor plate business. Though approving of government ownership and operation in instances where the public good is thus served, it is our judgment, from all the evidence of business experience, that a special product, such as armor plate, can be made to the best advantage in a plant where it can be advantageously combined with operations of allied nature, thus reducing overhead charges.

One phase of the matter which deserves attention is the possible substitution of Hadfield armor plate for the Krupp variety. Armor plate made by the process devised by Sir Robert Hadfield is much cheaper than Krupp plate because the manufacturing cost is less and the capital investment required for the construction of the plant is much less. If the Hadfield process is to be adopted for the government-owned plant, the cost of the armor can be much decreased, and probably with advantage, since the Hadfield steel has been used by the British navy. However, the maximum advantage would probably be gained by prevailing upon the steel companies to scrap their Krupp plants and engage in the manufacture of Hadfield steel on government account.

An Open Letter to Mining Men

By Charles E. van Barneveld*

Everybody will agree that the mining industry, which has done so much toward the settlement and upbuilding of this country, and which, in the last quarter of a century, has contributed over $40,000,000,000 to the wealth of the nation, should be adequately represented at the Exposition to be held at San Francisco in 1915.

Scope of the Exposition

The Panama-Pacific International Exposition is not a local or sectional affair; it is the nation's official celebration of the successful completion of the greatest task ever undertaken for the universal good of any nation. We welcome this opportunity to exhibit to the world our industrial and intellectual condition and to afford other peoples and nations an opportunity to participate with us in presenting a comprehensive picture and graphic record of the status of the world in 1915. The fundamental purpose of a universal exposition is educational; to provide the place and occasion for exchange of thought in congresses where the greatest minds from all parts of the world are brought together; to illustrate by actual examples, scientifically classified and arranged, what mankind is producing and the methods of production employed; to assemble under one roof, for comparison and study, widely scattered products of parallel industries; to create opportunities for the formation of those associations through which practical knowledge concerning markets and commerce is acquired.

This Exposition will be a record of the history of the world's progress in all the arts and industries. Its exhibits, gathered from all over the world, will tell the casual observer, the student, the thinker, by object-lessons instead of by words, what mankind is, does, and seeks to do. It will be a living picture illustrating and interpreting the cold and bare statistics which, without such interpretation, are incomprehensible and meaningless to the average mind.

Mining Exhibits

It has been said that mining operations do not lend themselves readily to exhibition and that the legitimate mine-operator has little commercial incentive to exhibit because he has nothing to advertise, nothing to sell! Fortunately, the mining industry is, in the main, in the hands of public-spirited men, accustomed to taking a large view of things, men who will not allow the lack of commercial incentive, the lack of apparent direct individual benefit, to outweigh the decided indirect, collective benefits to be derived from the right sort of publicity. We hear much of the decadence of prospecting and mining, of the lack of security and stability of mining investments. The miner has suffered greatly from misunderstanding, from public ignorance, and above all from persistent misrepresentation. We all recognize, in a general way, the importance of education; it is the greatest remedy for prejudice, superstition, and ignorance; it makes for greater all-around efficiency. A well planned exposition is of incalculable value as an educator of the public mind and no industry is in greater need of this service today than mining. Many important questions in which the miner is vitally interested are pressing for settlement. The public is taking an increasingly active part in forcing these settlements. When not blinded by prejudice and ignorance, the public is essentially fair-minded; it only needs to be educated. You have before you now an opportunity which probably will not recur for a decade to give the public an insight into the importance, the stability, and solidarity of your industry, its legitimate speculative and investment features, your need of capital, of fair treatment, of wise legislation, of public support and coöperation. Surely this is sufficient commercial incentive!

The miner takes pride in the fact that he is engaged in the upbuilding and further expansion of an industry which has contributed more than any other to the commercial supremacy of this country. We of the second and third generation owe it to the pioneer miners to see to it that the industry for which they so courageously laid the foundation is properly represented at the coming Exposition, which makes a peculiarly direct appeal to the individual pride of the miner: to his state pride, his national pride—in a word, to his patriotism.

Status of the Exposition

The following brief résumé will give the status of the Exposition to date. The foundation for the fourth International Exposition to be held in this country was laid in the raising of an original fund of $17,500,000, which amount was pledged to it by the people of San Francisco and California before Congress was asked to give it official governmental recognition. Of this amount, more than $4,000,000 was raised within two hours by popular subscription at a great mass-meeting held in San Francisco during April 1910. This was later increased by other pledges to the amount of $7,500,000. In addition to the popular subscription fund, the state of California has appropriated $5,000,000 to aid the Exposition, and the city of San Francisco has authorized $5,000,000 worth of bonds for the same purpose. Approximately $5,000,000 more is assured through county tax levies of 6 cents on each $100 assessed valuation to raise funds for county displays at the Exposition. This shows the spirit of the people who are entrusted with the building and conduct this Exposition.

On February 15, 1911, the President, Mr. Taft, signed the bill extending federal recognition and designating San Francisco as the official site for this great celebration. On February 2, 1912, a proclama-

*Address all communications to Charles E. van Barneveld, Chief of Department of Mines and Metallurgy, Panama-Pacific International Exposition, San Francisco, California.

tion was issued announcing the forthcoming Exposition and inviting the nations of the world to participate. The Exposition company is a California corporation, managed by a board of directors comprising thirty representative citizens of San Francisco, who are freely giving their best energies to this great undertaking.

Penalty for Procrastination

Construction work on the exhibit palaces is in full swing, and all buildings will be completed by the end of June 1914. The organization of the Division of Exhibits is completed, the last department to be organized being Mines and Metallurgy. The reports and records of former expositions impel a note of warning against procrastination and delayed action. Always and everywhere, late comers have paid and must continue to pay a penalty for deferring their building, booth, or installation work until the eleventh hour. The law of supply and demand is unavoidable. When the peak labor load is on, peak prices are demanded and efficiency suffers. This Exposition will be ready to receive all participants in July 1914—eight months before the opening day, February 20, 1915—and thus no valid excuse for unpreparedness on the part of any participant will exist. Exhibits of every character from every part of the world may be landed directly at the Exposition docks. The same facilities will be offered in the case of railway shipments, which will enable cars to be lightered from the various tidewater terminals of the railroads to the Exposition. There will be railroad tracks about the grounds and into the buildings, and large openings will be provided in the buildings to admit the large exhibits.

The exhibits in this Exposition will be installed according to a modern classification and according to modern methods. A copy of the Official Classification and of a pamphlet entitled 'Information for Exhibitors' may be obtained by application to the Chief of the Department.

Department of Mines and Metallurgy

The Department of Mines and Metallurgy deals with the natural mineral resources of the world, their exploration, exploitation, conversion into metal, their manufacture into structural forms and into raw material for various industries. It takes in the metals and the non-metals, including cement, clay, oil, gas, salt, gypsum, nitre, etc., and their products. The natural resources will of course be exhibited by the states of the Union through their several state commissions and by the various nations through their accredited commissions and representatives. It is hoped that each country and state will make a carefully selected exhibit, emphasizing its *distinctive* mineral product, thereby eliminating the usual duplication—the horror of an endless row of cases.

It has been suggested that the exposition of mining operations proper—that is to say, prospecting, development, and ore extraction—presents some difficulty. It may be said that the science and art of mining is a continuous overcoming of difficulties, and we confidently look to the proved ingenuity and resourcefulness of the miner to devise ways and means of illustrating the everyday mining processes. Machinery plays an important part in the operating end of mining, and we expect to develop an interesting, instructive exhibit of mining machinery with a reasonable proportion of operative features. Fortunately, we have the metallurgical and manufacturing side to draw on for operating exhibits. Plans are under way for working exhibits in copper smelting, gold milling, and the manufacture of nitre. Metallurgical processes, the production and manufacture of cement and clay, gem cutting, the production of crude oil, and the manufacture of its derivatives and by-products furnish a large and interesting field for exhibitors.

The responsibility of making a creditable exhibit in this department rests with *you*—with the individual. The occasion and the opportunity are at hand. The building and the necessary outdoor space are available. The Department is at your service. What are you going to do about it? Please send in your ideas and suggestions. The time for action is short.

The Millstone Industry

There were 14 operators in New York county in 1912. The production of millstones, burrstones, chasers, and dragstones in the United States in 1912 was valued at $71,414. The methods employed in quarrying the rock are simple. The rock is pried or split out, advantage being taken of the joint-planes, especially the concentric-surface joints. The tools used are the ordinary hand-drill, together with plugs and feathers. Blasting is often resorted to, but the charges of powder are usually light. The rough stones thus obtained are quarry dressed and finished, these operations being performed entirely by hand, the chief tools employed being the bull-point and the hammer. The operation of drilling the 'eye' is performed by centring the stone and then drilling from the centre of both faces inward.

In many stones the eyes are square. To fashion a square eye, a round eye is first drilled out and then squared up. A few of the men engaged in the industry make a modification of the regular millstone for use in grinding paint. In this modification the ordinary millstone is cut in halves and an iron casting is placed between the halves, which are then joined together by an iron band. Chasers are larger than the regular millstones. They are used for heavier work, such as grinding quartz, feldspar, barytes, etc., and they run on edge. Though they are made with a diameter as short as 24 in., they are usually turned out with diameters ranging from 50 to 84 in., and are as much as 22 in. thick. These chasers are run on pans paved with roughly cubical blocks of the conglomerate, with edges about a foot in length. In grinding quartz in such pans, the chasers are used in the preliminary crushing; then rough blocks, usually three in number, are either attached to or carried along by lateral arms, which in turn are joined to a vertical revolving shaft. By the circular movement of these blocks the material placed in the pan is ground to powder.

Rand Conditions and Future Outlook

By Owen Letcher

Last year the mines of the Witwatersrand yielded 8,752,568 oz. of gold, having a total value of £37,182,795. This probably represents 40% of the output of the whole world, a remarkable contribution, and one which prompts the question, 'Will this rate of output be maintained?' In a recent contribution to the technical press, H. C. Hoover asserted that the gold output of the world had reached its zenith, and he also expressed the opinion that the Main Reef Series of the Witwatersrand would not be able to record further annual increases in production. The gold output for the first month of the current year has been declared by the Transvaal Chamber of Mines at £3,232,440, or, allowing that January was one of the seven 'long' months, at the rate of, say, £38,700,000 per year. This is 4% in excess of last year's production. It may, however, well be argued that the question of maintenance and increase of production must be considered from a broader point of view than this.

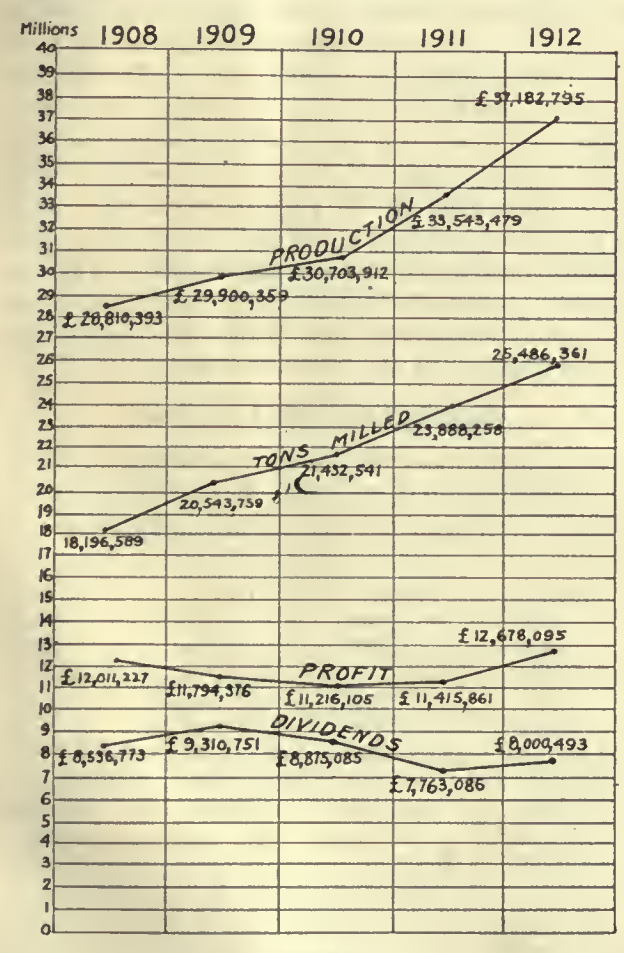


Chart 1.

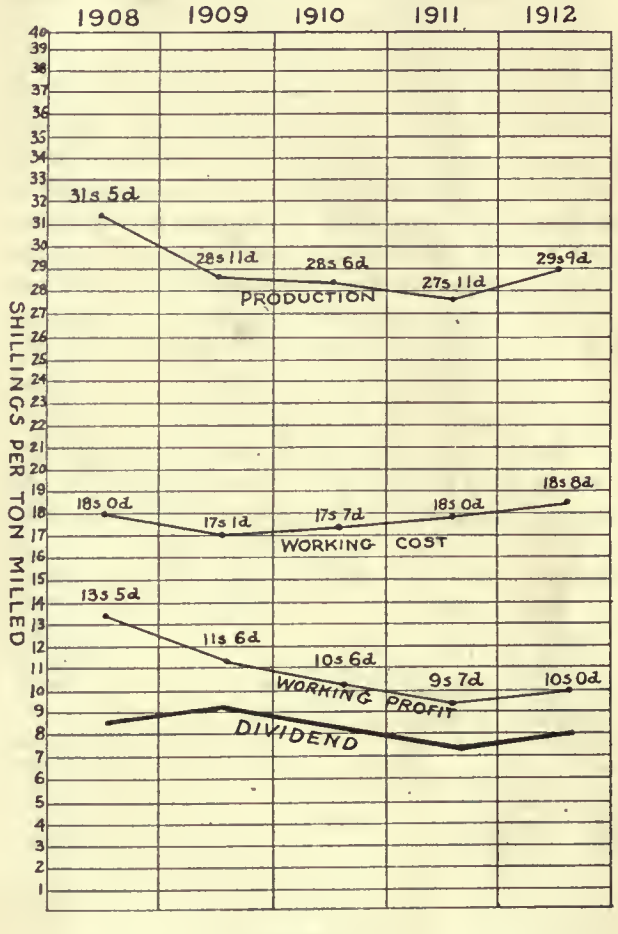


Chart 2.

Small Increase for This Year Expected

Will the January output be maintained throughout the present year? There is every reason for thinking that it will be. In fact everything points to a small increase in the annual rate of production, disclosed in the report for January, and it is not unlikely that the production from the Main Reef Series for 1913 will be about £39,000,000. Since the prospect of increased production from other goldfields of the world during the current year is admittedly poor, it can at least be presumed that the Rand's contribution will be 41 or 42% of the entire output of the world. But let us return to the Main Reef Series and its own achievements and probable production, without reference to other fields.

New Milling Equipment

One entirely new treatment plant, that of the Van Tyne Deep, which will consist of 80 stamps and 8 tube-mills, and have a crushing capacity of 40,000 tons per month, will commence work shortly after the half-year. The Geduld plant is being enlarged and remodeled. There are several other mines which are expected to drop more stamps or run additional tube-mills and so increase their tonnage; notable among these are the Randfontein Central, Crown Mines, and City Deep. Furthermore, additional stamps will in all probability be installed at the Brakpan Mines and New Modderfontein. At Brakpan, the enlargement of the existing 160-stamp mill to 200 stamps is contemplated, while at the New Modderfontein an entirely new battery will, so it is understood, be erected adjacent to the new circular shaft, which is to serve virtually the whole

of the immense eastern area of that property, which is almost unexplored. At a later date the Modderfontein Deep Levels, and the Government Gold Mining Areas, will install crushing equipment. After this, Springs Mines and 'Brakpan State Mines' will reach the producing stage, and later again the Cloverfield, Welgedacht, Daggafontein, and Grootvlei areas will become productive. All these mines are situated in what has come to be known as the 'Farther East Rand,' a vast half-basin shaped annex of the Central Witwatersrand which lies to the east of the township of Boksburg. The connection of the conglomerate beds in this farther east field with those in the central section is disputed by some.

Geological Relations of Deposits

Near Boksburg, the geological sequence of the auriferous conglomerates is obscured by the overlying coal measures of the Karroo system; and moreover, the reef formation between the Kleinfontein and Benoni mines is broken. Farther east, however, the auriferous 'bankets' occur in regular and unbroken sequence, but dip to the south at a very much flatter angle than in the Johannesburg-Germiston-Randfontein sections. The weight of evidence is overwhelmingly in favor of the view that the deposits worked by the Kleinfontein, Modderfontein, Van Ryn, Brakpan, and Geduld mines are extensions of the Main Reef Series proper of the Central Rand. At any rate, they contain gold under quite as advantageous conditions as the average of the rest of the field, and, inasmuch as many of the most profitable mines in the central section will become exhausted within the next ten years, it is to this farther east annex that the world will have to look for augmentation of gold supply from South Africa.

By the time this eastern portion is being worked at full capacity, the output of the Central Rand will be on the decline—in all probability markedly so. It is very difficult at this time to estimate, in anything like exact figures, the probable lives of the larger present-day producers on the Central Rand. It is also hard to predict the maximum output with any degree of accuracy.

Similarly, anything but very approximate calculations as to the life of the Rand, as a whole, are out of the question. There are vast accumulations of low-grade ore in the mines, over and above the tonnages of profitable ore, but whether the great bulk of this 2 and 3-dwt. rock will yield dividends during the time that the Witwatersrand is the premier goldfield of the world, or not, nobody can say. Economic questions of this magnitude are too complex, as well as too unwieldy, to respond to the most far-seeing and careful statistician.

The dividend factor is, of course, the predominant consideration. Not even the big mining houses of Johannesburg can be expected to continue working the mines when all the profitable ore has been exhausted. In order to appreciate the complexities of the question of maximum output, maximum dividends, and duration of productivity, some inquiry into the economic questions on the Rand today should be instructive and informing.

It is generally admitted here that the result of the past few years' work on the Witwatersrand has proved disappointing. True, the industry has had enormous difficulties to battle with—difficulties in regard to labor both white and colored, difficulties in regard to improving the ventilation and safety of underground workings, difficulties in finance, in legislation, and general difficulties inseparable from the never-ceasing kaleidoscope of South African affairs. These troubles are the lot of most large mining districts, but the Witwatersrand has had more than its share of them. However that may be, it must candidly be admitted that the results of the consolidation of mines and big mill, low grade policies have not come up to expectations. The two charts accompanying this article will enable one to gauge the sum and total of the endeavors of the past five years on the Witwatersrand.

Results of the Past Five Years

In concrete form, the results secured by the mines of the Main Reef Series since the beginning of 1908 and up to the end of last year are as follows:

	1908.	1909.	1910.	1911.	1912.
Percentage of ore raised and rejected at surface as waste	15.5	14.45	13.64	13.01	12.57
Stamps at work	8591	9158	9205	9432	9449
Tons milled	18,196,589	20,543,759	21,432,541	23,888,258	25,486,361
Duty per stamp per 24 hr., tons	6.27	6.79	7.19	7.88	8.39
Tube-mills at work	89	134	170	216	262
Output	£28,810,393	£29,900,359	£30,703,912	£33,543,479	£37,182,795
Profit	£12,011,227	£11,794,376	£11,216,105	£11,415,861	£12,678,095
Output per ton milled	31s. 5d.	22s. 11d.	28s. 6d.	27s. 11d.	29s. 0d.
Working cost per ton milled	18s. 0d.	17s. 1d.	17s. 7d.	18s. 0d.	18s. 8d.
Total dividends	£8,536,773	£9,310,751	£8,875,085	£7,763,086	£8,000,493

An outstanding feature of these figures is that since 1908 the scale of working, based on tons milled, has increased by 40%, while the increase in working profit has been little more than 5%, and there has been a decline in dividends distributed of practically 6 per cent.

An examination of Chart 1 will show, that while the tonnage milled and production have increased in almost parallel fashion, the lines of profits and dividends distributed, show but very little movement. The second diagram shows that on a unit basis the recovery has decreased, working costs have risen, and the profit and the dividends per ton have declined.

Such results are different from what was expected a few years ago. That dividends should be less in 1912 than in 1908, despite the huge expansion in tonnage, is disappointing. This result has been caused largely by the decline of certain of the older and

richer mines of the Central Rand, such as the Robinson and the Ferreira properties, which made those goldfields famous, and which were the prime factors in attracting the vast capital required for the development of the auriferous conglomerates in depth. These declines were inevitable; but the real disappointment has been that the various consolidations of mines have not produced the results anticipated.

Impoverishment with Depth

It may be alleged that impoverishment of gold in the banket beds, as greater depth is attained, is the cause of this. Personally, I will say that, excluding the rich outcrop central section—the Golden Mile of the Rand—I do not see any real evidence to support the statement that poorer ore is the rule as greater depths are reached on the Witwatersrand. This is of course based on experience to date, when a maximum working depth of 5000 ft. has been reached. But I do think that many of the Witwatersrand mines have milled ore having a higher value than the average value throughout this region. Admittedly, there is much to be said in favor of selective mining—in other words, making hay while the sun shines. Unfortunately, however, that such a policy has been pursued is not generally recognized. Unfortunately also, the expectations of lower working costs have not been realized. On the face of official statistics, given herewith, the winning of an equal dividend from ore of lesser grade, as a consequence of lower running charges, has been a presumption that has not been fulfilled. Neither has the automatic transfer of ore from the unpayable or unprofitable side of the ledger, to the payable or profitable side been manifested, and this despite the operation of 858 additional stamps and 173 additional tube-mills, despite the electrification of surface plants, marked improvements in metallurgy, and colossal efforts to better underground working conditions. Such innovations and additions place, for a time, additional burden on the working cost sheet of the Rand; and it may be argued that the industry has not yet emerged from the transition stage created by new ideas, new men, and new methods. Still the larger scale of operations might have been expected to bring in its train the economic advantages looked for. Apparently, it has signally failed to do so, and one is almost forced to the conclusion that in a number of instances consolidation has been carried out on too ambitious lines. In several cases the consolidations have proved unwieldy and many mines have been over-equipped and sacrificed on an altar of false economy.

Rand Policies

For years past the Rand has been hovering between the two policies of reducing expenditures at all costs, and that of subordinating large tonnage and low costs to cleaner and less hurried mining. In each case maximum dividends consistent with sound development, sound finances, and sound working conditions below surface, has been the goal of achievement. In this complex and comprehensive problem, each mine must be considered on its own particular merits or demerits. Generalization even on such a remarkably uniform goldfield as the Witwatersrand is impossible. The problem is full of difficulties, but it has been receiving whole-hearted attention for months past, and it would now seem that a moderate course has been determined and is being pursued at most mines.

However that may be, it does not dispose of the fact that the large sums of capital authorized or spent on additional improvement and reorganization, when consolidation was advocated so extensively, have not borne anything like the result expected.

In conclusion, I may return briefly to the initial inquiry of this article as to whether the rate of output on the Rand will be maintained. This year, by virtue of further stamps and new plants, the output is likely to be in the neighborhood of £39,000,000. In 1914 the influence of the Farther East Rand will be further felt and the production should rise to approximately £40,000,000. A further increase, but not a large one, seems likely in 1915, but by the end of the year the rise in output of the district lying to the east of Boksburg will be counterbalanced by a restriction of output on the central section. The Randfontein mines, in conjunction with other properties on the Farther East, may enable the industry to maintain an output of about £41,000,000 for a year or two more. After that, and probably before the end of this decade the production will steadily decline unless wholly unexpected development take place.

Dividend Question

Dividends are likely to increase, but not in the ratio of production. There is little or no prospect of an improvement in the grade of ore milled, despite the report of ore above average grade on the Farther East Rand. The exhaustion of the richer mines in the central section will in all probability more than counteract this advantage and a small but steady decline in recovery is most probable. As to costs, the outlook is more hopeful by reason of the prospect of cheaper native labor owing to the consolidation of recruiting interests; but the practical scope for reduction in costs, consistent with clean mining, is not very great. To sum up, I look upon the Rand as approaching a tableland both in regard to its outputs and dividend distributions. In a year or two the highest point of production and earnings will be reached, which will be maintained for a time, and then will come a decline, down which the Rand production will travel at a rate corresponding to that at which it has climbed to its present height.

Bids were opened at Washington on May 17 for dynamite in the following quantities: 1,644,750 lb. of 45%, in cartridges 1¼ by 8 in.; 410,500 lb. of 60%, in cartridges 1¼ by 8 in.; 130,000 lb. of 60%, in cartridges 2 by 8 in. One company's bid at 10.88c. per lb. on one-third of item 1, and 12.13c. per lb. on item 2, offering a powder in substitution for dynamite, was accepted. Another company's bid at 11.17c. per lb. on item 1 and at 12.23c. per lb. on items 2 and 3 was accepted for the remainder. Prices paid on expiring contracts have been 11.25 and 10.95c. for 45% dynamite, and 12.45 and 11.22c. for 60% dynamite. The dynamite is for Panama.

DREDGE IN OPERATION AT MENDANHA.

Dredging Operations in Brazil

While but little is known of the early mining history of Brazil, evidence is abundant and records are to be had which show it to be by no means a modern development. Although the mineral output of the country is of secondary importance to the agricultural, the country is, nevertheless, an important producer of precious gems, of gold, and has a growing production in other lines.

With the development of the diamond-drill for prospecting purposes, the demand for black diamonds, or carbons, has been on the steady increase, with the result that it has been with difficulty that the supply has kept pace with the demand, as is to be noted in the rise in price which has taken place within the past decade. Brazil has been in the forefront of black diamond production since the first demand for the stone was created, and although the mining methods have been crude, the production has been kept up and that country still remains the chief and almost sole source of supply. In the past, diamond-mining has been conducted almost entirely by the natives, who with a seemingly inherited instinct as to where the pay-placers were to be found, have been able to wash diamonds at a cost considerably below that of the white man, which has resulted in the white man acting largely as a middleman in the diamond industry, buying the stones from the natives and finding a market for them in the mining camps of the world. At the present time, however, an awakening is taking place as to the wonderful possibilities of this industry if conducted along scientific lines with modern dredging methods and equipment, and capital is being invested to exploit the gold and diamond placers of the Brazilian rivers. It is believed, and with every degree of certainty, that with the handling of thousands of tons of material, where formerly a few tons were handled, an industry will be established which will be the source of great future wealth. Today, with the generally primitive methods, Brazil stands alone in the production of black diamonds. A small production has been obtained from northern China, but this may be regarded as *nil*.

One of the oldest mining towns of Brazil is Tijuco, which was settled prior to 1700 by gold miners who came west from the settlement of 'Serro,' which is now known as Diamantina. The hill, upon which the city is built, has been penetrated with numerous adits and tunnels, evidences of the gold workings, which were closed by the government in 1729, at which time active diamond-mining commenced. A railway is at present in course of construction and will be completed soon, which will connect Tijuco with the Brazilian Central railway. This road will be completed to Diamantina in September. All transportation in the past has been by means of mules and ox-carts, which has been an impediment to the mining industry.

Diamond King Mining Co.

The Diamond King Mining Co. is a pioneer in dredging operations in the Minas Geraes country, where it has been operating successfully for a number of years, regardless of the handicap of having to transport machinery and supplies a distance of 95 miles on muleback from the railway. The dredge was modeled after the El Oro No. 2 and built of native timber with machinery furnished by the Link-Belt company. It was launched in 1907. To date, April 12, 1913, there has not been $50 spent in timber renewals. After all material below 3/32 in. has been discharged upon the gold-tables, the gravel from the main revolving screen is elevated to two 3 by 16-ft. revolving screens for sizing. The discharge from these screens is by gravity and the products are conducted to 8 single 2-compartment Harz jigs, which are on either side of the dredge and may be seen in the illustration. These jigs are used for concentration and the recovery of diamonds, and have been most successful in their operation. The dredge shown here is at Mendanha, on the Jequitinhonha river, in Minas Geraes, and at just this time is experiencing some difficulty in the removal of a stone dam, a reminder of the work of the ancient Portuguese miner and slavery days.

Pig iron production in the United States during May was the largest in the history of the industry. There were 285 active blast-furnaces on May 31, and the output was 2,815,336 tons.

Iron-ore shipments on the lakes in May amounted to 7,284,212 tons, the largest on record. The total tonnage for the season to June 1 was 8,150,599.

The Yukon Gold Company

By O. B. Perry

*During the past year the Company acquired control of Flat creek, the principal producing creek of the Iditarod district, Alaska. Twenty-four placer claims were secured, either by working agreements with the owners or outright purchase. These claims are all contiguous and include all the dredgable ground on Flat creek, extending from the head of the creek to the mouth, a distance of four miles. The dredgable area contains approximately 5,500,000 cu. yd., a large percentage of which is thawed. In the Klondike district some few purchases of outstanding claims were completed on Upper Bonanza and other creeks.

Equipment

The only additions to the Dawson equipment were in the hydraulic mines and consist of the installation of pipe-lines, cuts, and sluices in the newly opened properties on Monte Cristo gulch and hill. The No. 7 dredge completed its work on Upper Hunker creek in October 1911, and was dismantled preparatory to moving to another group of claims on the same creek. The Iditarod contracts required the installation of a dredge immediately, so that the plan for rebuilding the No. 7 dredge was abandoned. It was loaded on barges and shipped to Iditarod, where it was rebuilt on the upper end of Flat creek on the Marietta claim. The shipments totaled 850 tons, all of which had to be transferred at Dikeman, the head of navigation on the Iditarod river, to small gasoline boats which delivered the material in small lots at Iditarod after many vexatious delays. The material was handled by tramway from Iditarod to the mouth of Flat creek, and from there to the dredge site by wagon-road, a distance of four miles. This road was constructed by the Company to handle the heavy loads. The cost was approximately $3000 per mile. To furnish the dredge with power, a 300-kw. plant was erected on Flat creek, near the Bonanza claim. The installation consists of a steam-driven turbine direct-connected to a 4400-volt generator, boiler plant, and transmission line two miles in length. The foundations were completed by the time the machinery arrived, so that there was no delay in erection. The last of the machinery for the dredge and power-plant arrived at Iditarod on August 5, was transported, erected, and the completed plant in operation on August 15.

Dredge Operations

The eight Dawson dredges commenced operations in the first week of May and worked continuously throughout the season until October 24, when they were forced to suspend, owing to failure of the power-supply, which, at the end of the season, is purchased from the Granville Power Co. The average length of the dredging season was 172 days, during which the dredges operated 86.15% of the possible time. The material mined totaled 5,157,280 cu. yd., which produced $3,346,026, or an average of 64.88c. per cu. yd. The average cost was 30.64c. per cu. yd. The results, as compared with last season, show an increase of approximately 1,000,000 yd., and an increase in gross production of $674,181. The value per cubic yard increased 0.53c. and the cost decreased 4.79c. per cu. yd. The gain in yardage and production is accounted for by increased capacity due to the addition of one dredge; a higher average rate of mining for all the dredges, measured in cubic yards per hour run; and an increase of 4% in the running time of the entire fleet. The physical conditions were better, a larger percentage of the material being thawed, and both the thawing and dredging operations showed improvement. Of the area mined, 509,544 sq. yd., or 73.58%, was frozen and had to be thawed by steam. The thawing method has been better developed and is gaining in efficiency each year. Better dredging is the result, as the principal impediment to dredging is the frozen ground. The two new all-steel dredges, which were finished late in 1911, did excellent work under severe conditions.

The Iditarod dredge commenced operations on August 15 and closed down for the winter season on October 29. The dredge handled 172,333 cu. yd. which produced $404,040 gross gold, or an average value of $2.34 per cu. yd. Some of the gravel in the main pay produced $8.90 per cu. yd. This was on the Marietta, which is known as one of the best claims on Flat creek. The total operating cost was $79,113.92, which is 45.91c. per cu. yd. The daily average yardage was low (2361 cu. yd.), which means a correspondingly high working cost. The low yardage and high costs were due to the delays incidental to starting up a new plant, the excessive grade of the creek at the upper end, and the heavy wash which was encountered. These last two adverse conditions will disappear in working down the creek.

Hydraulic Operations

A total of 2,967,750 cu. yd. of gravel was handled in the hydraulic mines, which produced $629,043 gross gold, an increase of 842,000 yd. and $195,000, approximately, in gross production as compared to the season of 1911. The average cost for 1912 was 9.37c. as compared to 15.5c. for the season 1911. This decrease was largely due to the better water conditions and the decrease in maintenance and operating cost of the main ditch system. The Twelve Mile water system was in operation 168 days, which was 96.8% of the possible time, and delivered 524,249 miner's inches, an increase of 41,669 over the season of 1911. The total cost for operation and maintenance of the water system for the season 1912 was $76,760, as compared to $135,710 for the season 1911. The work of previous years has put the entire system in excellent condition. With a normal water-supply the hydraulic costs should remain in the neighborhood of 10c. per cu. yd. for the remainder of the life of the mines. The power-plant on the Little Twelve Mile was operated throughout the season when

*Report as constructing engineer and general manager for the year that ended on January 31, 1913.

water was available, without any delays or stoppages.

The Pacific, Atlin, lay operations on properties owned by the Company, and winter driving contributed a total of $484,337.56 at a cost of $204,672, yielding a net profit of $279,665.56.

Summary of Operating Results

	Production.	Working costs.	Operating gain.
Dawson (dredges)..	$3,346,026.79	$1,589,289.82	$1,765,736.97
Dawson (hydraulics)	629,043.65	277,953.12	351,090.53
Iditarod (dredge)...	404,040.01	79,113.92	324,926.09
Misc. operations....	484,337.56	204,672.00	279,665.56
Total	$4,863,448.01	$2,142,028.86	$2,921,419.15

From the operating profit, as shown, were deducted: royalties paid, $692,995.43; amortization and deferred charges, $577,146.27; interest charges, general expense, and examinations, $378,685.88; making a total of $1,648,827.58. The figures indicate a material gain in all branches of the Company's operations during the past year. The work for the next season will be conducted along the same lines as last, and with equally favorable physical conditions, still further improvement may be expected.

Wakamatsu Steel Works

The iron and steel works at Wakamatsu, Japan, is now making a comfortable profit according to the report of Baron Yujiro Nakamura made to the budget committee. It will be remembered that 1910 marked a turning point in the history of these works, since it was in that year that the first profit was realized. In 1909 the works were new, the operatives untrained, and the loss amounted to 800,000 yen. In 1910 there was a profit of 50,000 yen, and in 1911 this was increased to 1,500,000 yen. For the year 1912-13, the figures are not yet complete but the probable profit is estimated at 2,000,000 yen. The production has now grown to about 180,000 tons of pig iron per year. One of the great difficulties in the operation of the plant is that a large variety of products must be made, but no one in quantities comparable to American units of manufacture. The works were described in the *Mining and Scientific Press*, January 6, 1912.

Railway Construction in Chile

Railway construction made good progress in Chile, with the result that the Arica-La Paz line was opened to traffic, and the construction of the Longitudinal railway connecting Santiago and Iquique was so far advanced that the line is to be completed before the close of 1913. It is over 600 miles long. During the year the Government expended $19,400,000 on railway construction, covering 15 different lines, and opening 477 miles to operation. In December, the Longitudinal railway from Osorno to Puerto Montt was opened to traffic, completing the line from Valparaiso to the latter place, a distance of about 800 miles.

in turn are joined to a vertical revolving shaft. By the circular movement of these blocks the material placed in the pan is ground to powder.

Efficiency in Underground Drilling

At a meeting of the Copper Country Club at Houghton, Michigan, on March 8, a paper was read by Andre Formis on 'Efficiency in Underground Practice.' Mr. Formis has observed underground work very carefully from the position of a mine superintendent; his paper was in part as follows:

In consequence of the increased cost of labor and supplies in mining, it became advisable to investigate these factors with a view to reducing wastes to a minimum. Considering that the labor factor in mining is about 75% of the total cost, this item is of proportionately greater importance than the other 25%. However, owing to its nature, it is much more difficult to accomplish results with it, partly on account of the distrust of the so-called old-time mining captains of anything suggested by a technical graduate, partly on account of the inertia of labor itself, and partly on account of the natural hesitancy of some mine managements to permit anything that may seem a radical departure from ancient and honorable customs.

The following time record was taken from the chart of a single underground shift on January 31, 1913, in the usual tough, amygdaloid rock of the copper country:

	Per cent.
Drill at work	36.5
Changing steel	15.4
Moving drill on post	17.5
	69.4
Cleaning out for post	10.7
Time lost going to face	4.1
Getting drill steel and water	2.2
Cleaning and charging holes	2.8
Blasting	2.9
Blowing smoke	7.8
	30.5
Number of holes per shift	6
Feet drilled per shift	40.5
Cutting speed, feet per minute	0.205

Air pressure, about 96 lb. absolute.

The record shows that the first three factors, amounting to 69.4%, depend largely upon the type of rock-drill used. The rock-drill should be carefully chosen. For testing the amount of air consumed by a drill, the graphic air-flow meter can be used (perfected by the General Electric Co.; see Bull. No. 4004, 4827, 4941), which measures in cubic feet the air consumed by any device connected to it. In the time-chart given above, the consumption of air was about 110 cu. ft., with an air-pressure of about 96 lb. absolute; for the C-110 drill, commonly known as the 'Butterfly' one-man drill, the consumption of air was found to be 85 cu. ft. A recording air-gauge was connected to the line near the drill for comparison with the air-flow meter records at any time.

The Nevada-Douglas Copper Co. has announced that it will build a smelter.

The Mother Lode of California—II

By J. H. G. Wolf

The veins, on which the mines have been worked, follow roughly the strike of the belt, N. 20° W., and dip east usually at angles which vary from low to vertical. But there is no marked continuity of any of these features, excepting upon a vein system in a particular area. Often there are two or three veins in a zone of say 300 ft. wide, each having the characteristics of an independent vein, yet all seeming to unite in depth. The veins vary in thickness from a few inches, or a mere gouge seam, to 12 and 16 ft., the pay-shoots occurring usually in the thicker parts where the country rock adjacent to the hanging wall may be gold-bearing and of continuous length and depth. There is a record of a particular mine yielding 10,000 tons of milling ore ($9.50 yield per ton) and 325 tons of shipping ore ($90 per ton) from one pay-shoot in a vertical depth of 300 ft. So far as deductions have been drawn, the presence of the sulphides of the base metals, lead, arsenic, zinc, and copper has not produced what is looked upon as a 'base' ore, as the proportion of each to the volume of ore in a mine is small. It has recently been demonstrated conclusively that by fine grinding and cyanidation, omitting concentration, a very high extraction is obtainable. This course of treatment is particularly

BLACK OAK MILL, WHERE ALL-SLIMING IS APPLIED TO MOTHER LODE ORES.

for a considerable distance. The vein filling is either quartz or altered and (usually) silicified rock, with the usual substitution products. The ore is often accompanied by the sulphides of iron, copper, zinc, lead, or arsenic, though all these minerals do not appear in combination in the same mine. The iron sulphide is always present in some form, frequently as monosulphide or pyrrhotite.

Ore Deposition

All quartz bodies in the veins are not ore, nor do the sulphides always constitute ore. Solid masses of sulphides which were almost barren have been observed on the outer edge of a pay-shoot, and which had the physical appearance of the commercial ore 20 ft. away. The proportion of ore to waste in the entire content of a vein is 1/7, as on the central belt. This, of course, must be accepted as a rough generalization. The ore seems to have been formed in two periods, the first deposition being of quartz of average milling value from which the concentrate is low grade, and the second of high-grade shipping ore in lenses 6 to 18 in. thick advisable because the concentrate from the average milling grade of ore is under $30 in value, an indication that the gold is free. This method is further to be recommended because of the highly silicious character of the ore and its freedom from clay and such products. These recently obtained results show that in situations where only moderate tonnages are available, good commercial results may be expected from amalgamation alone by following the stamps with some form of slow-speed rotary mill that will grind the ore finely in the presence of plenty of mercury.

The ore-shoots as a rule do not outcrop for any great distance at the surface, though generally where there is a shoot the surface will carry some evidence, as, for instance, a cropping of barren quartz—the portion containing the pay-shoot having been disintegrated by the oxidation of the pyrite contained and subsequently eroded. In the early days, the Mexicans worked the deposits of these counties, and almost every important vein-system may be traced by the number of shallow shafts sunk along its course. Excavations up to

5000 cu. yd. may be seen where they ground-sluiced the disintegrated portion of a vein that paid well at the surface; the quartz ore was ground in arrastres.

A workable pay-shoot near the surface may vary in length from 100 to 300 ft., and is usually made up of short lenses, 20 to 30 ft. in length, which are more or less clearly connected. In depth, where

KENNEDY EXTENSION MINING CO.

the deposit is an important one, the succession of lenses appears to be more frequent, making longer pay-shoots. There is no evidence that the character of the ore changes with depth; that is, becomes base, or that the proportion of the base elements increases. In the granodiorite, dikes of exceedingly hard, dense blue diorite cut the veins frequently, particularly in the vicinity of a pay-shoot. When the vein is displaced by the dike, the dike is usually a thick one, at times as much as 40 ft. wide. Where the dikes are from 3 in. to 3 ft. wide they appear to be earlier or contemporaneous with the vein and have probably influenced the deposition of ore. Large, basic, granitic dikes cut the veins in places. In any one mine, the dikes usually have a uniform strike and dip, which is sometimes parallel with the joint-planes of the surrounding rock. The pitch of the ore-shoots may follow roughly the dip of the dikes, hence dikes are important assistants to prospecting.

General Summary

Mining costs, like the yield per ton from the ore, vary in the different belts. Costs in Amador county on the central belt are fairly constant; $2.75 per ton may be considered as a good average. The yield per ton for 1911, from 654,000 tons, was $4.67 per ton. Fixed charges such as taxes and other general expenses, plant renewal, depreciation, and tailing losses are probably not reckoned in the foregoing. In Amador county it costs roughly $2.45 per ton to mine and develop, and 30c. per ton to mill. The mining cost compared with milling is relatively high, because of the heavy expense for keeping excavations open. Due to swelling ground, a mine manager is doing well to keep more than a year's ore supply actually blocked. A main drive upon a newly opened level may be timbered with 20-in. round or 18-in. square sets, and within a year these may be crushed as if made of candle-sticks. The Nevada square-set system, or that with slight modifications, is used in timbering excavations. Sawed pine timber from Oregon, or round poles from the Sierras, and costing about $20 per thousand, are used. What some system of caving might do toward lowering costs is problematic. The stopes are filled as rapidly as the ore is removed, generally to within one set of the working face; the material therefor is taken from the hanging wall by over-hand stoping, which work sometimes reveals new ore unexpectedly.

The ore is a plain quartz, impregnated with from 1 to 2% iron pyrite; or silicified slate and rock, likewise impregnated, or a combination of the two. It is easily broken, and reduced in the mill. The low milling cost is due to the simple reducton process of crushing in stamp batteries to about 20 mesh and concentrating with Frue or Johnson vanners, without classification. Efforts to save the fine sulphide slime with canvas plants have been tried spasmodically with indifferent results.

The stamp-duty is about 4¼ tons per day with stamps of 1000 lb. and less. The concentrate, with the exception of the Kennedy mine, which has a chlorination plant, is shipped to the smelter. The local custom chlorination plants have long since suspended operations. A simple mill practice was established in the early days and has remained in use ever since; 80 to 88% represents probably the average of results, and it would seem that metallurgical opportunities exist at a number of important mines. On the east belt, where the ore and wall rock is hard, little if any timbering is required, and mining costs can be kept as low as on the central belt. The metallurgical results have not been as good as they were formerly.

Continuity of Ore

As to the continuity of the ore, no general deductions can be drawn. It can be said broadly that where a mine paid at or near the surface, its reopening has been attended with success at depth, due often to the better mining facilities of today; where a mine was a failure originally, its subsequent development has likewise yielded disappointment only. The South Eureka, confining its operations to the east vein only, was practically a failure for 30 years, until one day the west vein was cross-cut on the 2500-ft. level. Since that time (about 1907) a mine has been made upon this vein to 300 ft. deeper than where cut and reaching 1000 ft. above the 2500-ft. level. One prominent mine in the early days worked a pay-shoot some 400 ft. long to 700 ft. depth, with good results. The ore was later lost, and the mine

ZEILA MILL, JACKSON.

MOTHER LODE MINES, CENTRAL BELT, OF AMADOR COUNTY, CALIFORNIA.

Strike of veins N. ± 35°W., dip 45° to 70°N.E.

Mine and location.	Length on lode, ft.	Depth mined, ft.	Ore-bearing[1]: Length, ft.	Ore-bearing[1]: Depth, ft.	Ore-bearing[1]: Continuous vertically.	Orebodies: No.	Orebodies: Pitch in vein	No. stamps.	Reputed production.	Operating: At present	Operating: Paying dividends	Remarks.
Plymouth Con., Plymouth	3,875	1,290[3] 1,700[3]	3,000	1,750[3]	Yes	1	S.45°	160	$12,000,000	Yes		Under option to Bewick, Moreing & Co.; has been unwatered, and prospecting is under way.
Fremont Con, Amador City	3,975	1,280[3] 1,650[3]	2,400	1,650[3]	Yes, both bodies,	2	S.80° N.80°	40	5,000,000	Yes	Yes[4]	
Bunker Hill, "	2,750	1,650[3] 1,950[3]	1,600	1,950[3]	North body not; south body cont.	2	90°	40	3,000,000	Yes	Yes	Preparing now to sink to 2500 ft.
Original Amador, "	1,050	1,000	1,000	1,200	Yes	1	90°	20	3,000,000	Yes	No information.	
Keystone, "	2,100	1,000	2,100	1,575[3] 1,200[3]	East body cont.; west body not.	2	90°	60	16,500,000	Yes		Reorganized and operations resumed April 1912; sinking shaft to 2500 ft.
South Spring Hill, "	2,500	1,200	1,400	1,200	Yes	1	N.70°	40	3,000,000	No		
Lincoln, Sutter Creek	1,975	350[2]	1,200	850[3]	Yes, to 350 ft.				2,500,000	Yes		Under development; work intermittent at this time.
Wildman-Mahoney, Sutter Creek	2,400	1,250[2] 1,450[3]	1,000	1,450[3]		2	S.80°	40	4,500,000	Yes		Consolidated with Lincoln in 1912, and under development on 1950-ft. level from Lincoln; operations temporarily suspended.
Eureka or Amador Con., Sutter Creek	3,250	2,100[3] 2,200[3]	1,100	2,100[3] 2,200[3]	Yes	1	S. 60° for 700 ft., then N.75°	70	20,000,000	No		Company reorganized by late owners (Green interests), and reported to have plans for reopening.
Cent. Eureka, Sutter Creek	1,200	2,250[3] 2,600[3]	1,200	2,250[3] 2,600[3]	Yes	1	N .60°	40	3,400,000	Yes		Under development.
South Eureka, Sutter Creek	2,400	2,750	2,000	2,750	Ore for 900 ft.; barren for 700; ore to bottom.	2	90°	80	2,500,000	Yes	Yes[5]	Present orebody found by cross-cutting on 2700-ft. level westward into slates, revealing the 'west' vein, which is being successfully mined in other properties along the Lode.
Oneida, Jackson	2,850	2,200	1,200	2,200	Ore for 1200 ft.; barren for 300; ore to bottom.	2	90°	60	2,400,000	Yes		Bought by South Eureka in 1911 and is being reopened and prospected.
Kennedy, Jackson	2,100	3,500[3] 4,000[3]	2,000	3,753[3]	Yes, but pinched 2500 ft., reappearing below.	2	S.70° to 2500 ft., then 90°	100	12,000,000	Yes	Yes	Surface ores extended to 700 ft.; ore at 3500 ft. seems as persistent as anywhere in mine. Shaft sunk from 3553 to 3753 ft. during 1912; ore found to be continuous; is mining two parallel veins, each from 6 to 40 ft. thick, and an orebody on each end of the property. Argonaut receives the South body after passing 1000-ft. depth in Kennedy mine.
Argonaut, Jackson	750+ 2,500	3,100[3] 3,872[3]	750	3,000[3] 3,872[3]	Yes, below 1000 ft.	1	S.70° from 1000 to 2000 ft., then N.70°	40	4,000,000	Yes	Yes[4]	
	35,675		21,950					790[6]	$93,800,000			

[1]Ore-bearing for length of feet stated does not mean ore-shoots of such length; it means commercial ore has been found along the Lode for the distance indicated.
[2]Vertical. [3]Inclined. [4]Reputed. [5]Temporarily suspended. [6]Operating 520.

was shut down for a number of years. Upon reopening the mine, the ore was found by sinking a few hundred feet and continued to a depth of 1600 ft. There was another 'lean streak' at 2100 ft. and again at 2500 ft., below which point the ore was continuous and unbroken. The ore-shoot appears to get longer with depth, and is now over 700 ft. in length, and on the dual vein.

The deduction that the ore-shoots are longer in depth, though there may be a lowering of value per ton, seems to be thoroughly established. The most ambitious project at present under way to test out the continuity of the orebodies (or rather their repeating in depth) is at the Keystone mine in Amador City, where $16,500,000 has already been won. The big deposit dropped below commercial grade at a depth of 1200 ft., and the mine was closed. A new company was organized in 1912 and has sunk from 1550 to 2650 ft. without cross-cutting; lateral explorations are about to be begun, and the results will be anxiously watched, particularly locally, since the stock of these mines is owned to a large extent in San Francisco.

STAMP-MILL, KENNEDY GOLD MINING CO.

The presence of beautiful specimen-ore, found unexpectedly at any horizon, is a marked feature of the central belt deposit. A ribbon of pure gold encased in white quartz will extend at times almost unbrokenly for as much as 50 ft. in length and depth; again, the rich deposit will be concentrated in a small area and will yield $100,000 or more in gold. Such specimen-ore has been found at all horizons; and is as likely to be found in the lowest-grade deposit as at the Melones, as elsewhere along the belt. Specimen-ore is less frequently found on the east belt.

In closing, it can be said that the mining facilities of the Mother Lode region are the best. Electric power, cheap in cost and abundant in quantity, is supplied to all the regions excepting the eastern part of Amador county, from large hydro-electric plants, several of which are situated on the Lode. Water for the mills is unfailing and is supplied from large ditches bringing it from higher in the Sierras. Labor is chiefly from the south of Europe, and is unorganized, steady, reliable, and paid from $2.50 to $3 per day. The mines make a minimum of water below 1000 or 1200 ft. As each county seat is the terminus of a branch railroad, the transportation facilities are the best. The climate is the most equable and attractive of any section where mining is pursued: orange trees will grow wherever planted, even the fig tree and pomegranate, if one will take the trouble to set them out.

Bromo-Cyanide Litigation in Western Australia

An important suit was started on April 24 before the Supreme Court, at Perth, Judge McMillan presiding, in which the following companies are involved: The plaintiffs are the Gold Ore Treatment Co. of Western Australia, Ltd. (in liquidation), the London & Hamburg Gold Recovery Co., Ltd. (in liquidation), Carl Geopner, and Wilhelm Witte; and the defendants are the Golden Horse-Shoe Estates Co., Ltd. The plaintiffs complain of the use by the defendant at the Golden Horse-Shoe mine during the years 1907 and 1908 of the processes patented by them, in respect of which they claim: (1) An injunction to restrain the defendant company from infringing their patent rights; (2) damages for infringement, or, alternately, an account of the profits derived by the defendant company from such infringement; (3) delivery to the plaintiffs, or the destruction of, all the infringing plant, machinery, and materials as are in the possession of the defendant company; (4) costs; and (5) such further relief as the nature of the case may require.

The defendant does not admit any of the allegations and denies the infringement of the letters patent. It claims that Henry Livington Sulman and Frank Teed were not first and true inventors of the ore invention, and that Carl Geopner and Wilhelm Witte did not invent the second. It was contended that the alleged invention, in so far as it claimed the process in which halogen compounds of cyanogen, or their corresponding gases, were added to cyanide of potassium in water, was used before the date of the letters patent by Baumont and members of the Fraser's South mine staff at Southern Cross, Western Australia, in 1894.

In his opening for the plaintiffs, Mr. Pilkington said that the pleadings were of extraordinary length. He spoke for 19 hours. They contended that the defendant had infringed letters patent concerning two specific patents connected with the treatment of gold. The first patent was called the Sulman-Teed, and had to do with the manufacture of a solvent for precious metals, particularly gold. The second patent was for the manufacture of cyanogen bromide to treat the solution when separated from pulped ore. The main case for the defense was an attack upon the validity of the patents referred to.

The first objection raised was that the process was useless unless combined with sliming, agitating, and filter-pressing, and that the process was not known at the time the patents were obtained. The answer to that was that the process was known and that the patents were not invalid, even though they might be useless without those particular methods of treating ore. It was contended, further, that the processes which had to be used in connection with the invention were processes which could be used by any skilled and intelligent worker, and that they were of a purely mechanical nature.

Electric Smelting as Conducted at Heroult

By John Crawford, Jr.

*As early as the year 1900, experiments made in the smelting of iron ores by electricity as a substitute for that of charcoal and coke began to take a shape which indicated future commercial possibilities. The incentive for these experiments were:

1. The decreasing supply and increased cost of charcoal which began to threaten the charcoal iron industry, especially in Norway and Sweden.

2. More efficient and cheaper methods of generating electricity from water power.

3. The endeavor to find a market for surplus electric power.

4. The increased demand for iron and steel products, which turned men's attention to the possibility of utilizing various high-grade deposits of iron ore whose isolated location prohibited blast-furnace smelting.

The third and fourth of these reasons are in a great measure responsible for our activities at Heroult.

History

About twenty-five years ago the deposit of iron ore which we are now working was brought to the attention of C. B. Morgan, at present secretary of the Noble Electric Steel Co. The deposit, though at that time only slightly developed, gave promise of being of great extent, and from the following analysis its purity and high grade are at once apparent:

	Per cent.
SiO_2	3.43
Al_2O_3	0.81
CaO	0.70
MgO	0.32
MnO	0.28
CuO	trace
TiO_2	nil
Fe_3O_4	79.63
Fe_2O_3	14.56
	99.73
Fe	67.86
P	0.0116
S	0.021

Geologically, the iron ore lies between quartz-augite-diorite of this region and the metamorphosed (McCloud) limestone. It is a segregation deposit from ascending waters and vapors charged heavily with iron and is contemporaneous with the diorite intrusion and subsequent to the limestone.

The size and purity of the deposit, together with the ability to secure relatively cheap electric power and the possibility of a railroad outlet down the Pit river, decided Mr. Noble to endeavor to establish the iron industry in the state of California by means of smelting in the electric furnace.

Under the direction of R. Turnbull, an American representative of Paul L. T. Heroult, a 1500-kw. furnace of the resistance type was completed in 1907.

Pig iron was successfully produced, but after operating a short time the furnace developed mechanical weaknesses which caused operations to be suspended pending further experiments and investigation. As a result of these experiments there was designed by E. E. Cox, and others, in 1908, under the management of D. A. Lyon, an electric furnace somewhat on the lines of an iron blast-furnace. The bottom of the shaft rested on a circular crucible through which the electrodes penerated.

The art of making large sized electrodes was not developed at that time and delays due to electrode breakages as well as the fact that the furnace proved to be best adapted for making only low-grade foundry and white iron, for which the market was limited, caused the furnace to be shut down in the spring of 1911.

Following this, under the direction of S. T. Wellman, an attempt was made to develop on a commercial scale the scheme often previously proposed of separating smelting operations into two divisions, namely, to reduce the ore to the state of sponge iron in a set of small portable electric furnaces—and to smelt, siliconize, and refine this sponge iron in a separate melting furnace. Mechanical difficulties and inability to control the metallurgy of the process soon indicated that this method of operation was not efficient.

General Description of Our Present Furnaces

After this R. E. Frickey, and others, having in mind the causes which made the previous furnaces unsatisfactory, set out to design a furnace which would overcome these objections: that is, to make a furnace which could be built in large enough units to be efficient and which would admit at the same time of simple and rapid electrical and metallurgical control.

The long-and-narrow type of furnace was decided on, and in the fall of 1911 a furnace was built on these lines. This is the type which we are now operating and which we have decided is best adapted to our needs.

It consists of a rectangular steel shell 25 ft. long, 10 ft. wide, and 8 ft. high, battered four ways at the bottom to form a crucible. The portion above the batter corresponds to the bosh or smelting zone of the blast-furnace. The shell, which is lined with standard furnace brick, supports five charging stacks, 18 ft. high, and between these are suspended four electrodes which penetrate vertically into the charge. The furnace bottom is slanted from both ends to the middle where the metal notch is placed. On each side and a little above the metal notch is a slag notch, through which the slag is flushed at intervals.

The electrodes used are made of Acheson graphite and are 12 in. diameter and 48 in. long. They are machined on the ends with a screw thread so that

*Abstract of an address read before the Mining Congress of Northern California and Southern Oregon, and printed in *Mines and Industries*.

new electrodes may be easily fitted on as needed with little loss of time.

The first furnace of this type which was built had a transformer capacity which permitted carrying an average power load of 2000 kw. It operates with a production of 20 tons of iron per 24 hours on the above stated load. This furnace had been used with few interruptions, and last fall it was decided that it gave promise of commercial success, and construction of a companion furnace was commenced. The second furnace was designed somewhat larger than the first one and its transformer capacity was increased to permit of an average load of 3000 kw. being carried. This latter furnace has only been in operation for a month, but it indicates an average daily production of 25 to 30 tons when operating under full load.

The furnaces have not yet been brought to the highest possible state of technical and economic efficiency by any means, but there has been made certain and steady progress and I feel justified in stating that we are further ahead today than any plant in the world for the production of soft foundry irons in the electric furnace.

Pioneer work, if it results in permanent success, always proceeds slowly, for unlike most of the other industries, there are no established precedents by which to be guided.

Influence of Local Conditions

Further, local conditions must be considered in determining the proper angle from which a problem is to be studied; that is, the commercial, as well as the technical viewpoint must be taken into consideration. To illustrate, the gases produced from the reduction of iron by carbon contains a large amount of carbon monoxide. This carbon monoxide has a calorific value of 4320 B.t.u. per pound; that is, when its temperature is raised to the kindling point in the presence of oxygen, an exothermic reaction takes place, the carbon monoxide combines with more oxygen to form carbon dioxide, and heat is produced. But carbon monoxide at a temperature of about 800°C. will also react with the oxygen in iron ore to reduce it to the state of sponge iron. Thus it is apparent that there are several ways of utilizing furnace gases: (1) After being scrubbed and cooled they may be blown back into the furnace and the reducing value of the carbon monoxide utilized to cut down the amount of charcoal which is fed into the furnace. For this to be advantageous, one must consider height and temperature of the column of charge in the stack and mechanical difficulties in scrubbing and returning the gases. (2) They may be burned in an ordinary gas burner and blown back into the furnace so that their calorific value may be utilized to cut down the electric power consumption of the furnace. In this connection, one must not only consider the difficulty of scrubbing and returning the gases, but also methods for producing complete combustion at the end of the gas-burner without permitting additional oxygen to be drawn into the furnace, which would consume charcoal and electrodes. (3) The gases may be burned under boilers or in gas engines to furnish power for operating machinery, as is customary in blast-furnace practice. (4) The heat value of the gases may be utilized for making some outside product, as, for instance, burning lime, agglomerating iron concentrates, burning charcoal, etc. Thus it is apparent that before preparing to utilize furnace gases the way in which they are going to give the greatest economic efficiency as well as the attendant mechanical difficulty must be carefully considered. These same remarks hold true for the many other problems which come up.

Electrical Equipment

The Northern California Power Company, Consolidated, delivers three-phase current at 60,000 volts into our substation, which is equipped throughout with thoroughly modern apparatus.

The battery of lowering transformers consists of six Westinghouse oil-immersed and water-cooled single-phase transformers of 1500 kva. capacity each. They are wound for a voltage ratio of 38100-2200 volts and are Y-connected on the high-tension side.

The 2000-kw. furnace is served by a battery of four and the 3000-kw. furnace by a battery of six 750-kva. transformers, which are set close up to the furnaces and furnish three-phase current at 40 to 80 volts. This large transformer capacity was installed to take care of any erratic furnace conditions which might arise and result temporarily in very poor power factors. These transformers are specially designed G. E., type W. C., 60-cycle, oil-immersed, and water-cooled, and capable of standing an overload of 25 per cent.

On the 2200-volt primary side of the transformer, eight current taps are brought out for voltage regulation. These are led to individual solenoid-operated contactor panels connected with the switchboard so as to permit of regulating the voltage by means of hand-wheels in 15 steps from 40 to 80 volts.

The transformers are delta-connected to the four electrodes on the low-tension side by means of eight pieces of heavy copper busbar from each transformer. The busbars are connected to a water-cooled cast copper electrode holder which is designed on the principle of a stuffing box, so that an electrode may be raised or lowered without breaking contact or throwing off the furnace load. Electric control is through a switchboard on which are mounted in rows of three a separate set of meters for each phase. For operating the contactor panels there is a 7½-kw. motor-generator set.

From an electrical standpoint the furnace has been so well designed and equipped that it admits of very simple and perfect control. It may be said to be fool-proof, so that skilled electricians are not required as operators. The readings of the instruments, which are recorded hourly, often show little variation throughout the 24 hours. Under normal conditions the power factors will average, respectively, 90, 85, and 70, though they gradually drop off a few points as iron accumulates in the furnace crucible and straighten up again after it is tapped.

Metallurgy

One is so frequently asked, even by semi-technical

men, to explain the reactions which take place in the electric furnace, that it may not be amiss to say that the metallurgy of the electric furnace for smelting iron ore is practically the same as that of the iron blast-furnace, though because the source of heat is concentrated to a greater extent at the bosh of the electric furnace, the reduction of ore by the carbon monoxide does not extend to so great a distance up the stack. The heat necessary to bring about the reducing reactions, which is supplied in the blast-furnace by burning an excess of coke with a blast of air, is supplied in the electric furnace, either by the resistance offered to the passage of a current of high density and low voltage through the charge, in which case the electrode is deeply imbedded in the latter, or by having the end of the electrode penetrate only a short distance, which sets up an arc between the end of the electrode and the charge. The former method is used at Heroult, as it admits of a deeper crucible and gives less trouble with melting out of the furnace roof.

Method of Operation

Stock crushed to the proper size is charged into the five stacks on the basis of a 500-lb. unit of iron ore. The proper amount of charcoal, depending on the grade of iron which is to be produced, together with the necessary barren quartz and limestone fluxes, is charged simultaneously with the ore so that the whole is well mixed by the time it has reached the smelting zone. This is a very important precaution in a furnace of the long and narrow type, where there is little opportunity for reduction of the ore by gases going up the stack. Because of the relatively short stacks, the gases have a high ratio of carbon monoxide to carbon dioxide, which is not economical smelting from the point of fuel consumption, but since in this case the stack gases will be used for burning lime, commercially the extra fuel cost will be somewhat more than balanced.

The furnace is tapped usually three times a day and the iron run into sand-pig beds. When it has cooled so that it will not bleed, the sow with its attendant pigs is lifted from each bed by grab-hooks carried on a traveling crane. The iron is broken by a drop, lifted by a magnet and transferred to the platform scales, where it is weighed. From here it is stacked according to grade. The iron is graded altogether by silicon content, as the sulphur and phosphorus are universally very low. For economic reasons the practice is confined to making the four foundry grades.

Grade of Iron

As compared with other charcoal irons, the iron produced is tougher, finer grained, and has a more homogeneous fracture. Since its manganese content is quite low, the reason for its toughness is not altogether understood.

Iron made at Heroult has been used for making almost every article which comes within the province of the foundryman, and likewise for making steel both by the open-hearth and converter processes, and where it has been intelligently used with due regard to its composition it has met a favorable reception.

Analyses taken at random from recent shipments will indicate the composition of the different grades of foundry iron which are produced and will illustrate how uniformly low the sulphur and phosphorus content is; analyses being for carload lots:

Grade No. 1, Foundry, High

Si	2.88
Graphitic carbon	2.86
Combined carbon	0.25
Total carbon	3.11
S	0.035
P	0.031
Mn	0.16

Grade No. 3, Foundry, High

Si	1.87
G.C.	2.50
C.C.	1.00
T.C.	3.50
S	0.040
P	0.041
Mn	0.19

Grade No. 1, Foundry, Low

Si	2.61
G.C.	2.12
C.C.	0.98
T.C.	3.10
S	0.046
P	0.034
Mn	0.26

Grade No. 4, Foundry, Low

Si	1.01
G.C.	2.26
C.C.	1.10
T.C.	3.36
S	0.031
P	0.038
Mn	0.11

Furnace Efficiency and Conclusion

While the power and fuel consumption are somewhat higher in the long and narrow type of furnace than in the shaft type, such as, for instance, is being operated in Sweden, the long and narrow type has the very signal advantage that it admits of rapid and certain metallurgical control. The reason for this is at once apparent when we consider that any alteration in the furnace burden is distributed over five stacks. This fact is very important if a furnace is to produce consistently gray iron of silicon content sufficiently high for foundry purposes, and the difference in price which can be obtained for soft foundry irons will generally more than counterbalance the difference in efficiency between the two types of furnaces. Furthermore, the long and narrow type admits the possibility of a very much longer furnace than either of the two thus far built, and in which more electrodes could be suspended, thereby increasing the total furnace efficiency.

There is no doubt that electric furnaces for smelting iron ore of both the shaft and the long and narrow type are now permanently established and will occupy a field where there is no blast-furnace competition. In my opinion, the future will show the shaft type to be used almost entirely for making low silicon foundry iron and white iron to be made into steel by the open-hearth process while the long and narrow and similar types will produce the softer grades of iron for general foundry use and for making steel by the converter process.

Production of Secondary Metals in 1912

The value of the 'secondary metals,' exclusive of gold, silver, platinum, iron, and aluminum, recovered in 1912 reached the enormous total of $77,395,843, compared with $52,585,390 in 1911, according to J. P. Dunlop, of the United States Geological Survey, an increase of nearly $25,000,000.

Value of Secondary Metals

The values given for the secondary metals are arbitrary and are based on the approximate average value of the primary metal for the year. After remelting or refining, the metals are sold at only slightly lower prices than new metal. These secondary metals displace an equivalent quantity of primary metals and must be considered in any estimate of stocks available for consumption in any year. For a few special purposes requiring especial purity of material, it is necessary to employ primary or virgin pig metal, but as a general rule secondary metals can be used in whole or in part. In fact, most foundries, in order to compete for business successfully, must use secondary material at least in part, and hence scrap metal is purchased by them and remelted with primary pig metal or with composition ingot. The secondary smelters, by handling large quantities of all kinds of scrap, are able to classify their material so as to produce continuously alloy metals of uniform composition suitable for use in work of different classes. Such composition ingots are being purchased and used in increasing quantities by many foundries and other manufacturers in place of primary metals or mixtures of new and scrap metals.

There was a notable increase in the use of magnetic separators to obtain scrap free from iron filings, and at some plants concentrating tables were introduced by means of which cinders and molding sand from brass foundries containing as little as 2% of metal were treated successfully. The general tendency is to save all waste metal of every kind and obtain more for it by better grading and classification. Copper wire and heavy copper and brass scrap are kept separate from light copper and brass, and small scrap is briquetted to reduce the loss in remelting. It is impracticable to segregate the refining, remelting, and re-use of secondary metals according to states, but over 90% of the refining and smelting of drosses and scrap metals in the United States is confined to the territory east of St. Louis and north of the Ohio river.

The total amount of secondary copper recovered, on the assumption that the brass remelted had an average copper content of 70%, was 137,507 tons, of which 14,541 tons was recovered by plants refining primary metals and the remainder by plants treating only secondary materials. At least 37,500 tons was recovered from clean scrap made in the course of manufacture of copper and brass ware, so that only about 107,000 tons was obtained from ashes, cinders, and scrap, or from material that had actually been used and discarded. The production of copper from secondary sources in 1912 was equal to 17.5% of the smelter output of primary copper in the United States from all sources, or 22.3% of the primary copper smelted from domestic ores.

Secondary Lead

The secondary lead recovered amounted to 67,168 tons, or about 13,000 tons more than in 1910. The secondary lead recovered as pig lead increased about 3000 tons, a normal increase in view of the fact that the average lead price was the same in 1911 and 1912. The recovery of lead in alloys was very large, increasing over 10,000 tons compared with 1911. This abnormal increase was mainly the result of the prevailing high prices for the other metals in the alloys and of the expansion in manufacturing and in transportation, which occasioned a more extensive use of remelted babbitt and bearing metals. The total output of secondary lead was equal to 13.3% of the refined lead produced in the United States in 1912, compared with 11.1% in 1911, or to 16.7% of the refined lead produced from domestic ores in 1912. The zinc recovered in alloys other than brass amounted to 3912 tons. Of the 52,251 tons of secondary zinc recovered as spelter, 26,064 tons was obtained by redistillation.

Secondary Antimony

The production of secondary antimony, of which all but 13 tons was recovered in alloys, increased from 2369 short tons in 1911 to 2506 tons in 1912. No antimony ores of domestic origin were smelted in 1912, but the total for the year includes 135 tons of antimony contained in antimonial lead scrap recovered by regular smelters. The 1912 imports of antimony as metal, in ore, or oxide amounted to 8685 tons, and the recovery from secondary sources was equal to 29% of such imports.

There were no domestic tin ores smelted in the United States in 1912, though some tin concentrates were shipped from Alaska to Great Britain for treatment, and a small quantity of foreign tin ore was smelted in New York. This condition makes secondary tin an important factor in supplying domestic consumption. The secondary tin recovered in 1912 was equal to 26.6% of the tin, as metal or as oxide imported into the United States during the year. Secondary tin recoveries increased from 14,706 short tons, valued at $12,353,040, in 1911, to 15,401 tons, valued at $14,301,368, in 1912.

PRODUCTION OF SECONDARY METALS

Metal.	Short tons.	Value.
Secondary copper, including that in alloys other than brass	66,441	$21,593,325
Remelted brass	101,523	27,279,516
Secondary lead	30,266	6,045,120
Recovered lead in alloys	36,902	
Secondary spelter	52,251	7,750,494
Recovered zinc in alloys other than brass	3,912	
Secondary tin	8,333	14,301,368
Recovered tin in alloys	7,068	
Secondary antimony	13	426,020
Recovered antimony in alloys	2,493	
Total value		$77,395,843

A Large Gas-Pump Installation

The water supply of the City of London was recently enlarged by the construction of the Chingford reservoir of 3,000,000,000-imperial gallon capacity, which impounds water from the River Lee, and the installation of four Humphrey gas-pumps, which have a capacity of 33,600 U. S. gallons each per minute, and one with a capacity of 16,800 gal. per minute, against a head of 25 ft. This makes the supply 180,000,000 gal. per day. The Metropolitan Water Board was dissatisfied with the performance of several makes of pumps, so called for bids. The tenders, when opened, showed that the plant proposed by H. A. Humphrey would, inclusive of gas-plant, buildings, and foundations, cost $91,000 less

DISCHARGE AT THE CHINGFORD RESERVOIR PUMPING STATION.

than the lowest tender for triple-expansion, steam-engine, centrifugal pumping-plant. There was moreover an enormous difference in the guaranteed fuel cost. The fuel consumption of the Humphrey pump was guaranteed not to exceed 1.1 lb. of anthracite per actual pump-horse-power hour, a penalty of $4800 being attached to every 0.1-lb. consumption in excess of this figure. Anthracite is, of course, an expensive fuel, but even so, it was estimated that the fuel for the steam plant would, in practice cost from two to three times as much as that for the Humphrey pumps, and the makers believe there is little doubt that the guarantee for these will be substantially bettered on trial. Another clause in the contract imposed a penalty of $96,000 should the plant prove a failure. It was a somewhat bold step to accept a contract under such heavy penalties for pumps 7 ft. in diam., and developing each between 200 and 300 hp., on the basis of an experimental pump with an output equivalent to about 35 hp. only; but the results have undoubtedly thoroughly justified Mr. Humphrey's confidence in the capabilities of his remarkable contribution to the progress of mechanical engineering.

As the Humphrey pump is still relatively new, it may be a convenience to many readers if a short description of its mode of operation is given before describing in more detail pumps supplied to Chingford.

Fig. 1 represents a diagrammatic view of the Humphrey pump in its simplest form. It consists merely of a bent pipe terminating at one end in the delivery-tank, and at the other in a combustion chamber, in which the charge of gas and air is exploded over the surface of the water. When such a charge has been fired, the pressure above the water surface sets the whole column of water in motion, the hot gases expanding above it. Once the column of water is set in motion, its inertia carries it forward, so that the pressure of the gases in the combustion chamber ultimately falls below that of the atmosphere, and as a result the exhaust-valve E opens under its own weight. The forward motion of the water continuing, the level in C finally falls below that of the water in the supply-tanks S T, and fresh water then enters through the valves V. Finally, the momentum being exhausted, the water begins to flow back along the play-pipe D, and rising in the chamber C, closes the valve E by impact, trapping above this level a cushion of the spent gases mixed with a large proportion of air which was drawn in through a scavenger-valve, not shown in the figure, during the forward motion of the water. This cushion of air is compressed into the head of the chamber by the continued return of the water-column, the latter being thus finally brought to rest, in which condition the pressure of the cushion is much above that due to the static head. As a consequence the water-column begins a second forward oscillation, in the course of which the pressure in the cushion space falls again below that of the atmosphere. By means of interlocking gear, the exhaust valve E, and the scavenger valve, are now prevented from opening, but the valve shown at A being simultaneously unlocked, a charge of gas and air enters the chamber.

When the forward momentum of the water-column has been exhausted a second time, a return flow takes place, which compresses the new

charge and fires it automatically at the proper time, thus starting a fresh cycle of operations. This working cycle, it will be seen, involves, in the first place, a long out-stroke, during which the exploded charge is expanded down to and below the atmosphere, the in-drawing of scavenging air, and the entrance into

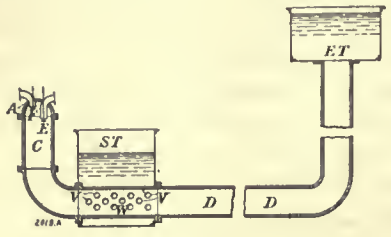


FIG. 1.

the pump of a fresh supply of water. This is followed by a return stroke, during which the spent gases are driven out through the exhaust valve, exhaust valve closes, and compression of the cushion takes place; and it will be seen that the maximum pressure attained on this return stroke is in this case higher than the explosion pressure. From *G* to *H* the cushion expands, and at *H* the air-valve opens, closing again at *J* on the return of the water-column to compress the new charge, *J* being the point at which a fresh cycle of operations is started.

In principle the pumps erected at Chingford differ in no respect from the form illustrated in Fig. 1, but in place of single large valves for admitting, for scavenging, and for exhausting the charge, a number of smaller valves are used. The general view, Fig. 2, shows in elevation one of the 40,000,000-gal. per diem units. Of these there are four, having pump cylinders 7 ft. in diameter, while the fifth pump, rated at 20,000,000 gal. per day, has a barrel 5 ft. in diameter. Each pump consists of a east-

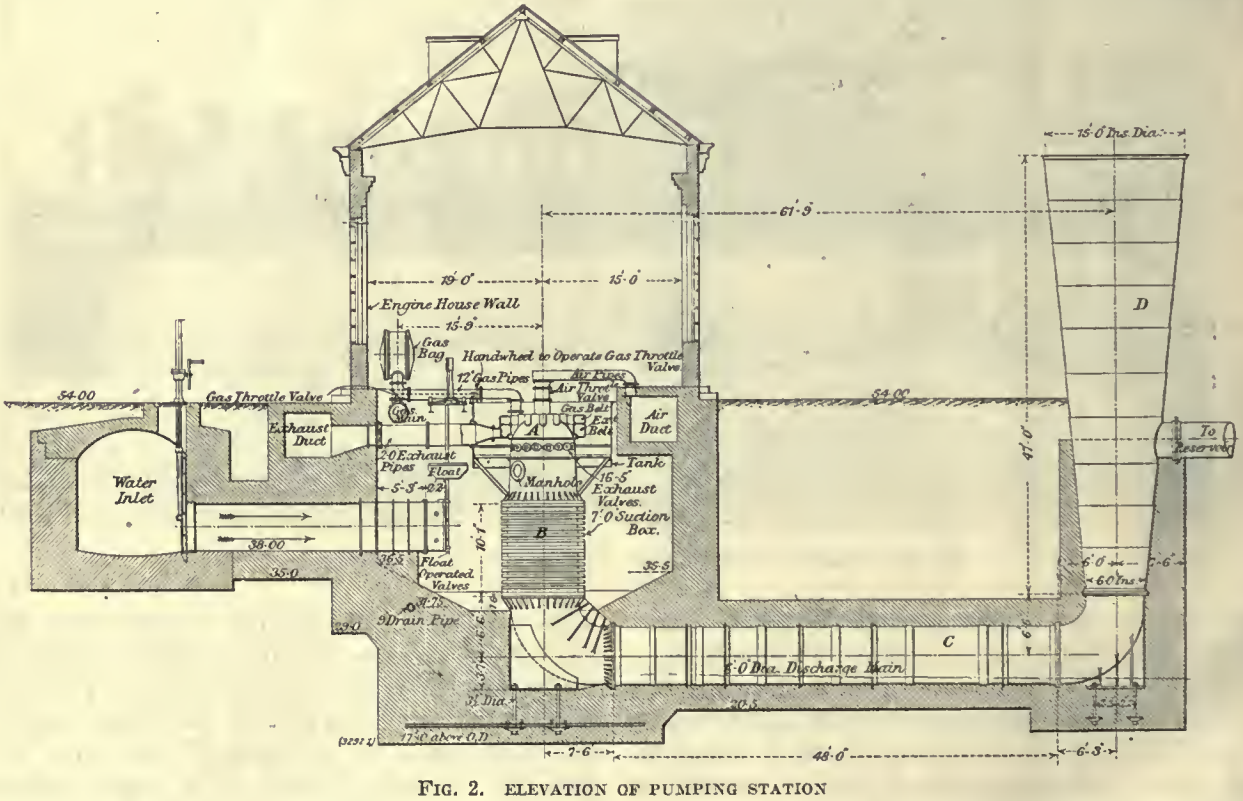


FIG. 2. ELEVATION OF PUMPING STATION

after which the latter is closed, and a cushion compressed in the head of the pump-chamber. Next comes a short out-stroke, during which a fresh charge of air and gas enters the pump, while a return stroke, compressing and finally firing this charge, completes the cycle. The pump has the thermodynamic advantage that the charge is expanded down to atmosphere, thus utilizing the so-called 'toe of the diagram,' which is lost in the case of the ordinary gas-engine, in which the charge, before being exhausted, is only expanded down to about 45-lb. absolute, or so. An indicator driven by clockwork at a uniform rate, if fitted to the pump, gives a diagram of the type shown in Fig. 3. Here, from *A* to *B*, the charge is compressed, being fired at *B*, which causes the pressure to rise to *C*; from *C* to *D* the gases expand doing work. The exhaust valve opens at *D*, and from *D* to *F* the pressure in the pump-chamber remains atmospheric. At *F*, the steel head *A*, into which the explosive charge is compressed and fired, and a water-suction valve box *B*, from which a play-pipe *C* leads to the base of a

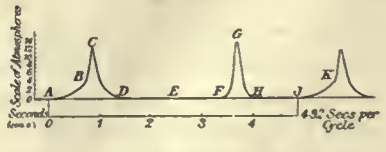


FIG. 3.

water-tower *D*, built up of riveted plates. From each of these towers, a 4-ft. pipe leads over the top of the reservoir embankment, and discharges into the uppermost of a series of water-cushions extending to the bottom of the reservoir. The supply of water is led along the back of the pump-house through a conduit formed in the concrete, as clearly shown in Fig. 2. From this, a cast-iron pipe, embedded in concrete, is led into each of the five pump-

pits. Sluice-valves are provided, as indicated in Fig. 2, by which each pit can be shut off when desired. A working platform is fixed around the pump-head as indicated, giving access to the valves and other operating gear. The play-pipe *C*, is, it will be seen, also embedded in concrete into which, moreover, it is keyed by its flanges. The air-duct for the supply of the pumps is arranged below the floor-level on the right of the building, as shown in Fig. 3, and the exhaust-duct by which the spent gases are passed into the atmosphere on the left. Owing to these gases being exhausted at atmospheric pressure, the pump works practically without noise, and the smooth working, absence of shock, and freedom from vibration, are truly remarkable.

Fuel

The bend which connects the bottom of the suction-box to the play-pipe is a steel casting of unusually large dimensions, and its bore tapers from 7 to 6 ft. It serves to anchor the pump-chamber securely to the foundation against the up-lift, due to the fact that the full pressure of each explosion does not reach to the bottom of the bend, a part being absorbed in the mass acceleration of the intervening fluid. The fuel required for operating the pumps is supplied from a Dowson gas plant. This consists of four producers, one of which is rated to convert into gas 138 lb. of anthracite per hour, and the other three, 370 lb. each. A cooling-pipe leads from the top of each producer to a corresponding coke-scrubber. The steam required is supplied by three vertical boilers. One boiler is a stand-by. In all, seven coke-scrubbers are provided, there being two arranged in series for each of the larger producers, while one scrubber only is fitted for the smaller plant. After passing the coke-scrubber the gas is sent through a sawdust scrubber, of which one is provided for each producer, and it is then led through an underground conduit to a gas-holder, 24 ft. in diameter and 12 ft. high. A governing-gear is fitted, by which the rise of the gas-holder regulates automatically the rate at which steam is admitted to the producers, thus keeping the rate of production of gas the same as the rate of consumption.

The simplicity, ingenuity, and high economy of the Humphrey pump excited the greatest interest among engineers on its first introduction, and all will join heartily in congratulating its originator, and those associated with him, on the now assured success of the first large commercial adaptation of the system. The pumps now working were constructed from the designs of the Pump & Power Co., Ltd., by Siemens Brothers Dynamo Works., Ltd., Stafford, England, the former being represented in the United States by the Humphrey Gas Pump Co., Syracuse, which kindly supplied these notes and illustrations.

Operating revenues of the railways for April were $237,362,424, an increase over those of April of last year of $22,893,968 in the aggregate, or 9.7% per mile. This was reduced by an advance in operating expenses of 12.3% per mile.

Mine Tailing Valuable

Millions of tons of 'chats' or mine tailing is produced annually in the Flat River and Joplin lead and zinc districts. According to statistics collected by the Missouri Geological Survey, more than 2,700,000 tons have been utilized during the past year in the building of good roads, in concrete construction, and as railroad ballast. The material, as obtained from the mills, is in ideal condition for these purposes, the principal cost to the consumer being that of transportation. The mining companies sell the chats at $1 per car, or less than 10c. per ton. The following table indicates the number of tons used for commercial and railroad purposes in 1911 and 1912:

	1911.	1912.
Southeast Missouri		
Commercial	273,544	258,623
Railroad	214,270	462,498
Total	487,814	721,121
Southwest Missouri		
Commercial	365,048	553,075
Railroad	650,741	1,449,207
Total	1,015,789	2,002,282
Total for state	1,503,603	2,723,403

The total tonnage used in 1912 shows an increase of more than 80% over 1911. Although the production of tailing is approximately equal in southeast and southwest Missouri, only about 25% of the tonnage utilized is obtained from the southeast mines. Missouri today makes use of a greater tonnage of chats than any other state.

The Ridgway Filter

The reciprocating type of this filter is gaining in popularity in Western Australia, and at present there are three each at the Bullfinch and Victorious mines, one at the Boulder No. 1, one at the Associated Northern, and two at the Great Boulder. The three first-mentioned mines produce a kaolin ore with low percentage of silica, treated raw, while the other two are the regular Kalgoorlie ores, which are roasted. The capacity on the former is 100, and on the latter 300 tons per day. The following is a description of a filter at the Boulder mill. Two rectangular tanks, 11 by 6 by 5 ft. deep, placed 7 ft. apart; one 8-ft. shaft situated at the centre of the tanks and considerably above them and carrying two strong arms, and two worm-wheels 8 ft. in diameter. From the arms on one side is suspended a cast-iron beam pipe, designed to accommodate 20 filter-frames 4 by 5 ft., attached with the necessary pipes and fittings to a vacuum-pump and air pipes; and on the other side are fitted heavy balance weights to equalize the load. The worm-wheels are connected to a driving-shaft by means of worms and bevel gear. The driving shaft has two drives, one forward and the other backward, the speed of which can be made to suit local conditions. Under the main 8-in. shaft carrying the frames is an iron chute, and on one side is placed a mixer 8 ft. in diameter and

7 ft. deep. The operations are carried out as follows: The pulp tank being filled to a certain mark, the forward drive runs the frame into the pulp, the vacuum and slime valves opening automatically as the frame enters the pulp. The vacuum rises steadily to about 20 in., and on roasted sulphide ore a charge of three tons is taken on in four to five minutes. The man in charge then sets the machine going on the fast gear to the wash-tank, the operation occupying one minute. It is this rapid means of transferring the cake into the wash solution that gives to the Ridgway filter its wide scope of usefulness, as it is practically impossible to hold a heavy roasted sulphide cake on for more than 60 seconds without the appearance of cracks, so detrimental to the thorough washing of any cake. After washing for 8 minutes, the machine is set in motion in the direction of the pulp tank, and takes 2 minutes. When the frames are directly over the centre of the shaft and have had sufficient time to dry to 30% moisture, the vacuum valve is closed, and the air-valve opened automatically. The 3-ton cake falls into the chute and is washed by a stream of water to the discharge mixer, and thence to the tailing dump by means of a 7 by 12-in. duplex plunger pump. Costs are from 8 to 16c. per ton.

Rochester Mining District, Nevada

The United States Geological Survey, through F. C. Schrader, geologist, has just made an examination of Rochester, the new and promising mining district in Humboldt county, Nevada, which for the last five or six months has been attracting much attention. The ores are chiefly silver bearing, but also carry gold, which in some of the ore amounts to 50% of the value. They were apparently deposited by hydro-thermal solutions.

Nenzel Hill Deposits

The find in Nenzel hill was made late in November 1912, and the shipment of a couple of carloads of high-grade ore by Joe Nenzel, Frank Schick, and Walt Moynaugh about Christmas started the Rochester boom. In less than a month the hitherto desolate canyon had a reported population of 3000 and contained many substantial two-story frame buildings. Leases on blocks 300 by 600 ft. in area were taken and operated by experienced mining men, with the result that to date the development of the mines and the showing of ore are remarkable. Six or eight leases are opened to a depth of 130 ft. by cross-cut adits from 100 to 300 ft. in length. About 2000 tons of ore averaging $30 per ton has been mined and shipped, and it is said that 100,000 tons of ore in sight. Nearly a score of properties are producing.

The Rochester district lies mainly on the eastern slope of the Humboldt mountains, between 4000 and 8400 ft. in elevation, in a north-south area about 6 miles long by 5 miles wide, on which the Survey will later probably publish a report accompanied by a geologic and topographic map.

The district is easy of access, being 10 miles east of Nixon, formerly Oreana, the nearest station and ore-shipping point on the main line of the Southern Pacific railroad, and 25 miles northeast of Lovelock. With both of these places it has daily freight, express, passenger, and mail auto service and telephone connections. The country is mountainous, but not rugged. The ravines are open, and most of them are passable for team and wagon.

Nenzel Hill Development

Nenzel hill, in which lie the orebodies from which the present production is chiefly derived, is situated in the eastern portion of the district and forms a part of the crest of the range between the head of Rochester canyon on the west and South American canyon on the east. It is a north-northeastward-trending oval part of the ridge, about 3000 ft. long by 2000 ft. wide, and rises to 7300 ft. in elevation, or about 500 ft. above the adjoining portions of the divide. In Nenzel hill the veins, ten or more in number, vary from 100 to 3700 ft. in length and some apparently have a vertical range of at least 400 ft. The west vein or lode, now being worked chiefly on the Codd lease and the Platt lease, is about 32 ft. in width and contains two veins, 7 to 8 ft. wide, of good ore composed chiefly of alternating layers of quartz and silicified rhyolite. The workings on these veins have been entirely in ore.

Lincoln hill, which also contains producing properties and received much attention last winter, is a prominent landmark in the western part of the district 2½ miles distant from Nenzel hill, on the north side of Rochester canyon, above which it rises 1200 ft., or to 6600 ft. above the sea.

Packard hill, the seat of the new 'find,' is in the southern part of the district, at an elevation of about 5800 ft. in the lower part of a broad ridge, and on the trend of the Nenzel hill zone of mineralization.

Ore Deposits

The ore deposits of the district are chiefly quartz replacement veins in fissures and shear zones in rhyolite and rhyolitic rocks which are of great thickness. The rocks vary from felsitic to coarsely prophyritic. They are more or less silicified, devitrified, and sericitized, and were referred by geologists of the Fortieth Parallel Survey to the Triassic period. The rocks dip about 35°E., but the veins dip 60°W. and are approximately conformable with the dominant sheeting and shear structure of the country rock.

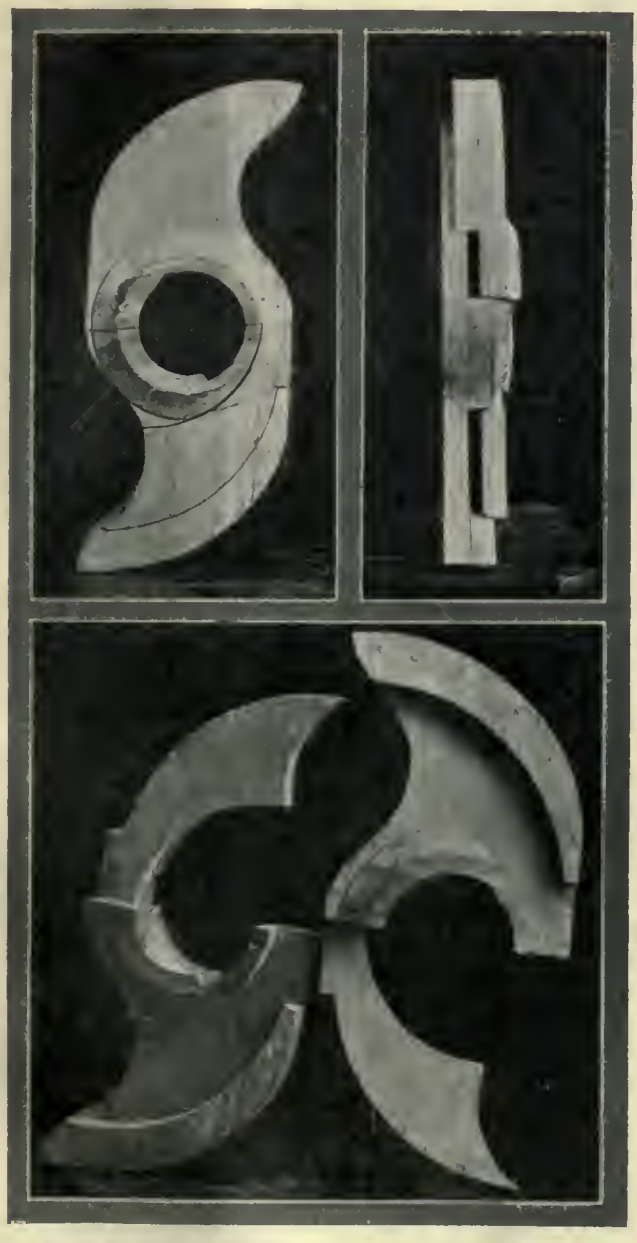
The principal camp is East Rochester, with a population of 700, situated at an elevation of 6200 ft. in the head of Rochester canyon, at the foot of Nenzel hill, where about 200 miners are at work. Rochester or 'lower town,' 2 miles down the canyon at the foot of Lincoln hill, has a population of 250, and Packard, the newest settlement, but a few weeks old, at the south base of Packard hill, has a population of about 100, which is daily increasing. Panama, on the northeast near Spring Valley pass, in the head of Limerick canyon, has about a score of people.

The geology of Rochester, Nevada, was described by J. Claude Jones in the *Mining and Scientific Press*, May 17.

The Berrill Cam

By M. W. von Bernewitz

The present battery cam has been developed after numerous trials with various types during many years. Among those types that will be remembered are the plain long-armed cam; split type; Spiers' dove-tailed; the bed-post cam, in which the arms fit into the boss similarly to the angle-iron of a bed; and the ordinary keyed style, which is still used in many mills. The first five cams were keyed to the shaft. Later came the Blanton patent, which most millmen consider to be the last word in cam design. Then followed the improved Blanton, the cam-shaft of which looks, in section, like a circular saw, this cam wedging in ten places instead of one, as in the original. Following this type came the African cam, designed by Hans C. Behr. This cam raises the stamp slowly, the lifting being accelerated toward the end of the arm. A design for a sectional cam, to allow of easy removal from the shaft without disturbing the others, has often been attempted, and about the most ingenious I have seen is the Berrill patent divided or split type. As a cam is a difficult piece of apparatus to describe, and this one in particular, the illustrations will help to explain its construction. The Berrill cam is made in two parts or sections which, when fitted together, form a complete cam. As is seen in the illustration, there is an opening in both parts of the cam, which allows it to be fitted on the shaft, or removed at will. A Blanton key is used for holding the cam fast on the shaft, and a copper rivet is driven through the two sections, near the centre of the blades, and riveted up. This is simply to keep them from chattering. As the weight of the stamp comes on the cam, the scarfed parts are jambed together, and being a good fit, and also held by the rivets, there is no movement of the two parts, and a rigid cam is formed. The opening in each section is made ⅛ in. larger than the shaft to be used; and when fitting the parts together, there is plenty of room between any two stamps to tighten them.



SHOWING WOODEN MODEL OF CAM. (1) COMPLETE CAM; (2) FITTING CAM TOGETHER; (3) CAM IN HALVES, SHOWING CONSTRUCTION.

Advantage of This Type

The advantages of this cam might be stated as (1) it is unnecessary to remove other cams to replace a broken one; (2) if one part of the cam is broken or chipped, it may be discarded and replaced by a new one; (3) in replacing a broken cam-shaft, the new shaft can be put in place, and the cams fitted afterward; and (4) a saving in time.

On the whole, there are not many cams broken in a battery, yet the Berrill device has points to commend its use. The Ivanhoe mill of 100 stamps breaks 19 cams yearly; Alaska Treadwell mill of 540 stamps breaks 42 yearly; and Homestake cams last from two years up.

A cam as described, was made in Melbourne at a cost practically the same as for the ordinary cam. This cam worked for two weeks at the Hannan's Central mill, at Kalgoorlie, lifting an 1100-lb. stamp 105 times per minute; and in the Horse-Shoe mill a similar time, lifting a 1250-lb. stamp 112 times per minute. The mill managers at both places were satisfied with its behavior. It was designed by N. H. Berrill, of Kalgoorlie, Western Australia.

Costs at the Tom Reed Mine

This property is situated 28 miles from the railroad in Mohave county, Arizona, and all freight costs $11.50 per ton delivered at the mine. During the year ended April 1, 1913, the mill treated 43,478 tons of ore and 12,185 tons of tailing. Costs were as follows: Mining, $3.80 per ton; milling, $1.20; cyaniding, $1.33; and marketing, 13c.; making a total of $6.46 per ton. The total indirect cost, depreciation, amounted to $1.25 per ton. Power costs were about $1.25 per ton, this being supplied by the Desert Power & Water Company.

Preliminary metallurgical work at Rhodesian mines has not always been well studied, and there is now a tendency to install 5-stamp experimental plants for this purpose.

Permissible Explosives

By Clarence Hall

*An explosive is called a permissible explosive when it is similar in all respects to the sample that passed certain tests by the United States Bureau of Mines, and when it is used in accordance with the conditions prescribed by this Bureau. But even the explosives that have passed those tests, and are named in this list as permissible explosives, are to be considered as permissible explosives only when used under the following conditions:

(1) That the explosive is in all respects similar to the sample submitted by the manufacturer for test; (2) that detonators, preferably electric detonators, are used of not less efficiency than those prescribed, namely, those consisting by weight of 90 parts of mercury fulminate and 10 parts of potassium chlorate or their equivalents; (3) that the explosive, if frozen, shall be thoroughly thawed in a safe and suitable manner before use; (4) that the quantity used for a shot does not exceed 1½ lb., 680 gm., and that it is properly tamped with clay or other non-combustible stemming.

It must not be supposed that an explosive that has once passed the required tests and has been published in lists of permissible explosives, is always thereafter to be considered a permissible explosive, regardless of its condition or the way in which it is used. Thus, for example, an explosive named in the permissible list, if kept in a moist place until it undergoes a change in character, is no longer to be considered a permissible explosive. If used in a frozen or partly frozen condition, it is not, when so used, a permissible explosive. If used in excess of the quantity specified (1½ lb.), it is not, when so used, a permissible explosive. And when the other conditions have been met, it is not a permissible explosive if fired with a detonator of less efficiency than that prescribed. Moreover, even when all the prescribed conditions have been met, no permissible explosive should necessarily be considered as *permanently* being a permissible explosive, but any permissible explosive when used under the prescribed conditions may properly continue to be considered a permissible explosive until notice of its withdrawal or removal from the list has been officially published, or until its name is omitted from a later list published by the Bureau of Mines. Furthermore, the manufacturers of a permissible explosive may withdraw it at any time when introducing a new explosive of superior qualities.

In a table given in the bulletin, the explosives are arranged in four classes, and the rate of detonation of 1½ by 8-in. cartridges of each explosive is given. The following is a summary of 97 permissible explosives: (1) ammonium nitrate, 43 makes, 4750 to 13,990 ft. per second; (2) hydrated, 9 makes, 8140 to 13,940 ft. per second; (3) organic nitrate, other than nitroglycerin, 3 makes, 9420 to 10,590 ft. per second; and (4) nitroglycerin, 42 makes, 7340 to 14,560 ft. per second.

*Abstract from Bureau of Mines Technical Paper 52.

Discussion

Readers of the Mining and Scientific Press are invited to use this department for the discussion of technical and other matters pertaining to mining and metallurgy. The Editor welcomes the expression of views contrary to his own, believing that careful criticism is more valuable than casual compliment. Insertion of any contribution is determined by its probable interest to the readers of this journal.

What the Forest Service Does to the Prospector

The Editor:

Sir—Under the above caption, the undersigned wishes to correct two or three statements made by Leroy A. Palmer in an article published in the *Mining and Scientific Press*, May 24, and since then widely published in other journals under the heading of 'What the Forest Service Offers the Prospector'—the impression being given to the uninformed reader that the procedure outlined by him is universal in the practice of the U. S. Forestry Service.

Possibly Mr. Palmer has not been employed by the Forest Service long enough to know that the practice, in some cases at least, does not agree with the procedure laid down in manuals and Use Books which have been issued; for his article is seemingly sincere and is certainly well written. At any rate, he but echoes part of an address delivered by the district forester, Smith Riley, at Denver, Colorado, February 4, 1913, before the Colorado Chapter of the American Mining Congress. Mr. Palmer's statements, so far as universal application is concerned, will be disproved by a recent local instance, the facts as to which can be easily verified, without unduly prolonging the communication by citation of the many more flagrant cases which have been reported from time to time in previous years as having occurred in Colorado, Montana, and other states.

Mr. Palmer quotes correctly so far as he quotes at all, and I will here quote him verbatim. He says: "But the ranger does not inquire into whether a discovery has been made. If the claim is in a recognized mineral locality, if the requisite expenditure of $500 has been made, and if the indications are that it is being held in good faith and not as a subterfuge to acquire ground for other than mining purposes, he will make a favorable report. * * * An opinion seems to prevail quite generally that contests against supposedly invalid claims are initiated on the report of the ranger, who, it is true, sometimes has little or no knowledge of mining. This is incorrect." *This is, however, correct in some cases.*

Mr. Palmer admits that the usual forest ranger has little knowledge of mining. I have noticed that most of the forest rangers of the West are ex-cowboys or ex-sheep-herders. For certain duties of forest management and control, probably no better class of men could be had, but no one will accuse the ordinary cowboy of being qualified by training, experience, and education, or by natural cast of mind, to act as a mining or mineral expert; yet he must and does pass upon the most vital and intricate questions pertaining to what constitutes a discovery as well as other features of mining laws and decisions. The more intelligent and honest of the cowboy rangers will not claim to possess such

qualifications, yet their dictum goes, and while it may not be final, the burden of proof that he is unqualified, and that his objections to a mineral application are trivial and not well taken, is thrown upon the claimant and not on the Forest Service. The expense of this is usually heavy. In fact, in the whole elaborate system of rules and regulations it is carefully arranged that after the Forest Service has started something through its employees lowest in rank, it then sits back and lets the claimant and the General Land Office fight it out; the main expense of the fight always falling upon the claimant.

Mr. Palmer goes on to say: "On receipt of a report from a ranger showing the non-compliance with the above conditions, the mineral examiner is detailed to the case. The mineral examiner is a man who must have actual mining experience. He qualifies, etc. * * * The mineral examiner makes an exhaustive investigation of the claim, measuring and estimating the work and also considering the question of character and extent of discovery, and if it develops that no discovery has been made, as well as the claim being deficient in other respects, the facts are reported to the General Land Office. If the Commissioner considers the facts sufficient to justify cancellation of the application for patent, the claimant is informed of the charges against the claim and given an opportunity to present his evidence at a hearing."

Now in a specific recent instance here cited, this procedure was not followed. The Manhattan, Nevada, mining district lies across the south end of the Toquima range, which lies within the Toiyabe Forest. The timber embraced in the reserve consists of scrub cedar and piñon, valuable only for fuel and to a limited extent for mine timbers. The boundaries extend out into the plains and valleys where there are no trees or shrubs other than sagebrush. The mineral belt extends in an east-west direction across the range. While there are other veins, the main mineral zone consists of a thick bed of uptilted altered and replaced limestone, extending along the longitudinal axis of the mineral belt. This zone is cut at frequent intervals by north-south fractures and faults with vein filling, the main movement of the fault blocks between the north-south fractures being in a horizontal direction. The main orebodies are found at the intersections of these fractures or veins with the main ore-zone mentioned, and oftentimes in these fractures at a long distance from axis of main ore-zone, and in schists and other formations cut by them.

Two claims, partly overlapping at their ends, upon which an approved patent survey was made last autumn, extend in an east-west direction in close proximity to and upon the axis of the main ore-zone. The White Cap vein, one of the principal producers of ore in the district, outcrops near the south line of the westerly claim, both outcrops being within the boundaries of the two claims as surveyed. A smaller parallel vein extends through the claims near the lode lines. There are also a number of small cross-veins running in a north-south direction. The two claims embrace but a few scattering piñon trees, have no springs or other water-supply, and control no means of access or rights-of-way. All mine managers, superintendents, mining engineers, and lessees in the district have long recognized the territory embraced as distinctly and decidedly mineral ground and useless for any other purposes. Some $10,000 has been expended for the development of the claims embraced in the survey, several leases have been given thereon at different times, and ore has been milled therefrom. Within a year past, a large amount of ore has been milled from adjoining and conflicting claims on the south side and west end, while at an earlier date ore was milled from nearby claims to the north.

Application was made for patent in December last and final proof and payment for the land was made early in March 1913. The issuance of the register and receiver's final receipt did not follow as usual in due course, and the attorney-in-fact for the claimant was unable to learn definitely the reasons for suspension of issuance of the final receipt until May 15, 1913, when a notice was received from the Register of the U. S. Land Office at Carson City, Nevada, to the effect that a forest officer had filed charges against the validity of the application: (1) that there had been no discovery of mineral in rock in place; (2) that less than $500 on labor and improvements had been expended. Then followed the requirement to answer objections and make appearance within 30 days, or the application will be held for cancellation.

The "forest officer" referred to in the foregoing notice is the local forest ranger. No field examination of the ground has been made by a competent examiner of either the Forest Service or the General Land Office. The local forest ranger has admitted that not to his knowledge has such an examiner been on the ground for such a purpose. Here is an instance where the claimant is put to a great expense to meet charges of a ranger alone, and expenditures to that end have already commenced.

It will be noted also that the ranger did inquire into and pass upon the question of discovery. No one had heretofore questioned the good faith involved in the location and possession of this claim, or probably even thought of it, yet the ranger did not make a favorable report, as Mr. Palmer says he will do in such cases. Under the head of why claims are examined is the following statement in the National Forest manual, by H. S. Graves, taking effect February 1, 1912:

"As to mining claims, it should especially be borne in mind that good faith almost necessarily exists when the claims are located on untimbered and unwatered lands which control no means of access or rights-of-way and are valueless for any occupancy purposes."

This and a few other paragraphs which are to be found in publications of the Bureau, including its 'Use Book' of 1907, read fairly; but the actual practice is not in accord with them in all cases. The paragraph quoted, and a few others, seem to indicate that a supervisor or ranger was expected to exercise some discretion, judgment, and commonsense in making reports; but these qualities cer-

tainly are not exercised in many cases.

In the last two paragraphs of his communication, Mr. Palmer undertakes to show the beneficent effect of free-use permits for fuel and timber, and gives a lot of figures to show what the practice amounts to in dollars and cents. Free-use permits are no longer issued in the Toiyaba Forest. At least, the local ranger has said so, and has refused permits to go out and pick up decayed limbs and timber on the ground. Certain it is that the granting of free-use permits is not universal, as the reader would be sure to infer from Mr. Palmer's statement. The free-use permit is a trifling matter, but that of charging for every possible thing in a reserve, or any privilege connected therewith, is a large one, upon which a volume could be written. On page 44 of the 'Use Book' of 1907 are given some 40 special uses and privileges for which the forest employees may charge. These are outside of and additional to the many charges which relate to timber and grazing, from which the greatest revenues are had. These matters will not here be discussed. I will only say that the first act pertaining to the forests and subsequent acts did not contemplate or provide any material changes from pre-existing laws which always allowed the free use of fuel and timber for domestic purposes within certain limits and under certain restrictions. Certain rather obscure and inexplicit clauses in the Act of June 4, 1907, of February 1, 1905, of June 30, 1906, of March 4, 1907, and perhaps in later ones, have been made the basis of the most remarkable set of rules and regulations for the gathering of heavy and indirect taxes which have ever been promulgated. Most of these taxes go into the coffers of the Bureau, or are placed to its credit in the United States Treasury, and are borne wholly by the pioneers of the West, who often have extraordinary burdens in other forms.

Bureaucracy or bureaucratic government—the promulgation and execution of czar-like rules and regulations by a bureau, which, while oftentimes having no basis in an existing law, have all the effect of laws of Congress—has had a rapid growth in the last 15 years in these United States. The most striking examples are shown by the Forest Service. No one of intelligence has any quarrel with the general principles of conservation. I have always been strongly in favor of all practical measures to prevent the useless destruction of the forests, on account of their close connection with irrigation and other water supplies in the West as well as the degradation of soil areas in the New England and other Eastern states, and I am still enthusiastic on the subject as well as the reforestration of denuded areas when this can be done.

J. C. KENNEDY.

Manhattan, Nevada, May 27.

[In a popular government there is no cure for ills equal to publicity, and Mr. Kennedy points out here one instance where practice does not exactly follow principles. Perhaps there are others that might be cited, but we will confess that we have heard much of the 'czar-like' action by officers of the Forest Service but have had poor luck in obtaining facts as to definite actions properly the subject of complaint. In the instance cited by our correspondent, it appears that the action of the ranger, while not final, has operated to put mineral claimants to unexpected and presumably unwarranted expense. We shall await with interest the explanation offered by the Service, confident that it is no part of the general plan or purpose that there should be any such result. Incidentally, we would point out that a fundamental trouble is that the field service of the Land Office is inadequately manned At present only approximately half the lands upon which application for patent is made are examined to determine whether or not they are mineral and the laws as to location and patent have been observed. The Government is continuously in the position of selling land on the basis of the purchaser's statement as to its character. It would seem to be good business to require examination of all lands prior to issuing of patent. It is not wise to permit the buyer to fix the price, even within the limits set by the law, and it is not fair to throw expense of proof upon him, save after doubts have been raised by a competent examiner.

Incidentally, too, we would call attention to the fact that in the U. S. Bureau of Mines there is at Washington an able and friendly bureau established to serve the miners. There is an informal arrangement between it and the Forest Service, under which the advice of the Bureau is taken in matters relating to mining, and in a number of instances where mining men have come into conflict with local officers of the Forest Service, the Bureau of Mines has been instrumental in effecting a speedy and satisfactory adjustment of the difficulties. If, therefore, any mining man has a sound grievance and fails for any reason to get the prompt action from the local Forest officers that his contention merits, we suggest that he lay the matter before the Bureau of Mines. This, of course, will not meet the wants of those who merely want 'to blow off steam' and relieve pent-up feelings by criticism, and we are frank in saying that we believe this is often the basis of complaints, but it will lead, perhaps more speedily, to solution of such real difficulties as arise.—EDITOR.]

Petroleum Concessions in Colombia

Petroleum deposits found on government lands, or on lands which had such character and have been adjudicated as such before the law 30 of 1903 became in force, may be denounced by their discoverers in the extension and under the same proceedings, and on payment of the amount required by the code of mines for the denouncement and exploitation of placer and alluvial gold deposits.

In this connection this consulate is informed that recently the government of Colombia has granted certain petroleum concessions in Colombia, on which the concessionaires are to pay the Government 18c. gold per ton on such petroleum as may be produced within the concession on government lands.—*Consular Report.*

Special Correspondence

NEW YORK

COPPER MARKET.—MEXICAN AFFAIRS.—NIPISSING MINES CO. COURT DECISION.—NEVADA DOUGLAS.—BREITUNG MINES CORPORATION.

The copper market, from the producer's standpoint, has been a very unsatisfactory one. The Nichols refinery, at which demands for increased wages by the operatives led to a shut-down on June 12, remains closed. Exports to Europe continue good, but still the big consumers delay coming into the market. On June 19 the American Smelting & Refining Co. quoted electrolytic in London at £69 10s. (15⅛c.) and the other large concerns at once followed suit. By the end of last week the large sellers in New York were nominally quoting 15c., delivered 30 days, and the dealers in small lots were making sales at a lower figure. In London, Amalgamated sold blister at £65 10s. (14¼c.), which is approximately equal to 15c. for electrolytic. The situation in the Balkans is nervous in the extreme, and American agents were eager sellers of copper, both in London and Paris. Exports from New York, from June 1 to 19, totaled 20,113 tons, as compared with 17,815 tons for the same period last year. On the other hand, refinery production to the end of May was over 74,000,000 lb. larger than in the same period of last year. Consumers are evidently undismayed by the low level which stocks of copper have attained, and Misha E. Appelbaum is predicting that the price of the metal will sink even lower before the autumn.

Mexico is reported to be negotiating the sale of the National Tehuantepec railroad, a foreign syndicate of which Lord Cowdray is said to be the principal member having been organized by José I. Limantour to take over the property. S. Pearson & Son, Ltd., of which Lord Cowdray is the head, is now operating the road under a 51-year lease. The road is 186 miles long and does a big transcontinental traffic. The Mexican government is cash poor, as the $25,000,000 paid in on account of the national loan had been exhausted by pressing obligations, and no more has been made available yet. The National Railway 6% notes, which were issued at 97, are being traded in London at 95 and 95½. The Minas Pedrazinni has been shut down for over a year, with no prospect of resumption of work, and any number of other valuable properties have been unable to continue work. The situation is so discouraging that market operators have turned their attention elsewhere. As a reflection of dullness in the stock market, the New York Curb Market Association has reduced the commission charge to 2% of the money involved in the handling of stocks selling at between 25c. and $1 per share, thus encouraging dealing in low-priced stocks. The announcement during the week of President Wilson's plan for currency reform was not reassuring to Wall Street, which did not like the degree of control over the banking situation which it confers on men who may be political appointees. Tariff legislation drags on slowly, and few modifications have been made in the rates originally proposed, though a number of objectionable administration features have been eliminated, and a number of items have been added to the free list, among them cyanides of potassium and sodium, and a variety of iron and steel products.

The Dome mill, at Porcupine, will be increased from 40 stamps to 80 stamps, as it is judged that the condition of the ore reserves justifies the increased capacity. No new stock will be issued, the construction work being paid for out of earnings. The Nipissing Mines Co. recently won its suit in the United States Circuit Court of Appeals, which affirmed the judgment of the District Court that this holding company for a Canadian corporation and merely "owning property, maintaining investments, collecting the income, and dividing it among stockholders," do not constitute doing business within the meaning of the corporation tax law, and it is therefore not liable for income tax. The lower court awarded a judgment to recover taxes already paid, but this was reversed, on the ground that a judgment cannot be issued against the United States Government.

The past week saw an upheaval in the Quicksilver Mining Co., which owns the New Almaden mines in California. Charles A. Nones, the president, resigned following the filing of a petition in bankruptcy and the appointment of a receiver for his property. M. E. Harby was elected president and W. H. Landers was made managing director, in charge at the mines. There has been dissension in the Company for some time, and present developments correspond to the ejection of the 'ins' and the triumph of the 'outs,' which will probably be to the marked advantage of the Company. The changes probably mean that a vigorous effort will be made to develop new orebodies in this famous old mine, since it is understood that Mr. Landers conditioned his acceptance of the position upon this. There is a large amount of favorable ground that has only been partly explored, but the Company has been living on the sale of farm lands and has not paid dividends for some time. Goldfield Consolidated is back on the Curb market again, where it will be easier to create a market for it. There are 3,559,148 shares, of a par value of $10, now outstanding, and the New York quotation on June 20 was $1.75. On the Curb, commissions will be lower, and the Company will save the expense of maintaining separate registry and transfer offices, as required by the 'big board.' The attorneys for the Federal M. & S. Co. in the suit brought by the minority stockholders, have withdrawn the demurrers of the directors, and the way is now open for the hearing of the case on its merits. Recent developments in the Stewart have shown unusually good orebodies, and the mill feed has been averaging 10% lead and 9 oz. silver, which is much above the average of similar ores in the district.

Greene Cananea shares have been increased from $20 to $100 par value by reducing the number of shares outstanding from 2,500,000 to 500,000. The retiring directors were reëlected. Greene Cananea now owns 951,862 shares of Greene Consolidated. The Nevada-Douglas announces that the debt of $365,000 remaining at the close of its last fiscal year has been liquidated. Gross revenue amounted to $824,891, and operating profits were $434,814. Under the direction of Archie Orem, the superintendent, W. L. Austin has devised a leaching process which, it is claimed, can treat 2% ore at a profit, the cost of the proposed plant being estimated at $200,000. The minority shareholders of Giroux have assented to the plan of the Coppermines merger so that everything should now progress smoothly in the organization of the new company.

E. N. Breitung, Edmund L. Baylies, W. A. Hamilton, Joseph P. Hodgson, S. R. Kaufman, J. M. Satterfield, and A. C. Ludlum were elected directors of the Breitung Mines Corporation at its recent meeting. Mr. Breitung is director and manager of a number of iron-mining companies in the Lake Superior district, as well as director of various banks and industrial enterprises. Mr. Kaufman also has large iron-mining and banking interests in the Marquette district. Mr. Baylies is a director and prominent in the management of real estate and industrial enterprises in New York and Mexico, Mr. Hodgson is general superintendent of the Copper Queen mines at Bisbee, and Mr. Ludlum is president of the New York Engineering Co. The Breitung Mines Corporation, as mentioned in an earlier issue, has interests in gold placers in Colombia. Capital stock of the par value of $1,500,000, in shares of $5 each, has been issued, but of this Mr. Breitung has placed shares of the par value of $400,000 in escrow in the Hanover National Bank, providing that none of it shall be released until 7% in dividends shall have been paid. Exploratory work in Colombia is now in progress under the direction of R. B. Cranston. Though no official statements have been made, rumors which have leaked out are not especially encouraging. Gold placers are abandoned in Colombia, but American efforts to develop them have not heretofore been especially successful.

BOSTON

BUTTE CENTRAL AFFAIRS.—CONDITIONS AFFECTING MARKETS.—SMELTER-FUME PROBLEMS.—FUTURE COPPER PRICES.

The recent selling down of Butte Central on the Curb to 35c. per share has been discomfiting to the principals of that Company, who have worked hard to make the property a winner. The last break in the price, which took it down to this level, was caused by the news from Butte that three creditors had attached the property for sums aggregating about $7000. The truth of the situation seems to be that mine and mill results have been disappointing, due entirely to the ore not averaging as high as the mine superintendent estimated. As far as the mill is concerned, it would seem that it is doing fair work. The probabilities are that Butte Central's outstanding debts and payroll will be met by the directors, and a reorganization averted, while a change of policy will be made. The mill, which is a good one, will probably be enlarged to treat custom ores, while the mine down to the 500-ft. level will be turned over to lessees, and the Company will devote itself to developing the property

BUTTE DISTRICT, MONTANA.

at greater depth. The shaft is down 1053 ft., with three compartments to 500 ft., and about 3½ miles of underground workings from the 500-ft. level up.

Indications of a modification of pessimism have appeared in the market here in the last few days. Wiggin & Elwell, a stock exchange house which specializes on mining issues, has been bearish for some time, but has recently become moderately bullish. Stock exchange and curb sentiment is affected by liquidation of the local copper and railroad stocks; by the offer of the Treasury Department to 'sweeten' the straitened money-market situation by an issue of $500,000,000; and by the hope of the tariff bill being better received than was at first expected. A banking and currency bill is also looked forward to in the nature of a panacea. Considerable solicitude is felt here over the smelter smoke conditions in the Shasta county, California, fruit belt, where the Mammoth and Balaklala smelters are situated, the former operating and the latter idle. A committee appointed by the Southern Oregon & Northern California Mining Congress to investigate conditions reports that the Mammoth smelter has its fumes under control by its baghouse process, and vegetation of all kinds is flourishing right at the smelting plant. This report, appearing at the same time with the announcement that the First National directors are making a liberal appropriation to experiment with a new process for controlling the Balaklala smelter fumes, is welcome to Boston, which has been much worried over the Shasta situation. It is believed the Balaklala smelter would not have been allowed to remain idle so long had it not been for the hopes entertained that the Bradley process for leaching copper ores would be perfected and might be adopted at this plant. The failure of the Bradley process has doubtless been the controlling factor in trying the new system.

Boston is just now the prey of conflicting ideas as to the course of the copper market during the summer months. The price of the metal has been discounting accumulation of stocks by producers in this country, notwithstanding the favorable showing made in the last Copper Producers' Association statistics. Some authorities believe that there will be little doing in the metal market until the fall, except by second-hand dealers and those who make concessions in order to get business. On the other hand, John D. Ryan and his able lieutenant, W. D. Thornton, are now in Europe, and it is pointed out that the Ryan trips, whether as a matter of design or coincidence, are usually attended by a new buying movement. Besides, hot weather or labor strikes usually interfere with refinery production in the summer, and the strikes are already in evidence, there being about 1500 men out at the Nichols Copper Co.'s refinery at Laurel Hill, Long Island. It would not take a great deal of curtailment to check the tendency toward overproduction, which the refineries showed in May. As far as the European situation goes, it is believed that as much copper will go into consumption there this year as last. Every day of the smelter strike takes over 1,000,000 lb. of copper out of the market, and further curtailment from other conditions would easily take care of all the surplus copper being produced at present.

The annual report of the Nevada-Douglas Copper Co. for the year ended December 31, 1912, has been issued, showing net profit of $270,157, which is a disappointment. The policy of the directors of this Company in declaring a premature dividend of 12½c. per share, following it immediately with the announcement of a $2,000,000 bond issue, has been regarded as so weak as to hurt the standing of a property which many people believe has great possibilities. It wss announced that the bond issue, among other things, was to enable the Company to maintain dividend stability, but several months have elapsed since the initial declaration, expected to be a quarterly one, and no intimation has been made of another dividend coming. It has further been announced that the Company will build its own reduction plant.

ARIZONA

OUTPUT OF THE MIAMI MINE INCREASING.—THE INSPIRATION MILL.—IRON CAP DEVELOPMENT WORK.

J. Parke Channing, of the Miami Copper Co., reports that recent work has revealed no serious damage to the pillars of the Miami mine resulting from the cave-in of April 17. During the first 10 days of June, 26,473 tons of ore was delivered to the mill; but during the following seven days the output averaged 3119 tons per day, a rate of extraction that will continue. With only five of its six units in operation, the mill is easily treating this quantity. The sixth section of the mill is being employed in experimenting. Multiple-deck Deister tables and other equipment has resulted in a saving of 1.5 lb. more copper per ton of ore treated. Because of the fact that much of the Miami ores near the surface and in the stockpiles contain considerable oxides and other minerals which would not be saved by the flotation process, the management has decided not to alter in any radical manner any portion of its concentrator until the flotation, leaching, and other methods now being tested have been thoroughly tried out. Before leaving Miami, on June 19, Mr. Channing stated that while all manner of water concentration, flotation, and leaching methods would be tried thoroughly,

it is his opinion that leaching will prove most effective in saving the copper now lost in treatment of the Miami's ores. The machinery for a 600-ton mill to test the flotation process has been ordered, and the mill will be built at a point just west of the main concentrator site. H. Kenyon Burch states that the machinery to be used in equipping the test mill has been so selected that it can be used in the main mill in the event of the flotation process not being adopted. Building of the test mill will occupy six months, but construction of the Inspiration concentrator will not be retarded as a result of this alteration of the original program, as the test plant and all tests necessary will have been finished before that portion of the equipment will be needed. Grading at the millsite will be finished about August 15, and building will proceed as rapidly as arrival of supplies permits. Railroad grading between the mine and millsite has been finished, and the track laid. Work on the main haulage-drift of the Inspiration, between the Live Oak orebody and the main east and west shafts, will be discontinued probably until September, the New Keystone company not yet having filed its answer to the suit instituted by the Inspiration invoking the right of eminent domain. The Inspiration testwells below the mill have proved successful, one having shown no diminution of flow when 1750 gal. of water per minute was pumped from it, and a second well, which will be tested early in July, seems to have an equally strong flow. The working force at the Live Oak section of the mine has been reduced considerably, presumably because of the enforced discontinuance of work in the main haulage-drift. Three churn-drill rigs are operating on the Live Oak end.

The east drift on the 661-ft. level of the Iron Cap continues to improve. The cross-vein opened recently still runs north 20° east. The main lode is straightening again to a more easterly course, making it probable that the veins will not intersect at a point farther eastward, as their appearance a week ago would indicate. As cutting of the cross-vein delayed the raise which was to have been started, it is impossible to predict the depth or width of the orebody. The entire force is still engaged in extracting ore from the two veins, and shipments from the property will be over 500 tons in June.

REPUBLIC, WASHINGTON

NEW POWER-PLANT AND ADDITIONS TO MILL AT REPUBLIC.—SUPRISE AND LONE PINE MINES.—LAST CHANCE LEASED.—LITIGATION COMPROMISED BETWEEN COMPANIES IN FERAY COUNTY.

The Ben Hur Leasing Co. has finished installing the new machinery at the Ben Hur mine and is now shipping about 550 tons of ore per week.

The North Washington Power & Reduction Co. is dismantling the old engine at the power-house annex to its mill, and has completed an excavation for a 40 by 32-ft. addition to the power-house, made necessary for increased power equipment, to be installed immediately. This will consist of a Corliss engine from 450 to 700 hp., a 12 by 12¼-in. Ingersoll-Rand low-pressure air-compressor, and an additional electric generator of 150-kw. capacity. Possibly blowers for forced draught will be added. An additional 150-hp. boiler will be added to the power equipment when the machinery for increased tonnage in the cyanide plant is installed. The mill is undergoing general repairs, and slight changes are being made, which, during recent operation were found would be of advantage in the future. The second 5 by 22-ft. tube-mill and an additional Akins classifier are being installed. In future all of the product of the crushing plant, the maximum size of which will be 3/16 in., will be reduced from that to 200-mesh by the tube-mills direct, that practice having been found the most expedient in the reduction of the ores of the Republic district. Later, two additional tube-mills will complete the equipment for the reduction of 250 to 300 tons of ore per day.

During the first half of June, 1160 tons of ore was shipped from the north stope on the 500-ft. level, and the south stopes on the 400 and 700-ft. levels of the Surprise mine. This assayed from $12 to $20 per ton. From the Lone Pine mine, under advantageous rates, ore assaying $9 per ton is being shipped to the smelter at Greenwood, British Columbia. The Surprise and Lone Pine mines are at present being operated under the direct superintendence of William Pierce, the office of general manager of Republic Mines Corporation having been abolished at the last annual stockholders' meeting.

During May the net returns from Knob Hill ore received by the Knob Hill company from the smelter amounted to $29,280. The company has made the final payment for the purchase of the Knob Hill mine, about four months in advance of its being due. The last dividend paid by this company amounted to $5000, bringing the total amount up to $50,000. The price paid for the mine was $125,000.

J. L. Harper has secured a lease and bond on the Last Chance mine from the Lone Pine-Surprise Consolidated Mining Co. for a consideration of $187,560, being equal to 6c. per share for 3,126,000 shares issued. Royalties apply on the purchase. The bond is payable in installments, the final payment to become due in the fall of 1915.

Stipulations have been filed in the auditor's office of Ferry county under which the litigation pending between the following companies is compromised: the Quilp Gold Mining Co. *v.* The Republic Mines Corporation; the Quilp Gold Mining Co. *v.* The Imperator-Quilp Co.; the Quilp Gold Mining Co. *v.* The North Washington Power & Reduction Co.; and the Imperator-Quilp Co. *v.* The Quilp Gold Mining Co. The Republic Mines Corporation agrees to purchase the Quilp mine for the sum of $250,000, to be paid in installments, the last to become due in 1915, and the royalties to apply on the purchase price. Since the filing of stipulations, the Quilp mine has been again turned over to the Imperator-Quilp Co., and The Republic Mines Corporation has resumed possession and operations on the 700-ft. level of the Surprise mine workings, in ground claimed by the Quilp Gold Mining Company.

TORONTO, CANADA

PORCUPINE SHARES SUFFER.—STRIKE CALLED OFF.—CROWN RESERVE FINANCES.—KIRKLAND LAKE DISTRICT.—COBALT DIVIDENDS.—NEW VEINS AT NIPISSING.

In sympathy with the general financial market, mining stocks have lately been much depressed, and now low records have been made by several of the leading Porcupine issues. Prices have been firmer during the last few days, the improved feeling being largely due to the reported calling off of the Porcupine miners' strike. Though this had for some time been a negligible factor as regards the operation of the larger companies, its continuance had a prejudicial effect upon public confidence. The shareholders of the Crown Reserve, at a meeting held in Montreal on June 11, took the final action necessary to separate the McEnaney mine from the parent company, transferring the property to a new concern under the name of the Porcupine Crown Mines, Ltd., with an authorized capital of $2,000,000. The Crown Reserve shareholders are offered 440,000 shares at 80c. each, and the employees are accorded the opportunity to take up 26,664 shares at the same price. The Board of Directors will be identical with that of the Crown Reserve. The shareholders of the Swastika on June 12 ratified the increase of capital from $2,000,000 to $3,000,000. The new issue will be offered to the shareholders at a low price shortly to be announced, and arrangements have been made for underwriting a large block should they not be readily taken up. The new 5-stamp mill at the Three Nations is completed, and will shortly be in operation. The first clean-up has been made at the Lucky Cross in the Swastika district, as the result of one month's run, which yielded about $6000. Five additional stamps are being added to the mill, making 10 stamps in all. The Ontario government is devoting some attention to the opening up of the Kirkland Lake district and has a force of about 50 men at work building a

road from Swastika to Kirkland lake. The Department of Mines has commissioned A. G. Burrows to make a geological investigation of the district and map it in detail. C. Keith, clean-up man of the McIntyre mine, was arrested on June 10, charged with 'high-grading,' which had apparently been going on for some time. Gold amalgam valued at $1500 was found in his possession. He was convicted and sentenced to a fine of $500 with the alternative of a year's imprisonment. He paid the fine.

The Cobalt mines are doing well and keeping up their dividends. McKinley-Darragh declared a dividend of 10%, Buffalo announced a 10% dividend supplemented by a 3% bonus, and the Seneca Superior has declared its third 10% payment. La Rose pays its usual quarterly 2½%. The statement of the latter company for May showed profits of $84,407 and a cash surplus on hand of $1,439,447, the total surplus including value of outstanding shipments and ore on hand being $1,752,150. The annual report of the Buffalo for the year ended April 30 showed a production of 2,235,853 oz., as against 1,525,262 for the previous year. The net income was $891,192, and the surplus on hand $623,028. The Nipissing during May mined ore of an estimated net value of $284,625, and made shipments of an estimated net value of $280,244. Hydraulic prospecting is being done by day and night, and two veins were discovered during the month. One of them is a strong low-grade vein, may be a continuation of vein 43. The Cobalt Lake mill of 40 stamps is in steady operation treating about 150 tons per day. A continuous shoot of high-grade ore for 90 ft. has been found in No. 1 vein, which is probably a continuation of one of the Cobalt Townsite veins. At the Seneca Superior a winze is being sunk below the 200-ft. level on the main vein and it is proposed to put it down for 100 ft. In case the ore proves continuous, a new level will be opened up. On the Gould property, adjoining, cross-cutting is being undertaken on the 200-ft. level to reach the Seneca vein. At the Penn Canadian, a stringer, which had been regarded as worthless, has developed into a vein carrying 3 to 5 in. of high-grade ore. A raise put up for 50 ft. on this orebody is all in good ore.

PHILIPPINE ISLANDS

STATE OF THE MINING INDUSTRY.—GUMAOS DREDGE OUTPUT.—COLORADO MINE.—SURIGAO PLACER PROPERTY.—COAL PURCHASES.

The mining industry in the Philippines is, in the words of the prospector, 'bucking up'; but it is still beset with unusual difficulties, not the least of which are various political questions which are agitating all persons in the islands or those who have interests here. No sooner do the islands weather one squall than another appears on the horizon. A short time ago it was the Jones bill, with its independence bogey; now it is war with Japan.

The two most interesting occurrences in the mining field within the last month have been the reported record run of the Gumaos dredge in Ambos Camarines, which cleaned up on an average of ₱4000 per day for a month. This is said to be the world's record. Whether it is or not, it is certainly a good showing. The second event of importance is the publication of the president and general manager's report of the Colorado mine in Masbate. The total production for 1912 from that mine as given in his report is ₱681,030, or $340,515 (a peso being equal to 50c. United States currency), the total operating expenses, including capital expenses, being ₱425,042. Not including capital expenses, the profits for the year were reckoned at ₱330,000. There was 113.2 tons of ore milled per day for 293 days, the average value per ton being ₱23.40, and average recovery 89.84%. The reserves are estimated at ₱4,777,770. This estimate is made on the basis of ore blocked out. Still other items of interest are the formation of the Surigao Gold Mining Co. As published in local papers, R. Y. Hanlon reports as follows on the property, which is situated in Mindanao:

Total ground, acres	4,127
Possible ground, acres	2,627
Examined, acres	1,920
Tested, acres	325

Total payable ground in the 325 acres, cu. yd.....6,292,000
Average value per cu. yd., 22c. U. S. currency.

The total quantity of gold is estimated at ₱2,768,480. This ground will he worked by hydraulicking, and the machinery will he ordered in the near future.

The Syndicate Mining Co. of Masbate has increased its stock from ₱300,000 to ₱600,000, and has taken over the property of the old Eastern Mining Co. An up-to-date mill

MAP OF LUZON.

is now being erected. A small mill is also being erected on the Keystone property in the same district. Masbate is confirming the early prediction made by the wise ones, that it would in time lead all the other districts in the islands in gold production. The machinery for the Rizal Cement Co. has been ordered from Germany, and will soon be on the ground. The plant will be situated near the town of Binangonan on Laguna de Bay, a short distance from Manila. Some good-looking copper ore has been reported from Antique province, Island of Panay. Interest in the Tayabas oilfield still keeps up, but no development work has been begun, and this will probably be postponed until the government geologists issue their report.

A matter which is of general interest locally is the combination formed between the Insular Government and the Merchants' Association to consolidate orders for coal, and the government agent, E. Randolph Hix, has been put in charge of the purchase of these big lots of coal. It is understood that the coal will be bought upon the basis of analysis and calorific tests, which is in line with the recommendations of the United States Bureau of Mines st Washington. The gas-producer recently installed at the Bureau of Science is especially designed for Philippine coals having a high moisture content, and is reported to be a great success. Unfortunately, no Philippine coal mines are in operation at present. This successful test may stimulate the local industry. From the preliminary estimates it is believed that the total mineral production of the Philippines in 1913 will greatly exceed that of the past year.

General Mining News

ALASKA

Cordova

The Port Wells district, which is a large gold-bearing area, situated on the northwest arm of Prince William sound, is attracting some attention. The Golden Eagle has developed a 2-ft. vein carrying high-grade ore; while in the Eureka, a quartz lode 12 ft. wide, averaging $8.60 in gold and $7.10 in silver per ton has been opened.

Fairbanks

(Special Correspondence.)—The Rhoads-Hall mine continues to be a consistent producer, and large clean-ups mark the steady operation of the mill. Mr. Rhoads, who is in personal charge of the mine, is keeping development ahead of stoping, so that a shut-down for lack of ore is not likely. Joseph Henderson has been made foreman since the resignation of Allan Cunningham. There is no intention at present of enlarging the 5-stamp mill. From 15 to 20 men are employed at present. E. A. Smith and William McClone have uncovered a promising 7-ft. vein after sinking through the 'overbreak,' found by trenching on the surface, and sinking will be started at once. It is thought to be the extension of a vein already uncovered 2000 ft. up the hill. These prospects are located at the head of Eva creek just above the rich placer being worked on the Happy Home Association. The 300-ft. adit run by Crites & Feidman on the left limit of Fairbanks creek, still shows the same high value, a recent mill run of about 20 tons having returned over $100 per ton. Pomeroy, Ford & Wheeler, on the Teddy R., across Moose gulch, have their adit in 250 ft., and are understood to be in good ore. A previous mill run showed the rock in the adit to be of good milling grade.

Fairbanks, May 31.

The vein on the 215-ft. level of the Newsboy, on the ridge between Little Eldorado and Cleary creeks, was cut on May 30, according to the report of Louis Golden, the manager. Where found, the vein had a width of 30 in. and carried as good gold content as on the 150-ft. level, where work is being pushed on the vein. Mr. Golden estimates that the ore will average $40 per ton. The 5-stamp mill is in operation on ore from this shoot. At the Free Gold claim, on Bedrock creek, the Rhoads vein has been cut again, 110 ft. below the main adit. It is 16 in. wide of good quartz. An electric pump is keeping the winze free from water.

Juneau

(Special Correspondence.)—The Jualin mine, at Berners bay, about forty miles north of Juneau, is being opened

JUALIN MINE AND MILL, ALASKA.

by the Algunican Development Co., under the management of L. K. Kennedy. It is one of the older mines of the district that has been operated in a small way during the past ten or twelve years.

Juneau, June 10.

Nome

The Topuk Ditch Co., a mining corporation doing business in the Nome district, with headquarters at Oakland, California, filed a petition in bankruptcy recently. The liabilities are stated at $386,409, and the assets at $205,000, of which $200,000 is given as the value of land and claims at Bluff, Alaska. The heaviest creditor is Henry Bratnober, a mining man, who holds promissory notes aggregating $292,824. The next largest creditor is O. W. Ashby, for $75,000, secured by mortgage on $200,000 worth of realty in Alaska, including Daniels creek, Cheechaco Fraction, Edna Fraction, and others.

ARIZONA

Cochise County

(Special Correspondence.)—At the Calumet & Arizona, high-grade copper ore containing cuprite is reported to have been opened, although the management refuses to confirm or deny the rumor. It is said that the ore was cut in a 5-ft. vein 30 ft. from the shaft on the 250-ft. level. The shaft is now about 470 ft. deep, a shortage of labor making more rapid progress impossible. Water has been encountered at the rate of about 250 gal. per day. Crosscutting from the main adit to the shaft is making fair headway.

Douglas, June 19.

Within 31 days of starting its new shaft, the Commonwealth Extension Mining Co. has cut ore at a depth of 220 ft. This is an extension of the orebody being opened in the adjoining Commonwealth mine.

Greenlee County

The total tax levy in this county was $2.60 on each $100 valuation for all purposes in 1912. The assessment for the current year is much higher, and the mining companies are to protest against it.

Mohave County

The Boundry Cone mine, near Oatman, is opening well. On the 520-ft. level, the vein is 13 ft. wide, while on the upper levels shoots are 5 ft. wide. A 10-stamp mill and cyanide plant will be erected. Frank Dryden has been appointed superintendent.

The Tom Reed Gold Mines Co. paid last week dividend No. 35, amounting to $55,000. On No. 7 level of the mine good ore is being opened. The Cinnabar mine, near Parker, has a shaft down 500 ft. Quicksilver shipments total about 45 flasks per month.

Pima County

For a nominal consideration of $1, the Calumet & Arizona Mining Co. has taken advantage of its option and acquired a deed to the Cornelia properties in the Ajo district of this county. The reported consideration is $800,000. The company has held the option on the claims for about a year. The ground has been explored for them by E. J. Longyear & Co., using diamond-drills, with results said to be most satisfactory. This is notable as being the first extensive work with diamond-drills in exploring porphyry coppers. The company's chemists have outlined a process for treating the ore, and the engineers look forward to mining the ore by steam-shovels. The Cornelia is said to be well adapted to this kind of mining.

Pinal County

(Special Correspondence.)—S. H. Sherman, superintendent of the Gila Copper Sulphide Co., is employing 20 men. Most of the underground force is employed on the 800-ft. level, following the line of contact between the limesfone and porphyry. The Douglas Copper Co. is preparing to resume work at its property between Ray and Superior. Charles Davis of Globe has succeeded Mr. Carper, the former superintendent.

Superior, June 19.

Yavapai County

The Golden Eagle Mining Co. is opening a promising group of claims in the Buckhorn district, 15 miles from Wickenburg.

(Special Correspondence.)—New equipment and methods are being added to the Vulture mine that will materially reduce the cost of producing gold bullion. The company has leased land from the railroad and erected a freight platform 16 by 40 ft., also a storage tank for distillate,

which is used as fuel. The latter permits the purchase of distillate in tank cars at a substantial reduction in price. At the mine a drill-sharpening machine has been installed. A second retort-furnace has been added to the refinery, and also a tilting-furnace for melting bullion. A new air-receiver has been added to the compressed-air system. Fire hose has been placed in the mine to provide against fire among the timbers, and electric street lights have been placed in the village of Vulture. Operations are to be resumed at once at the Emporia mine in the Groom Creek district. During the month a carload of ore will be shipped to the Copper Queen smelter at Douglas. The main shaft is to be retimbered to a depth of 215 ft., and connection will be made with an old shaft some distance away. When operated several years ago, the Emporia workings had a large tonnage of ore ready for mining. It is of a character much in demand for smelting purposes. This ore will be mined, sorted if necessary, and shipped. There are 28 miners now employed at the Climax property. New ground recently opened warrants the recent increase in the number of employees. A 10-stamp mill is running day and night, and the ore is yielding good returns by amalgamation and concentration. A new 1800-ft. pipe-line is being laid while other incidental improvements are being added to the surface equipment.

Wickenburg, June 12.

CALIFORNIA

Amador County

The Bunker Hill company paid its regular dividend of $10,000 in May, making $50,000 for 1913. The shaft is being sunk to 2350 ft. E. Hampton is in charge. At the 3600-ft. level of the Kennedy, a station is being cut. The 100-stamp mill is crushing about 15,000 tons per month. At the Defender, development is under way on the 200 and 400-ft. levels.

Eldorado County

Cross-cutting on the 100 and 330-ft. levels of the Davidson mine, near Shingle Springs, has opened $4 to $7 and $12 ore, respectively. The 5-stamp mill works 10 hours per day, as water is short. Probably 10 stamps will be added to the plant soon.

Lassen County

The California-Utah Mining Co., which is sinking a shaft on one of its veins, 12 miles south of Doyle, has about 14 ft. of ore at a depth of 13 ft. The ore, which assays about 12% copper with a small amount of gold and silver, is a chalcopyrite with considerable bornite. The company has several hundred tons of milling ore on the dump. It expects to have a concentrating plant on the ground within a few weeks. This company consists of Salt Lake and Chicago people. Daly & Bruce are shipping 500 sacks of rich copper ore per week. A pump is to be installed. The California-Denver Mining Co., 15 miles west of Doyle employs 15 men at its gold mine and stamp-mill. The latter treats 15 tons of $24 ore per day.

Nevada County

After several weeks of preliminary work, actual mining has been started at Grass Valley by the Golden Center of Grass Valley Mining Co., which will work under the townsite. Charles A. Brockington is superintendent. The buildings and entire plant of the Le Duc Mining Co., situated at the mouth of the adit on Osborne hill, and consisting of a blacksmith shop, dry-house, two engines, blowers, and everything used in driving the adit and furnishing air, were destroyed by fire last week, entailing a loss of many thousands of dollars. How the fire started is apparently a mystery, all of the miners being at work 1000 ft. in the adit. All escaped without injury. The loss is covered by a nominal insurance.

A direct-driven Ingersoll-Rand air-compressor, of 1500-cu. ft. per minute, has been started at the Brunswick mine.

Placer County

Further information regarding the placer properties acquired by the Guggenheims, states that they include Brown's, Bushy, Kennebec, Little Kennebec, Buckeye, Sandine, Wild Cat, Quail, Texas, Hoosier, and Philadelphia, near Auburn. They were all famous mining spots from 1849 to 1870. A good deal of gold has been won from them.

In addition, the Guggenheims have secured an option on the property of the Placer and El Dorado Gold Mining Co., which includes Poverty and Yankee bars, a short distance

CALIFORNIA. BLACK DOTS MARK DREDGING DISTRICTS.

up the river. The promoters of the deal say that the amount which the Guggenheims will put into the venture, including the purchase price of the properties, will be $1,500,000.

Plumas County

(Special Correspondence.)—S. E. Francies and six associates have opened a large deposit of good talc, about 25 miles from Oroville, and 6 miles from a railroad. They have 7 claims, and the deposit is to be properly developed. The production of talc in California is of small quantity at present.

Sacramento, June 20.

Sacramento County

Early in July the rock-crushing plant of the Natomas Consolidated which crushes rock from the dredges, will be closed down permanently. The reason given is that the demand for crushed rock is not sufficient to keep the plant at Natoma and the one at Fairoaks busy. The crusher at Fairoaks is the larger and newer one, and can, it is said, turn out sufficient rock to fill all orders.

Shasta County

The Hazel Gold Mining Co., of French Gulch, has placed an order with the Wellman-Seaver-Morgan Co. for an electric hoist fitted with Wuest type of herringbone gears.

Sierra County

The Mayower mine, in Winters creek, has been bonded to Rochester, Nevada people.

Tuolumne County

(Special Correspondence.)—An adit is being driven at the Hope mine, near Sonora, to connect with the old workings at considerable depth. This will facilitate and reduce the cost of handling ore, which heretofore has been extracted through a shaft. Operations were only lately resumed at the property by a new company. An electric hoist similar to the one recently placed at the Dutch mine is being erected at the Harvard, near Jamestown. Other

improvements in the equipment are also being made. The new shaft at the Wheal Rough, near Soulsbyville, is being sunk rapidly, and before long a cross-cut will be started from the 100-ft. level to cut the vein. The property is being developed by the Tuolumne Syndicate, operating the Black Oak. A. Davidson, of Fowler, Fresno county, operating a gravel mine at the mouth of Turnback creek, above Tuolumne, reports the completion of a dam for impounding water for mining purposes, and states that everything will be in readiness for washing gravel next week. The Starr King mine, situated east of Tuolumne, is being unwatered with a view to the resumption of operations. In the south drift at the Morning Glory mine, near Confidence, the vein shows increase in width and improvement in grade of ore. The property is owned aand operated by Bingham, Burley, and Layman.

Sonora, June 21.

COLORADO

House bill No. 59, increasing the width of a mining claim from 300 to 600 ft., was passed by the Ninteenth General Assembly and was signed by the Governor early in May, and will become effective in the first week in August. At that time those who locate claims are entitled to the 600-ft. law, which gives two claims in width as against one under the old law. The bill reads as follows:

"An act to amend Section 4193 of the Revised Statutes of Colorado, 1908, relating to the width of lode mining claims. The width of lode mining claims hereafter located in Gilpin, Clear Creek, Boulder and Summit counties, shall be 150 ft. on each side of the centre of the vein or crevice; in all other counties, the width of the same shall be 300 ft. on each side of the centre of the vein or crevice; and the owner or owners of any lode claim or claims heretofore located and having a less width, desirous of securing the benefit of this act, may file an additional certificate claiming such additional width as herein provided. Provided, that hereafter any county may, at any general election, determine upon a greater width not exceeding 300 ft. on each side of the centre of the vein or lode, by a majority of the legal votes cast at said election, and any county, by such vote at such election, may determine upon a less width than above specified. All acts and parts of acts in conflict herewith are hereby repealed."

Clear Creek County

The Terrible mine, in the Silver Plume district, is being unwatered. The Capital company is extracting a large tonnage of ore from the 300-ft. level stopes. A Baldwin-Westinghouse storage-battery locomotive has been ordered by the Onondaga company to transport ore from the mine.

Eagle County

The Lady Belle Leasing Co., Brush creek, for the present has stopped driving the main adit and will now sink a winze from the breast of the adit, which is in 70 ft. Mr. Kempf, one of the owners of the property, states that the width of the vein carrying high-grade ore is between 4 and 5 ft., and that there is a mountain of low-grade ore that contains 18 to 50 oz. silver per ton, with 1 to 4% vanadium.

Gilpin County

The property of the Fifty Gold Mines Corporation at Black Hawk was sold on June 17 to Kansas City people for $61,500. The property included 50 patented claims, which have produced several million dollars of gold, silver, and copper since 1859, an 80-stamp mill, and other equipment.

Gunnison County

The Colorado Yule Marble Co., which maintans quarries at Marble, between Denver and Grand Junction, was named on June 17 by the capitol commission to furnish the interior marbles for the new Utah state capitol at Salt Lake City, with the exception of the state reception room, the senate chamber, the chamber of house of representatives, and the supreme court room. The Birdseye marble, a Utah product, was named for the reception room and the supreme court room. The value of the contract is $158,000. The company was once widely advertised and recently went into the hands of a receiver. The marble seems to have been better than the management.

Teller County (Caipple Creek)

Two dredges to be used in treating the Pikes Peak placer deposits will soon be on the property. Suit for more than $3,000,000 was filed last week in the United States District Court at Denver by the Christmas Gold Mining Co. against the Golden Cycle Gold Mining & Milling Co. The plaintiffs allege that the Christmas lode mining claim in the Cripple Creek district was taken from them by an armed force by the Golden Cycle in July 1904. They claim that they have been damaged in the sum of $500,000 in addition to having been deprived of ore to the value of $2,730,182.35. The total judgment asked is $3,380,183.35. A 20-drill electric-driven air-compressor is being installed at the Nichols shaft of the El Paso company.

IDAHO

Shoshone County

The auto-truck which was put in recently to haul ore from the Tyler lease has proved an unqualified success, and it is working 16 hours per day at present. On each trip it hauls between five and six tons of ore to the mill and makes the round trip from the bins at the end of the Tyler tram in an hour, resulting in the delivery of 80 to 90 tons of ore per day, the ore assaying about 13% lead. The National Copper Mining Co. will erect a 500-ton mill, 1½ miles from Mullan. It will contain the latest processes and should be complete about March 1914. Good ore is being opened in the mine. The Clearwater Gold & Copper Mining Co. is said to have a large tonnage of 5% copper ore, with a little gold and silver blocked out.

On July 4 there will be a rock-drilling contest at Wallace. The prizes will be about $500, and entries are limited to men from the Coeur d'Alene.

MICHIGAN

Houghton County

During the year ended April 30, 1913, the Lake Copper Co. showed the following results:

'Rock' stamped, tons	83,109
Mineral produced, pounds	1,982,080
Mass copper, pounds	171,048
Refined copper, pounds	1,300,562
Value of yield	$219,442
Loss	52,441
Surplus	35,071

The condition of the mine generally is improving.

MISSOURI

Jasper County

The total production from the district for the year, to date, shows Webb City to be well in the lead both in the output of zinc sulphide and galena. It shows an output of about 42,000 tons of blende and 10,000 tons of lead. Joplin is second in zinc sulphide production with 30,000 tons, but Miami, Oklahoma, takes second place in lead ore production with 3600, compared to Joplin's 3400 tons. Granby is by far the heaviest calamine producing camp, with an output of 4300 tons, while Duenweg is second with 1000 tons, and Spring City is third with 800 tons. The production of zinc sulphide, calamine, and galena ores from the Missouri-Kansas-Oklahoma district is as follows: zinc-blende, 127,087 tons, worth $5,584,786; lead, 21,636 tons, worth $1,123,742; also, from the silicate mines, 380 tons of zinc worth $8639, and 8288 tons of lead valued at $254,881.

MONTANA

Lincoln County

(Special Correspondence.)—Shanahan & Blakely, who have a contract for driving a drift on the vein in the Shaughnessy Hill mine, eight miles southwest of Libby, report that the entire face of the drift is in good lead-silver concentrating ore. The property is owned by the Hazel T. Mining Co., which has prosecuted development

work for over a year. Preliminary work has been started at the Howard placers, situated about 20 miles south of Libby, The placers have been leased to Charles F. Muffley, a state senator, who expects to start a force of men working soon.

Libby, June 13.

SILVERBOW COUNTY

(Special Correspondence.)—The mines of the Anaconda Copper Mining Co. are all working at a normal pace, and the amount of ore being hoisted and sent to the smelters would seem to indicate that the big copper producing organization is satisfied that there is no necessity for any curtailment, notwithstanding the unsettled condition of the market at the present time. The production during June will be between 25,500,000 and 26,000,000 lb., unless something unforseen occurs during the last few days of the month. The Washoe smelter at Anaconda is receiving on an average 13,000 tons of ore per day, and about half that amount is going to the Great Falls smelter. The Anaconda company will be shipping its ore to the Washoe smelter by electricity not later than October 1. The work of electrification is well advanced. At the present time the steam locomotives are a thing of the past in the yards of the Butte, Anaconda & Pacific railroad.

Butte, June 20.

NEVADA

ELKO COUNTY

The Ely Consolidated company, of White Pine county, is shipping ore from its claims in the Merrimac district, 30 miles north of Elko. The Copper Queen section produces 7.3% copper ore with some silver and gold. The cost of teaming is excessive. The auto-truck is being tested to determine whether it can move the product as economically as a traction engine. If the trial is satisfactory, a freight line of auto-trucks will be established. If not, the slower but more powerful traction engines will be substituted for mules. The suspension of work by this company at Ely is attributed to the difficulty encountered in reaching an agreement with the railroads upon the freight tariff to Salt Lake smelters. Although not operating, the mines are being kept unwatered by a neighboring company.

HUMBOLDT COUNTY

The total production of Rochester to date is 2450 tons, yielding $85,750. The Esperanza and Crown Point claims have been acquired by Tonopah people.

LYON COUNTY

The annual report of the Nevada-Douglas Copper Co. for the year ended December 31, 1912, states that the gross revenue was $824,891, operating profit $434,814, and net profit $270,157. It has been practically decided to erect a plant containing a leaching process to cost $200,000.

NYE COUNTY

May production of mines at Tonopah was 49,799 tons of ore, valued at $989,740. Individual returns were as follows:

	Tons.	Value.	Profit.
Belmont	15,590	$289,778	$181,281
Tonopah	14,954	194,225	92,292
West End	4,236	.....	34,591

During the week ended June 21, ten mines produced 11,111 tons of ore worth $243,290. On No. 14 level of the Belmont, the vein is 20 ft. wide. The Willow Creek Mining Co., which has six claims at Willow Creek, 98 miles northeast of Tonopah, is now controlled by George Wingfield of Goldfield. The property was examined by Fred J. Siebert, K. M. Simpson, and Albert Burch. High-grade silver ore has been opened.

STOREY COUNTY

The Ophir cyanide plant, treating old Comstock tailing, treated 2480 tons in May, yielding silver bullion valued at $12,310. The net profit was $8174. Recoveries were 91.35% of the gold and 73.88% of the silver.

NEW MEXICO

SOCORRO COUNTY

Frank H. Hitchcock, former postmaster-general of the United States, and E. A. Wayne have acquired a controling interest in the Ernestine Mining Co. and the Colonial Mining Co., operating the Last Chance and Maud mines at Mogollan. The former is the largest gold and silver mine in this state. The new power-plant, containing De la Vergne oil-engines of 530 hp., has been started and is highly efficient.

OKLAHOMA

WASHINGTON COUNTY

The Bartlesville *Enterprise* states that it is probable that a large smelter will be erected there soon, using gas from the local fields.

OREGON

BAKER COUNTY

Estimates for this year's gold production from mines in the county are as follows: Ben Harrison, $300,000; Rainbow, $250,000; Cornucopia, $250,000; Columbia, $240,000; Highland, $180,000; Humboldt, $120,000; Sumpter gold dredge, $300,000; and placers and small quartz mines, $350,000; making a total of $1,990,000. The Oregon-Washington Railroad & Navigation Co. in the recent reductions on ore from Baker to Tacoma established the following new rates: when valuation does not exceed $25 per ton, $3.50; and when valuation does not exceed $45 per ton, $4.25 per ton. This represents a material reduction from the old rate of $5.50 where valuation does not exceed $200 per ton, which rate still remains in effect as to high-grade ores.

TENNESSEE

KNOX COUNTY

The American Zinc Co. will install in its plant at Mascot considerable new electrical machinery. This will consist of two 25-kva. motors, one 200-kw. generator, two 1200-kw. generators, nine motors ranging from 20 to 150 hp., and switchboard apparatus. The order for all the apparatus for this electrical equipment has been placed with the General Electric Company.

UTAH

SUMMIT COUNTY

(Special Correspondence.)—A contract has been let to the Williams Contracting Co. to drive the Snake Creek

MAP OF UTAH.

tunnel 9000 ft. This will serve as a drainage and prospecting adit for the southwestern and western portion of the Park City mining district, and a portion of the East Alta district. The tunnel will be 9.3 ft. wide and 6.5 ft. high,

above the tramline, both in the clear; and on the right-hand side will be a ditch 3.5 ft. deep and 4 ft. wide. Preparatory work has been finished, and on July 1 actual driving will commence.

Midway, June 19.

A judgment ordering the payment of $758,953.94 damages, with interest and costs, making a total of over $1,000,000, by the Silver King Coalition Co. to the Silver King Consolidated Co. was made by the United States District Court on June 23. The judgment followed the refusal of the United States Supreme Court to review the case. The 1000-ft. level of the American Flag has opened high-grade ore. The vein is from 6 to 60 in. wide, and samples have given: lead, 7.30 to 21.80%; silver, 33.10 to 41.40 oz.; and gold, $11.20 to $22.80 per ton.

UTAH COUNTY

The Santaquin King mine, in the Santaquin district, is being examined by an engineer. The ore contains lead, gold, and silver.

WASHINGTON

OKANOGAN COUNTY

It is probable that the Lone Star mine near Conconully will be reopened after a shut-down of 15 years. The shaft is down 354 ft., but the surface equipment was destroyed by fire. The ore is principally silver-lead, averaging $30 per ton.

WYOMING

NATRONA COUNTY

(Special Correspondence.)—There is considerable activity at the Salt Creek oilfield. All new development is on the west side of the district, on the syncline, where two good wells were brought in, in the shales above the Wall Creek sandstone. This is outside of the government withdrawals. The Midwest Oil Co. is enlarging its fine plant at Casper.

Douglas, June 17.

The Midwest Oil Co. has been declared by Judge Riner, of United States District Court of Wyoming, to have a clear title to $30,000,000 worth of land in the Salt Creek oilfield. The title was attacked by the Government in order to test the validity of right of the company to hold the land. A test suit was filed several months ago by the Government declaring that the oil company was trespassing on government property. The Government demanded that the company surrender a 160-acre tract which was part of a vast tract in Salt Creek valley which was withdrawn from entry by the secretary of the interior, J. R. Garfield. Subsequent to this action President Taft withdrew land from entry by proclamation, and later Congress passed an act authorizing the President and Secretary of the Interior to make withdrawal. In the meantime the company was developing its holdings. Judge Riner held that actions of Mr. Taft and Mr. Garfield were illegal, regardless of congressional approval, because the Midwest company had located its claims in good faith. While the Government sought to recover only 4000 acres of land in this suit, the issues involved covered thousands of acres of other California and Wyoming lands withdrawn by the President's order of 1909, which was designed to conserve the country's oil resources. It is thought in Washington that attorney general McReynolds will appeal from the decision.

CANADA

BRITISH COLUMBIA

The adit being driven in the Payne mine of the Slocan-Payne Mining Co., in the Slocan district, is now in 1600 ft. Surveys show that a total of 3400 ft. will have to be driven to cut the shoots opened in the upper levels. The Hedley Gold Mining Co. has paid a dividend amounting to $60,000, being the second this year. Broken ore in the mine stopes amounts to 23,000 tons.

ONTARIO

Forty stamps are dropping at the Goldfields Limited plant at Larder Lake, about 80 tons per day going over the plates to the tables. Tube-mills have been ordered and a cyanide plant will be installed which will raise the capacity of the plant materially. The gold is being recovered by amalgamation only at present. Power comes from the Raven Falls hydro-electric plant, 11 miles away. All the ore is coming from the open-cut at the 60-ft. level.

Owing to power troubles, the Hollinger mill worked only 49% of the possible time in May. There was 6550 tons of ore treated, averaging $17.53 per ton, with 95% recovery. Costs were: mining, $4.48; milling, $2.28; development, 74c.; and the total was $9.28 per ton. The Dome Mines Co. has decided not to increase its capital, but to finance equipment extensions out of current profits.

The annual report of the Buffalo Mines, Ltd., for the year ended April 30, 1913, shows the following:

Ore reserves, increase of 53,330 tons, containing 1,719,900 oz. silver.

Ore milled on property tons	55,783
Silver recovered by concentration, ounces	2,112,684
Silver recovered by cyanidation, ounces	119,160
Total income	$1,390,900
Expenditure	499,707
Net profit	$891,192
Dividends	650,000
Surplus at April 30, 1913	623,028

Prospects for the current year are satisfactory, and a considerable tonnage of ore should be opened on the veins in the Nancy Helen workings.

YUKON

W. G. Weigle, forest supervisor of the Tongrass timber reserve, which embraces practically all the available timber from Portland Canal to Skagway, states that the current year promises to be a record one for the lumber business. The estimates of timber that will be cut are about 65,000,000 feet.

KOREA

The Belgian consul at Seoul states that the mining industry of Korea, which includes gold, copper, iron, lead, silver, graphite, and coal, has received a further impetus by reason of the recent discovery of zinc deposits in the mountainous country around Yen Ben, province of Pyeng Yang. A concession for developing these deposits has been secured by a Japanese company, and mining has already begun. It appears that during September (the first month of working), 1000 tons of ore was obtained. Unfortunately, the mines are situated in places not easily accessible, and the cost price of the mineral delivered at works is consequently enhanced. Road construction is, however, being actively proceeded with, and it is anticipated that improved transport facilities will eventually greatly stimulate this and other mining industries in Korea.

MEXICO

SONORA

(Special Correspondence.)—The mills of the Tigre Mining Co., during May, crushed 1230 and 4559 tons of ore, and treated 5579 and 2006 tons of current and dump tailing, respectively. The production was $142,744 from shipping ore, concentrate, and mill bullion. Mining, milling, taxes, marketing, and general expenses totaled $82,477, leaving a profit of $60,297. The old mill was shut down on May 15; the stamp-mill in future will treat all the ore formerly treated in both mills.

El Tigre, June 20.

At Cananea, one section of the concentrator, four furnaces, and two converters are in operation, or about 50% capacity. El Temblor mine, 15 miles from El Tigre, has been leased to W. L. Rynerson for another year. High-graders have opened very rich ore for the owners of the Red Top mine, five miles from Nacozari.

WESTERN AUSTRALIA

A gold nugget weighing 168.5 oz. was recently found near Meekatharra in the Murchison district. The Bullfinch company, near Southern Cross, was retorting amalgam early in May, when two robbers held up those in charge and secured $15,000 worth of gold.

Personal

Professional men are invited to send news of their engagements and travels. Such news is interesting to friends.

S. B. CHRISTY is in New York.

C. M. EYE is in San Francisco.

C. T. DURELL is at Los Angeles.

C. A. FISHER is at Casper, Wyoming.

R. B. MORAN is at Casper, Wyoming.

GEORGE R. STEVENS is now at Bakersfield.

J. PARKE CHANNING was in San Francisco.

WILLIAM SHARP is now at Yerington, Nevada.

J. F. THORNE is leaving for the Copper River country.

F. W. BRADLEY left Kellogg, Idaho, for Juneau on June 14.

J. J. BLOW has been in San Francisco returning from Australia.

D. F. DON, formerly of St. Francois, Missouri, is now at Magdalena, New Mexico.

D. W. BRUNTON was in San Francisco returning to Denver from British Columbia.

J. W. NEILL has been examining the placers of Ocean beach in southwestern Oregon.

FRANCIS DRAKE is now general manager for the Lonely Reef G. M. Co., Ltd., in Rhodesia.

H. W. HARDINGE sailed from New York on the *Olympic*, June 14 for a general business tour of Europe.

B. BRITTON GOTTSBERGER is expected to resume his duties as manager for the Miami Copper Co., on July 15.

C. B. BRODIGAN has been appointed manager for the Roodepoort United Main Reef G. M. Co. Limited.

SPANGLER RICKER is with the Amajac Mining Co., in the Hostotipaquillo district in the state of Jalisco, Mexico.

C. P. BROWNING is connected with the Britannia Mining & Smelting Co., at Britannia Beach, British Columbia.

T. J. SINGEWALD, JR., will examine methods of ore treatment at Silverton, Colorado, for the U. S. Bureau of Mines.

FRED SEARLES is at Pioche and will go to Toronto to attend the meeting of the International Geological Congress.

I. D. D. DAIMPRE has joined the staff of the Dominion Nickel-Copper Co., Sudbury, which is planning a 2000-ton smelting plant.

Obituary

CARL RICE, superintendent for the Superior & Boston company, died June 14 and was buried at Houghton, Michigan.

CHARLES F. HOFFMANN, who died at his home in Oakland, California, Friday of last week, was one of the older generation whose work was perhaps less well known to younger men than it deserved. Born at Frankfort on the Main in 1838, he was one of the pioneer engineers of the Pacific coast, and in particular he was a large factor in laying the foundation of American supremacy in topographic surveying. Trained at Freiberg, he obtained his first practical experience as topographer of the Lander's expedition and J. D. Whitney found him in California, 24 years of age and eager for a new task, when the California Geological Survey was organized. As a member of its staff he was associated with excellent men, Whitney, King, Brewer, Ashburner, Gabb, and others whose names are now well known. Then they were all young and with reputations still to make. Whitney ranked Hoffmann with Brewer as the best of his staff, and he placed in his hands all the topographic and cadastral work of the survey. As a result, Hoffmann was the engineer who developed the methods that have proved of such wide usefulness. He was able to reconcile the accuracy of engineering to the conditions under which geologists must work, and combined a well controlled base with sketched detail. It was this that Clarence King took from the California survey into government work, though in time a change was made from the German system of hachuring to contour sketching. Hoffmann deserves the credit of being the engineer back of this important development of method, one that has been widely influential in the rapid and sound development in the West. Incidentally, he made, in 1863, the first large map of San Francisco bay, and Whitney was deservedly enthusiastic over it. After the disbanding of the California survey corps, Hoffmann spent two years as a professor at Harvard and then turned to mining, and he was for many years associated especially with gravel mining in this state. He examined and reported on many of the more important properties of the Pacific coast from Alaska to Mexico and also made pioneer studies in Siberia and the Argentine. Later he engaged in actual operation. For years he was engineer and manager at the Red Point mine in Calaveras county, long the largest drift mine in the state. His four sons, George, Jack, Karl, and Ross, have all followed him in the profession and in South Africa, Mexico, and Siberia, as well as in North America, have played and are playing honorable parts in the work of the profession to which their father devoted three-quarters of a century. Ross Browne, his brother-in-law and close business associate, summed up his career most appropriately as follows: "Charles Hoffmann was one of the best known mining engineers of his time, both at home and abroad. He was an excellent judge of values and a man of unquestioned integrity. He leaves behind him the respect of all who knew him, and the far reaching influences of an upright and honorable life. Not one among us who will not feel that there is something missing in the world without dear old Charles T. Though we see him no more, he will always live in our hearts. What better may be said of the best of men?"

WILLIAM PENN MILLER, who died June 14 at his home in San Francisco after a lingering illness, was one of the most widely known mining engineers of the Pacific coast. Born in Philadelphia in 1837, he obtained his engineer's degree from the Polytechnic College of Pennsylvania in 1856, and he engaged for a few years in the anthracite coalfields of Pennsylvania, where his father was a pioneer operator. In 1861 he came to California and entered upon a career filled with excitement and adventure, which carried him into every mining district of note throughout the Pacific coast. In the early days of the Central Pacific railroad, Mr. Miller became connected with that enterprise as contracting engineer and division superintendent. In 1871 he went to Arizona, where, after considerable success with various mines and against various Apaches, he discovered and developed the rich lead-silver mines of Castle Dome, which he operated successfully until, in 1880, associated with the late William P. Blake, he organized a company in New York to take over the mines and establish a smelting and refining plant at Melrose, California, of which plant he was manager during the life of the company. During Mr. Miller's individual operation of the Arizona properties he established, about 1874, a small smelting furnace at Sixth and Berry streets, San Francisco, as the only means of avoiding the prohibitive tariff imposed by the one operating smelter. During his experience with Castle Dome ores, Mr. Miller developed and put into successful use the present form of inverted siphon for connecting furnace crucible and outer lead-well. The past 25 years of Mr. Miller's life, previous to his illness, were devoted to active work as examing and consulting engineer in the various fields of mining and metallurgy, during the course of which work he added largely to the general store of knowledge of mining geology and vein formation, and the treatment of ores. In 1891, during the infancy of the cyanide process, appreciating its possibilities as a means for recovering gold and silver from the then obnoxious 'slime,' after exhaustive laboratory work and experimenting, he was granted patents covering the application of agitation and filtration to slime treatment. Owing to lack of economically operated filtering appliances, such as have since been evolved, he was unable at that time to put into practical operation one of the greatest factors in the evolution of modern metallurgy.

The Metal Markets

LOCAL METAL PRICES

San Francisco, June 26.

Antimony	12—12¾c	Quicksilver (flask)	$41
Electrolytic Copper	16—16¼c	Tin	50—51¼c
Pig Lead	4.60—5.55c	Spelter	7—7¼c

Zinc dust, 1400 lb. casks, per 100 lb., small lots $9.50—9.75; large $7.50—8.50

EASTERN METAL MARKET

(By wire from New York.)

NEW YORK, June 26.—The metal markets here have been featureless and prices remain practically unchanged. London figures for today are cabled as follows: Copper easy; spot £64, off 5s.; futures, £64 7s., off 5s.; sales, spot, 250 tons. Tin weak, spot, £198 10s., off £2 15s. Spelter, £21, up 5s. Gold exports for the first 11 months of the fiscal year amounted to $6,000,000 less than for the same months of last year. The Treasury yesterday showed a total general fund of $139,726,429. The surplus for the fiscal year to date is $15,477,272, as against $6,850,393 in 1912.

SILVER

Below are given the average New York quotations, in cents per ounce, of fine silver.

Date.		Average week ending	
June	19 ....58.37	May	14....60.25
"	20....58.12	"	21....60.66
"	21....58.25	"	28....60.08
"	22 Sunday	June	4....59.99
"	23....58.00	"	11....59.75
"	24....57.75	"	18....59.08
"	25....58.25	"	25....58.12

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	56.25	63.01	July	60.67	....
Feb.	59.06	61.25	Aug.	61.32	....
Mch.	58.37	57.87	Sept.	62.95	....
Apr.	59.20	59.26	Oct.	63.16	....
May	60.88	60.21	Nov.	62.73	....
June	61.29	....	Dec.	63.38	....

LEAD

Lead is quoted in cents per pound or dollars per hundred pounds, New York delivery.

Date.		Average week ending	
June	12.... 4.33	May	7.... 4.40
"	13.... 4.33	"	14....4.33
"	14.... 4.33	"	21....4.33
"	15 Sunday	"	28....4.33
"	16.... 4.33	June	4....4.33
"	17.... 4.33	"	11....4.33
"	18.... 4.33	"	18....4.33

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	4.43	4.28	July	4.71	....
Feb.	4.03	4.33	Aug.	4.54	....
Mch.	4.07	4.32	Sept.	5.00	....
Apr.	4.20	4.36	Oct.	5.08	....
May	4.20	4.34	Nov.	4.91	....
June	4.40	....	Dec.	4.20	....

ZINC

Zinc is quoted as spelter, standard Western brands, St. Louis delivery, in cents per pound.

Date.		Average week ending	
June	12.... 4.90	May	7....5.31
"	13.... 4.90	"	14....5.28
"	14.... 4.90	"	21....5.28
"	15 Sunday	"	28....5.19
"	16.... 4.90	June	4....5.11
"	17.... 4.90	"	11....4.94
"	18.... 4.90	"	18....4.90

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	6.42	6.88	July	7.12	....
Feb.	6.50	6.13	Aug.	6.96	....
Mch.	6.57	5.94	Sept.	7.45	....
Apr.	6.63	5.52	Oct.	7.36	....
May	6.68	5.23	Nov.	7.23	....
June	6.88	....	Dec.	7.09	....

COPPER

Quotations on copper as published in this column represent average wholesale transactions on the New York market and refer to electrolytic copper. Lake copper commands normally from 1-5 to 1-4c. per lb. more. Prices are in cents per pound.

Date.		Average week ending	
June	12....14.75	May	7....15.30
"	13....14.70	"	14....15.54
"	14....14.70	"	21....15.50
"	15 Sunday	"	28....15.42
"	16....14.70	June	4....15.18
"	17....14.70	"	11....14.79
"	18....14.70	"	18....14.70

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	14.09	16.54	July	17.19	....
Feb.	14.08	14.93	Aug.	17.49	....
Mch.	14.68	14.72	Sept.	17.56	....
Apr.	15.74	15.22	Oct.	17.32	....
May	16.03	15.42	Nov.	17.31	....
June	17.23	....	Dec.	17.37	....

COPPER SURPLUS

Figures showing the visible supply of copper at the beginning of each month are now widely available. Below are given the amounts, in pounds, known to be available at the first of each of certain months. The figures are those of the Copper Producers' Association supplemented by Merton's figures of foreign surplus.

		U. S.	European.
July	1912	44,335,004	107,817,920
August	"	50,281,280	113,285,760
September	"	46,701,376	112,743,680
October	"	63,065,587	107,396,800
November	"	76,744,967	103,803,840
December	"	86,164,059	96,949,440
January	1913	105,311,360	96,859,840
February	"	123,198,352	100,067,520
March	"	122,302,198	95,542,720
April	"	104,269,270	106,565,760
May	"	75,549,108	102,654,720
June	"	67,474,225	93,378,880

UNITED STATES PRODUCTION AND CONSUMPTION

		Production.	Domestic deliveries.	Exports.
May	1912	126,737,836	72,702,237	69,485,945
June	"	122,315,240	65,146,229	61,449,650
July	"	137,161,920	71,093,120	60,121,600
August	"	145,628,521	78,722,418	70,485,150
September	"	140,089,819	63,460,810	60,264,796
October	"	145,405,453	84,104,734	47,621,342
November	"	134,695,440	69,369,795	55,906,550
December	"	143,353,280	58,490,880	65,712,640
January	1913	143,479,625	65,210,030	60,383,845
February	"	130,948,881	59,676,402	72,168,623
March	"	136,251,849	76,585,471	77,699,306
April	"	135,333,402	78,158,837	85,894,727
May	"	141,319,416	81,158,800	68,286,007

QUICKSILVER

The primary market for quicksilver is San Francisco, California, being the largest producer. The price is fixed in the open market, and, as quoted weekly in this column, is that at which moderate quantities are sold. Buyers by the carload can usually obtain a slight reduction, and those wanting but a flask or two must expect to pay a slightly higher price. Average weekly and monthly quotations, in dollars per flask of 75 lb., are given below:

Week ending			
May	29....41	June	12....41
June	5....41	"	19....41
		"	26....41

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	43.75	39.37	July	43.00	....
Feb.	46.00	41.00	Aug.	42.50	....
Mch.	46.00	40.20	Sept.	42.12	....
Apr.	42.25	41.00	Oct.	41.50	....
May	41.75	40.25	Nov.	41.50	....
June	41.30	41.00	Dec.	39.75	....

TIN

New York prices control in the American market for tin, since the metal is almost entirely imported. San Francisce quotations average about 5c. per lb. higher. Below are given average monthly New York quotations, in cents per pound:

Monthly averages.

	1912.	1913.		1912.	1913.
Jan.	42.53	50.45	July	44.25	....
Feb.	42.96	49.07	Aug.	45.80	....
Mch.	42.58	46.95	Sept.	48.64	....
Apr.	43.92	49.00	Oct.	50.01	....
May	46.05	49.10	Nov.	49.92	....
June	45.76	....	Dec.	49.80	....

The output of the Federated Malay States in May was 66,929 pikuls of 133.3 lb. each, the year's total so far being 321,692 pikuls. Arrivals of tin ore from Bolivia in May were as follows: at Liverpool, 1559 tons, equal to 935 tons metallic tin; at Hamburg, 881 tons, or 529 tons metallic; and at Havre, 37 tons, or 22 tons metallic, a total of 1488 tons fine. The Dolcoath tin mine, Cornwall, treated 8400 tons of ore in May for a recovery of 136 tons of black tin. The Tronoh mines, Federated Malay States, produced 162 tons of black tin, valued at $102,000, making a profit of $43,000. Sale of tin concentrate at Redruth in 1912 amounted to 6492 tons. To the end of May of this year the amount had been 2690 tons. The price May 26 was £132 3s. 8d. Prices of current date are given elsewhere. To the close of May, total Straits shipments to Europe and America had been 25,942 tons, and from Bolivia, 9304, as against 59,036 and 21,149, respectively, in the whole of 1912.

The Stock Markets

SAN FRANCISCO STOCKS AND BONDS.

(San Francisco Stock and Bond Exchange.)

BONDS.

Listed.	Closing prices, June 25.
Associated Oil 5s	99⅛
E. I. du Pont 4½s	83½
Natomas Con. 6s	90
Unlisted.	
Associated Oil 1st ref	80
General Petroleum 6s	55½

Unlisted.	Closing prices, June 25.
Natomas Dev. 6s	94
Pacific Port. Cement 6s	99
Riverside Cement 6s	77
Standard Cement 6s	91½
Santa Cruz Cement 6s	80
So. Cal. Cement	70

STOCKS.

Listed.	Closing prices, June 25.
Associated Oil	38⅛
Amalgamated Oil	79½
E. I. du Pont Powder pfd	88
Pacific Coast Borax, pfd	90½
do com	—
Pacific Crude Oil	35c
Sterling O. & D	1.10
Union Oil of Cal	73½
West Coast Oil, pfd	90

Unlisted.	Closing prices, June 25.
Mascot Copper	1½
Noble Electric Steel	3
Natomas Consolidated	11½
Pacific Coast Borax, old	—
Pacific Portland Cement	59
Riverside Cement	45
Standard Cement	17
Standard Oil of Cal	—
Santa Cruz Cement	87½

NEVADA STOCKS

(By courtesy of San Francisco Stock Exchange.)

San Francisco, June 26.

Atlanta	$ .15	Mizpah Extension	$ .62
Belmont	6.12	Montana-Tonopah	1.10
Big Four	.42	Nevada Hills	.95
Buckhorn	1.30	North Star	.91
Con. Virginia	.05	Ophir	.18
Florence	.37	Pittsburg Silver Peak	.48
Goldfield Con	1.80	Round Mountain	.49
Goldfield Oro	.13	Sierra Nevada	.13
Halifax	1.40	Tonopah Extension	1.95
Jim Butler	.74	Tonopah Merger	.63
Jumbo Extension	.18	Tonopah of Nevada	6.00
MacNamara	.17	Union	.07
Mexican	.67	West End	1.25
Midway	.44	Yellow Jacket	.22

COPPER SHARES—BOSTON

(By courtesy of J. C. Wilson, Mills Building.).

	June 26. Bid	Ask
Adventure	$ 1⅛	1¼
Allouez	30	31
Calumet & Arizona	59½	59¾
Calumet & Hecla	410	415
Centennial	10	11
Copper Range	39	39½
East Butte	9¼	10
Franklin	5¼	5½
Granby	53	54
Greene Cananea	5⅞	6
Hancock	14¾	15¼
Isle-Royale	18⅛	18½
Mass Copper	2½	3

	June 26. Bid	Ask
Mohawk	$ 44	45
North Butte	24	24¼
Old Dominion	42	43
Osceola	75	78
Quincy	56½	57
Shannon	7	7⅛
Superior & Boston	2	2¼
Tamarack	23	23½
U. S. Smelting	36	36½
Utah Con	7⅛	7⅜
Victoria	99c	1
Winona	1⅛	1¼
Wolverine	44	44½

NEW YORK QUOTATIONS

(By courtesy of E. F. Hutton & Co., Kohl Building.)

June 26.

	Bid.	Ask.
Alaska Mexican	8¼	8½
Alaska Tread	36½	38½
Alaska United	18⅜	19⅛
Alaska G. M.	10⅛	10½
Braden Copper	6½	6⅝
B. C. Copper	2	2¼
Davis-Daly	1⅞	2⅛
Dolorea	2	4
El Rayo	1	2
Ely Con.	7	9
First Nat.	1¾	2
Giroux	1⅜	1½
Greene Can.	5⅞	6⅛
Hollinger	15½	17
Kerr Lake	3⅛	3¼
La Rose	2⅜	2½

	Bid.	Ask.
Mason Valley	5½	6
McKinley-Dar.	1⅝	1¾
Miami 6s	168	173
Mines Co. Am.	2½	2⅝
Nipissing	8⅞	9
Ohio Copper	⅝	¾
San Toy	20	23
Sioux Con.	2	4
S. W. Miami	5	7
So. Utah	¼	⅝
S. O. Calif.	169	171
Tri Bullion	⅛	¼
Tuolumne	2	2⅛
United Copper	..	⅛
Wettlaufer	10	12
Yukon Gold	2¼	2½

LONDON QUOTATIONS

(By cable, through the courtesy of Catlin & Powell Co., New York.)

	June 26. £	s.	d.
Alaska Mexican	1	17	6
Alaska Treadwell	7	17	6
Alaska United	3	17	6
Arizona	1	17	6
California Amalg	0	3	9
California Oilfields	4	0	0
Camp Bird	0	15	0
El Oro	0	15	0
Esperanza	0	18	9
Granville	0	7	6

	June 26. £	s.	d.
Kern River Oilfields	0	5	0
Mexico Mines	5	12	8
Messina	1	8	9
Oroville	0	6	3
Pacific Oilfields	0	2	6
Rio Tinto	72	5	0
Santa Gertrudis	1	1	3
Stratton's	0	2	6
Tanganyika	2	3	9
Tomboy	1	7	6

AUSTRALIAN

	June 26. £	s.	d.
British Broken Hill	2	0	0
Broken Hill Props	1	16	9
Golden Horse-Shoe	2	16	9
Great Boulder Props	0	13	9
Ivanhoe	2	17	6
Kalgurli	2	1	3

	June 26. £	s.	d.
Mount Boppy	0	12	6
Mount Elliott	0	12	6
Mount Lyell	1	3	9
Mount Morgan	3	7	6
Waihi	1	15	0
Waihi Grand Junc	0	17	6

CURRENT PRICES FOR CHEMICALS

The Roessler & Hasslacher Chemical Co., of New York, report as follows under date of June 12. As the year progresses, the certainty of a satisfactory result seems secure. Even considering the disturbances and inconveniences of the pending tariff change we look forward to, the good prospects of the country's crops overshadow the same and give every assurance for a prosperous year. There has been little of note in our line of chemicals during the past four weeks, no unlooked for events have occurred and the previously reported tendencies in a number of our items remain the same. The only quotable change took place in tin oxide, the weaker metallic tin market causing a drop in the price of the oxide to 50c. per pound, and unless a reaction takes place in the price of the metal, a further drop in the price of the oxide will result. Prices of chemicals, etc., of interest to the mining industry are as follows:

Alum, chrome, casks of 900 lb., per lb	$0.05
Ammonia, anhydrous, cylinders of 100 lb., per lb	0.30
Ammonium, sulphocyanide, commercial, barrels, 300 lb., per lb	0.25
Antimony, needle, fine powder, in barrels, per lb	0.05
Arsenic, white powder, barrels, 500 lb., per lb	0.05
Chromic acid, crude, tins, 50 lb., per lb	0.24
Cobalt oxide, black, tins, 10 lb., per lb	0.90
Cyanide, potassium, 38.4% cyanogen, cases 224 lb., per lb.	0.24
Cyanide, sodium, 51 to 52% cyanogen, cases 100 and 200 lb., per lb	0.26
Cyanide, mixture, 39.5% cyanogen, cases 112 lb., per lb.	0.21
Lime, chloride (bleaching powder), electrolytic, iron drums or casks, per lb	0.0175
Oxalic acid, in casks, per lb	0.085
Potash, carbonate, calcined, 80 to 85% in casks, per lb.	0.04
Potash, carbonate, 99 to 100% in casks, per lb	0.06
Potash, caustic, 90% KOH, fused in drums, 560 lb., per lb.	0.06
Potash, permanganate, large crystals, cylinders 112 lb., per lb.	0.16
Zinc dust, barrels 1600 lb., per lb	0.08

PHILIPPINE STOCKS

The share report of Birkett & Holden, Manila, issued on May 5, states that there has been increased speculation and investment, and there is more disposition to enter into new enterprises. The following is the status of some of the companies as presented in the report:

	Closing quotations.	Issued value.
Benguet Consolidated	₱ 0.25	₱ 2
Colorado Mining	21.00*	10
Gumaos Placer	50.00	10
Headwaters Mining	5.00*	10
Keystone Mining	12.50	10
Malaguit Dredging	10.00	10
Paracale River Dredging	16.00†	10
Philippine Exploration	10.00	10
Philippine Gold Dredging:		
Ordinary shares	8.00†	10
Preferred shares	18.00†	10
Syndicate Mining	70.00	100
Paracale Gold Dredging	£7	£1

*Sellers. †Buyers.

METALS IN TEXAS IN 1912

The value of the mine output of gold, silver, copper, lead, and zinc in Texas in 1912, according to Charles W. Henderson, of the United States Geological Survey, showed an increase, compared with the yield in 1911, of $66,132.

Aluminum Industry in Switzerland

The Swiss aluminum industry made rapid progress during 1912, the export value being $2,681,260, compared with $1,303,143 in 1911, an increase of over 100%. The decrease in the price of the metal in recent years has encouraged the use of aluminum in the manufacture of a great variety of novelties and articles of utility. The latest utilization of aluminum is for automobile accessories, large quantities of which have been manufactured within the past year by the Swiss factories. These articles find a ready market in the United States, and the records for last year show a considerable trade in that line. Kitchen utensils and various kinds of containers for water, milk, and other liquids constitute the principal articles produced by the Swiss concerns. In addition to these, however, the production includes a great variety of articles classed as novelties. There are nine aluminum factories in Switzerland, the total products of which last year amounted to approximately $5,000,000 in value. There was a good export demand for the wares, and during most of the year prices were good, resulting in large profits to the manufacturers. At the beginning of 1912 a combination was formed by the manufacturers for the purpose of maintaining prices and controlling the output and for the promotion of the export trade.—*Consular Report.*

James Lewis & Son's Copper Report

Standard copper advanced from £67 for cash on May 1 to £70 on the 13th, and receded to £68 12s. 6d. on the 15th, recovering to £69 5s. on the 16th, falling to £68 8s. 9d. on the 20th, and advancing again to £69 on the 21st. From this point there was a gradual decline to £67 17s. 6d. on the 30th, when a treaty of peace between Turkey and the Balkan states was signed, three months prompt selling at £67 12s. 6d. On June 2 there was a further fall to £66 15s. cash and £66 12s. 6d. for three months, these being the closing values. The value of cash has been sustained by the concentration of warrants in a few hands, and relatively high prices have been paid for it to provide for prompts falling due. Very little desire has been shown to buy copper on speculation, and except for the manufacture of sulphate of copper, the demand from the trade has lately been limited. With the approaching close of the active season for using sulphate, the consumption of copper for this purpose will fall off materially. Sales for the month amount to about 32,000 tons. After considerable sales of electrolytic copper by American refiners at £72 10s. per ton c.i.f., they raised the price to £73 10s., at which but few sales have been made, £72 10s. being accepted for second-hand lots. Manufacturers, being fully supplied, are now mostly out of the market. American exports for May are advised as 38,251 tons; but about 5000 tons of this has already figured in the refiners' returns for April as deliveries destined for export.

The official German returns for the first four months of this year give the imports as 72,819 tons, against 70,791 tons in the same period last year, and the exports as 3650 tons, against 3506 tons. Allowing for an increase in stocks this year of 10,509 tons, and a decrease in 1912 of 3279 tons, the home consumption of foreign copper is 58,660 tons, against 70,564 tons, a decrease this year of 11,904 tons. The total consumption of foreign copper in Europe is therefore 122,673 tons this year, against 134,951 tons last year, a decrease of 12,278 tons. Arrivals from January 1 to May 1 of Australian copper in England and Germany are 13,801 tons this year, against 9876 tons last year. The average of the quantity returned as afloat from Australia on the first of each month during this period is only 4920 tons this year, against 6890 tons last year, although the arrivals this year are 3925 tons larger. European stocks have decreased 4391 tons, and the visible supply 4141 tons during the month. Imports into England and France are 9239 tons, and deliveries 6024 tons greater than during the same period last year. The total arrivals in England and France for the month have been 24,253 tons, and the deliveries 25,336 tons fine. The arrivals in England from Chile during the month have been 1381, and the deliveries 1442 tons fine, and from other countries 13,141 and 14,320 tons fine, respectively. The arrivals at Liverpool and in Swansea from the United States have been 3785 tons bars, etc., and 1791 tons ingots, etc., equal to about 5551 tons fine copper; in London 910, and in France 7906 tons fine. The Chile charters for the month are advised as 1600 tons, including 700 tons for the United States. Exports from Chile to May 31 total 15,373 tons fine.

STOCKS OF COPPER (TONS FINE)

	June 1, 1910.	June 1, 1911.	June 1, 1912.	June 2, 1913.
Chilean in—				
Liverpool and Swansea..	13,951	5,530	4,943	3,337
France	725	531	784	451
American in—				
Liverpool and Swansea..	35,614	21,034	5,890	1,728
France	4,910	4,957	3,933	2,270
Sundries in—				
Liverpool and Swansea..	2,147	1,013	503	321
London and Newcastle..	21,449	7,982	4,565	2,703
Birmingham	105	539	516	185
France	576	593	542	659
English in—				
Liverpool and S. Wales..	19,438	21,459	14,212	12,250
Total in England and France	98,915	63,638	35,888	23,904
Sundries in—				
Germany and Holland...	*3,866	17,750	8,002	12,083
Total European stocks.	102,781	81,388	43,890	35,987
Afloat (as advised by mail and cable to date)—				
From Chile	2,200	2,200	1,800	1,700
From Australia	5,700	6,775	6,900	4,000
Total visible supply...	110,681	90,363	52,590	41,687

*Proportion of year's stock.

The Nitrate Industry of Chile

*The Nitrate Committee of Propaganda at Iquique publishes a circular every quarter giving an account of the position of the nitrate industry. Circular No. 59 has just been published, and gives the following information:

There are at the present time 45,281 workmen distributed in the five nitrate districts, namely, Tarapacá, 21,000; Totopilla, 6140; Antofagasta, 8833; Aguas Blancas, 3970; and Taltal, 5438. The workmen still required in these five districts are as follows: 4500 in Tarapacá, 1200 in Tocopilla, 1200 in Antofagasta, 1100 in Aguas Blancas, and 1000 in Taltal; say 9000 men in all.

It is estimated that there are always about 1000 workmen constantly traveling in the nitrate districts.

	†Quintals.
Production in 1912	56,214,140
Production in 1911	54,804,856
Increase	1,409,284
Exports in 1912	54,197,439
Exports in 1911	53,250,327
Increase	947,112
Deliveries for consumption, 1912	54,990,104
Deliveries for consumption, 1911	52,181,477
Increase	2,808,627

†Spanish quintal equals 100 pounds.

The production for 1913 is expected to amount to 60,000,000 quintals, although a decrease is noted of 155,040 tons in the consumption of the months of February and March of the current year.

*Abstract from the *West Coast Leader.*

Company Reports

TONGKAH HARBOUR TIN DREDGING COMPANY, N. L.

This is a Tasmanian company owning a tin-dredging concession of 5350 acres, in the harbor of Tongkah, Puket, on the western side of the Siamese Malayan peninsula, 200 miles north of Penang. Five dredges are at work, and another is being constructed. To the end of September, 1912, 170 acres had been dredged, while the 'ore reserves' are estimated to contain 180,000,000 cu. yd., averaging 2 lb. of tin per cubic yard. During the six months ended March 31, 1913, the results were:

Dredges working, hours	15,479
Quantity handled, cubic yards	1,740,270
Black tin recovered (say 60% Sn), tons	686
Net value of tin	$405,600
Value of ground, cents, cubic yard	23

MASON & BARRY, LTD.

This company was formed in 1878 to acquire the lease on the San Domingos copper and sulphur mine at Mertola, Portugal, just over the border of Spain, and in the same belt of pyrite deposits as the Rio Tinto, Tharsis, and others. The mine had then been worked since 1858. A new lease for 50 years was subsequently acquired. In 1892 and subsequently, the nominal capital was reduced by the return of cash out of profits, the denomination of the shares being gradually reduced from £5 to £1. The present capital is £185,172. The report for 1912 shows that 425,963 tons of pyrite was mined and that the shipments of raw and washed ore were 350,733 tons. No details are given as to the production of copper, or as to the nature of the ore mined and shipped. The accounts for 1912 show a profit of £85,665, out of which £20,000 has been placed to reserve and £64,810 distributed as dividend, being at the rate of 35 per cent.

MT. LYELL MINING & RAILWAY COMPANY, LTD.

This well known company operates mines at Queenstown, and railways from Strahan to Queenstown, Tasmania, and superphosphate works in Victoria, South Australia, and Western Australia. The report covers the half-year ended March 31, 1913. Owing to a disastrous fire and the subsequent flooding of the North Lyell mine, operations were considerably restricted. This part of the property produces the high-grade copper ore, consequently the output was low. The half-year's work may be stated as follows:

Development done in four mines, feet	1,214
Ore reserves:	
Mt. Lyell mine, tons	2,295,232
Copper content, per cent	0.53
North Lyell mine, tons	1,078,384
Copper content, per cent	6.00
Ore for acid works from Mt. Lyell and Chester mines, tons	13,649
Ore and metal-bearing fluxes mined, tons	86,800
Ore smelted, tons	84,833
Average copper content, per cent	1.19
Copper production, pounds	1,650,000
Revenue from copper, gold, silver, railways, and chemical works	$648,000
Net loss on operations	$134,000
Cash, copper, supplies, accounts due, total net	2,372,000
Result of operations to date:	
Copper, pounds	243,330,000
Silver, ounces	10,207,756
Gold, ounces	312,550
Dividends	$13,276,800

TOM REED GOLD MINES COMPANY

This company operates at Oatman, Mohave county, Arizona, and has a capital of 1,000,000 shares of $1 par value each. The report is for the year ended April 1, 1913. The superintendent, S. S. Jones, reports as follows: Early in the year nine additional claims were purchased; three of these were known as the Hartman claims and adjoin the property. For them was paid the nominal sum of $1000. On all of them more or less work has been performed, and in the future development of the property may prove of considerable value. The other six claims are known as the Neglected group, and are about four miles to the north and west of the townsite. This property is improved to a depth of about 400 ft. by a good working shaft and 400 to 500 ft. of adit. On this property the former lessees expended in the neighborhood of $35,000; failing to develop a mine, they did develop what is apparently a large and permanent water supply. The Tom Reed company purchased the property solely on a basis of its value as a source of water, paying therefor $2500. However, these claims merit further investigation, and it is the intention of the present management, at some later date, to prospect further for mineral. The addition of these properties makes the total number of full claims owned by the company 23. Development and mining covered 3498 ft. The bulk of the ore treated during the past year was mined between the 350 and 550-ft. levels, known as No. 3 and 4 stopes on the Tom Reed claim. These shoots produced 31,271 tons, against a total of 43,478 tons from all sources. The continuity of stopes No. 3 and 4 of the fifth to the seventh level has been established by winzes, drifts, and an intermediate level between the 550 and 750-ft. levels. At present the orebody on the seventh level has been opened for a distance of 233 ft. in good milling ore, of about the same average value as that obtained above the fifth level. In stoping on No. 3 shoot it was found that this stope extended over 100 ft. farther east than the drifts showed on the third level. This added area of stoping ground above the third level gives promise of a large tonnage of ore which had not been previously considered. No ore has been stoped on No. 3 and 4 shoots below the 550-ft. level. During the year the drifts on the Olla Oatman claim were extended from the bottom of the 450-ft. level as follows: 208 ft. east and 882 ft. west. Up to the present time no orebodies of workable grade have been found. Owing to the fact that the mineralized zone on the Olla Oatman claim is more than 200 ft. wide in many places, systematic exploration demands that much cross-cutting must be done. This work is now under way. At a distance of 627 ft. west of Olla Oatman shaft, another shaft is being sunk, for ventilating purposes and for the more rapid development of the western portion of the Olla Oatman mineral zone. On the Black Eagle claim an incline shaft has been started on a large body of quartz, which gives promise of yielding ore. This shaft is also near the Aztec group of claims, purchased from George Hartman last summer. The Aztec claims can be prospected from the Black Eagle shaft.

In the crushing department of the mill two Dorr classifiers were installed, for better classification of tube-mill products. To the cyanide department has been added two Dorr thickeners; one before and one after treatment in the agitation vats. Both have accomplished the purpose for which they were intended. In the precipitating department zinc-dust precipitation has been installed. This method has now been in successful operation for two months. The year's work may be summarized as below:

Ore treated, tons	43,478
Tailing treated, tons	12,185
Gold yield from ore	$1,154,559
Gold yield from tailing	$145,381
Net value received	$1,149,180
Average mill recovery, per cent	95.19
Dividends paid	$563,924
Reserve fund at April 1, 1912	$75,000
Reserve fund at April 1, 1913	$165,000
Cash on hand	$47,422
Total production to date	$3,019,570
Total dividends	$1,155,220

Concentrates

Most of these are in reply to questions received by mail. Our readers are invited to ask questions and give information dealing with the practice of mining, milling, and smelting.

CORUNDUM has not been produced in the United States since 1906.

ACCUMULATION of amalgam on copper plates is due to three distinct phases: absorption, adhesion, and accretion.

HYDRO-ELECTRIC POWER in Japan was being generated by 383 concerns having an output of 2,172,891 hp. at the end of 1912.

MINERAL PRODUCTION of Charters Towers, Queensland, during April was valued at $130,000 from about 8000 tons of ore and 7054 tons of tailing.

AN OXY-ACETYLENE JET is useful in cutting large girders instead of using a hack-saw or other methods. Eight-inch steel girders can be cut in three minutes by this means.

ABRASIVE MATERIALS consumed in the United States in 1912 were valued as follows: natural abrasives, $1,576,556; artificial, $1,747,120; and imports, $898,892; making a total of $4,222,568.

CONSUMPTION of gasoline and lubricating oil by a Kelly 1.5-ton auto-truck, was recently tested, showing 1 gal. each for 11 and 350 miles run, respectively. This was with a normal load and on country roads.

EFFICIENCY of centrifugal pumps has been found to be only moderate by the Metropolitan Water Board of London, in actual running conditions with low lifts, the ratio of pump horse-power to indicated horse-power does not exceed 0.5 to 055.

A CIRCULAR SHAFT, 18 ft. diameter, is to be sunk by the Crown Mines, Ltd., Johannesburg. It will take about 14 months to sink 2000 ft., where the 'reef' should be cut. No hoisting will be done at this shaft, its object being mainly for ventilation.

POWER COSTS at Cananea, Mexico, amount to $5.62 per indicated horse-power year, with steam generation and crude oil fuel. Electric power is delivered from a central station to the various hoists and pumps and the surplus is sold to the Democrata and Calumet & Sonora companies.

FILTER CAPACITY is inversely proportional to the amount of clay present in an ore. With roasted ore from the sulphide plants at Kalgoorlie, the capacity of a Ridgway reciprocating filter is 300 tons per 24 hours, while on the kaolin ore at Ora Banda, 40 miles distant, the capacity is only 100 tons per day.

FOR MORE EFFICIENT VENTILATION of the Tom Reed and Ben Harrison mines, Arizona, an exhaust fan was installed at No. 4 shaft of the Tom Reed claim. This fan has a capacity of 40,000 cu. ft. of free air at 1.5-in. water-gauge pressure. This volume of air at the stated pressure suffices to free the mines from noxious gases within one hour after starting the fan. Under natural ventilation six hours was required to accomplish results that were far less satisfactory.

ARTIFICIAL ABRASIVES include carborundum, alundum, and crushed steel. Other abrasives, or rather abrasives with other names, which have appeared on the market during the past few years, are forms of the abrasives named adapted to special uses. Such, for example, are aloxite and samite, forms of carborundum, and carborundum fire sand. The abrasive known as 'corubin,' so far as is known, is not made in the United States, but is a European product. Alundum is finding extended use in the refractory as well as in the abrasive industry. The production of artificial abrasives in the United States, according to the United States Geological Survey, during 1912 was 29,002,000 lb., valued at $1,747,120.

BROMO-CYANIDE is used at the Ivanhoe, Horse-Shoe, and Lake View mills, Kalgoorlie, in treating raw slime, at the Kalgurli, on ball-mill dust; at the Santa Rosa mine, Mexico; and as required, at Stratton's Independence mill, Cripple Creek. A suit has recently been heard in Western Australia, in which the London & Hamburg Gold Recovery Co., holders of patent rights to the bromo-cyanide process, sued the Golden Horse-Shoe company for heavy damages for infringement of these rights.

ABSORPTION OF GOLD in amalgamation, according to Allan J. Clark and W. J. Sharwood, involves the actual passage of precious metal into the body of the copper, or of whatever metal is used for the mill plates; it may take place in two possible ways. The first is by true diffusion into the metal, in the same way in which Roberts-Austen proved that solid gold migrates with extreme slowness into the body of a mass of lead kept in contact with it, or as mercury may be seen to permeate rapidly metallic lead, tin, or gold, or more slowly into metallic silver. The other way it may enter is by following capillary openings, such as minute cracks or pores. Several samples of mill plates, sections of which we have examined microscopically, have proved that the latter condition exists, all those plates which give fairly high assays for gold and silver showing minute cracks or pin-holes filled with amalgam. The cracks were apparently produced during the rolling of the sheet copper. We have seen nothing to prove that true diffusion of precious metal or amalgam into copper plates occurs to such an extent as to be of any economic importance.

PRECIPITATION of gold on zinc at the Mysore mine, according to H. M. Leslie, was originally accomplished by using one-half of the extractor-box capacity for strong solutions, and the other half for weak solutions. It was noticeable, however, in this that the weak-boxes invariably contained as much slime at clean-up as the strong-boxes, but that it was not so rich in gold. To get a more even product, about 11 years ago the alternate use of the boxes was tried, those getting the strong solution one day, getting the weak the next, and *vice versa*. This proved a decided success, the resulting slime at clean-up being more uniform, and the precipitation equally as effective as before. It was further noticed, that when at any time the tonnage of a plant was reduced, thus giving less gold to precipitate, the bulk of the slime from the extractor-boxes remained much the same, without any improvement in the precipitation being noticeable. This pointed to the possibility that the excess of zinc was more a disadvantage than otherwise. In other words, this excess of zinc acted as what might be called a chemical filter, and precipitated other compounds in the extractor-boxes. This was probably due to the subsidiary reactions set up between the zinc, cyanide, and alkali plus atmospheric oxygen, and the result, taken from a reduction point of view, was undesirable. Working on this basis, experiments were made to reduce the amount of zinc in the boxes, and after trials at the Mysore mine lasting over two years, it was found that from the solution used in treating 10,000 tons of tailing per month, as good precipitation could be obtained by using 37 cu. ft. of space occupied by zinc shaving, as was obtained from the 97 cu. ft. previously considered necessary. This resulted in a great saving of time and material, and instead of four full boxes to clean-up, two partly full were found to be sufficient, at the same time the quality of the slime was greatly improved, and the quantity to be handled much less than it had ever been before. The fineness of the bullion also increased in much the same proportion, varying from 860 to 910 fine gold, with from 45 to 65 of silver per 1000 parts. The quantity of zinc used per ton of sand treated, averages from 0.06 to 0.08 pound.

New Type of Mine Trolley

As a result of the demand for a mine trolley differing from the standard lines, a new type, as shown in the accompanying illustrations, has recently been placed on the market by the Westinghouse Electric & Mfg. Co., which claims for this particular trolley several distinct advantages over existing types. Three important features are listed as follows: (1) the variation in contact pressure for different trolley wire heights is much less than that obtained by a standard single-pole trolley; (2) short length of trolley pole permits turning around in narrow passages; (3) trolley does not interfere with high trailing cars on sections where trolley wire is low. The design of the trolley is such that there is little variation in the contact pressure when traversing parts of mines where the trolley wire is suspended at different heights. When the wire is at a height of 5 ft. from the top of the rail, the trolley-wheel pressure is approximately 26 lb., while at a height of 11 ft. it is about 18 lb. This shows a variation of 8 lb. through a range of 6 ft., which is much less than can be obtained by a single-pole trolley. With the standard single-pole trolley, where the wire hangs low and extreme contact pressure is exerted, the pole is often damaged when the wheel leaves the wire and strikes a roof or other obstruction. The new type trolley under these conditions, owing to the slight variation in pressure throughout the wide range in height, will be less liable to danger of breakage. This slight variation also makes it unnecessary to resort to the heavy pressure for low trolley wires, with the result that the wear at the wheel and harp will be materially less than that caused by the single-pole trolley.

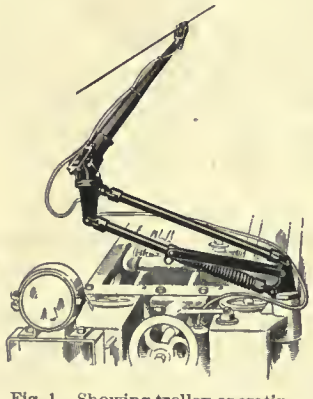


Fig. 1. Showing trolley operating with wire on opposite side of locomotive from trolley base.

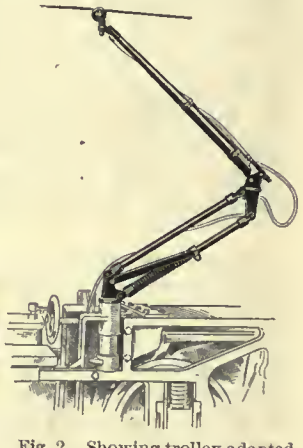


Fig. 2. Showing trolley adapted for reversing in narrow passage. Trolley is in raised position for backward operation.

In coal mines where the condition of the roof or overhanging rock is such that narrow entries are necessary, it is often impossible to run one of the longer single-pole trolleys; whereas this new type trolley can be turned around in passages from 4 to 6 ft. wide, with the socket approximately in the centre of the locomotive. Where fairly high cars are used and a wide variation in the height of the trolley wire occurs, trouble is often encountered with the single-pole trolley striking the car when the trolley wire is low, owing to the projection of the wheel over the car. The new trolley is designed especially to overcome this objection, as the entire operation of the trolley can be kept within a radius of 4 to 6 ft. from the vertical line through the trolley socket. If the trolley wire changes in height and position over the track during the run, as is often the case on surface haulage, particularly in iron and copper mines, the trolley wheel can be made to follow the wire throughout a 6-ft. vertical change and a wide horizontal range without stopping the locomotive.

When the locomotive is used for gathering purposes, and where two single-pole trolleys are ordinarily required, one on each side of the locomotive, this trolley can be used with the trolley socket near the centre of the locomotive toward the front end; the upper pole can be swung to operate satisfactorily on either side of the locomotive, whether the trolley wire be on the cross-cut side of the entry or on the room side. The trolley is designed to operate on a wire having a range in height of from 5 to 11 ft. above the top of the rail; it being assumed that the locomotive trolley socket is about 3 ft. above the rail. The trolley will operate successfully where the trolley wire may have a variation in position from the centre of the track on which the locomotive is running to 4 ft. to the right or left, without change of position on the locomotive itself.

The trolley consists of two members which operate in sockets. By means of a latch or pin at the lower socket, the lower member can be adjusted vertically and kept in a rigid position, and, further, can be swung horizontally and fastened in any definite position required. This trolley can be used for application to locomotives now in service. It is known as type D-20 and is illustrated in the accompanying figures.

Commercial Paragraphs

The General Electric Co., Schenectady, New York, has received orders for equipment as follows: Silver King Coalition Mines Co., Park City, Utah, one 240-kva. motor-generator set with 14-kw. exciter, to drive a 200-hp. motor for operating an electric hoist; American Zinc Co., Mascot, Tennessee, two 25-kva. motors, one 200-kw. generator, two 1200-kw. generators, nine motors ranging from 20 to 150 hp. and switchboard apparatus; Buckhorn Mines Co., at Beowawe and Palisade, Nevada, two 345-kva. generators with 35-kw. exciters, one 10-kva., two 25-kva., and eight 219-kva. transformers and switchboard apparatus in the power plant, and 24 motors ranging from 10 to 100 hp. for operating mining machinery; Penobscot Mining Co., Helena, Montana, five motors ranging from 10 to 25 hp., one 10-kva. and three 50-kva. transformers, and a switchboard; Oliver Iron Mining Co., for its mines at Ironwood, Michigan, one 300-hp. motor, six 5-kva. and six 10-kva. transformers, and switchboard material.

The plant of the California Ore Testing Co., San Francisco, which was built some five years ago at a cost of $25,000, has recently been thoroughly overhauled and new equipment added. There is a large laboratory for preliminary and small scale operations in ore treatment, while the main plant, in a building 45 by 100 ft., is completely equipped with full size machinery operated under practical mill conditions. The company is prepared to make small laboratory tests on 20 to 50 lb. of ore for preliminary information, at very low cost. These are of great advantage in the case of mine prospects or developed properties superficially examined for approximate information; where mines have a moderate tonnage of ore developed, with mine dumps, or mill tailings. Tests on 1000 to 3000 lb. of ore will give definite information regarding the metallurgical methods possible with economic considerations affecting same. Where consideration is given to building a plant, complete tests should be made on 3 to 10 tons of ore, on which all details of treatment will be worked out and the most efficient scheme formulated. In the case of going mills, special study of losses may be made and tests conducted with the object of improving extractions and working conditions. The entire testing plant or any part may be rented for the private conduct of testing work, either with or without the services of the company's staff. Descriptive booklet, flow-sheets showing the possibilities of the equipment, and information concerning prices or any details will be furnished on request.

Catalogues Received

Webster Mfg. Co., Tiffin, Ohio. 'Webster Method,' for May. 26 pages. Illustrated. 6 by 9 inches.

Hyatt Roller Bearing Co., Newark, New Jersey. 'The Hyatt Way,' June issue. 'Special Lake Shore Number.' 8 pages. Illustrated. 6 by 9 inches.

Edgar Allen American Manganese Steel Co., Chicago. Bulletin No. 61, 'Stag Brand Manganese Steel Castings for Rolling Mills and Blast Furnaces.' 28 pages. Illustrated. 6 by 9 inches.